Cityscape

A Journal of Policy Development and Research

CLIMATE CHANGE AND CITY HALL
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Guest Editors' Introduction: Governing the Sustainable City

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The term "sustainable city" is now an inescapable part of the urban studies lexicon, but what does it mean in practice to be a sustainable city? The answer, of course, depends on to whom and in what context the question is asked. In fact, recent work suggests that local elected officials and local government administrators define and pursue sustainability in very different ways (Francis and Feiock, 2011; Zeemering, 2009).

Sustainability is often referred to as the *three Es*: environment, economy, and equity. These three pillars of sustainability are critical to the United Nations' Brundtland Commission's conception that sustainable development "… meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987: Part I, Chapter 2). Sustainability- and climate change-planning documents often borrow this definition, but conceptualizing sustainability in terms of the three Es fails to add precision to its definition because the three Es are not always compatible. In many instances, policy actions involve tradeoffs among the three Es. Despite wide acceptance of the United Nations definition, observations of sustainability plans in U.S. cities and studies of program implementation demonstrate that, in practice, sustainability often means primarily environmental sustainability, especially as it relates to the causes and consequences of climate change. This introduction focuses on issues of scale, policy instruments, and governance to examine local government sustainability actions and to frame the research that follows in this symposium. In this way, we provide a foundation for understanding how sustainability is defined across communities, the scope of various conservation initiatives, and the many challenges municipalities face in encouraging and implementing sustainable practices both in government and among their citizenry.

Issues of Scale

The first issue relates to scale. We use the word *scale* in reference to the spatial or geographic scope of sustainability problems and their match to the spatial areas defined by local government boundaries. The issue of scale is critical to understanding city sustainability efforts because it begs the question of why cities initially engage in climate protection efforts. Local sustainability initiatives defy the accepted logic of collective action (Olson, 1965), which predicts that local governments will not voluntarily invest in climate-change efforts. Instead, cities are expected to free ride on the efforts of other governments, because a city's contribution to the collective good is minimal and the benefits generated are nonexcludable (that is, the benefits are impossible to compartmentalize and deny to others). Carbon emissions in particular are global pollutants, so local residents share any environmental benefit with every living being on the planet. Thus, the rapid adoption and diffusion of city-level energy and climate-protection policies, in the absence of strong state or federal incentives to do so, pose a curious puzzle for social science theories of policy adoption and collective action.

Why do local officials pursue climate policy initiatives when the benefits must be shared? Local officials are often able to overcome collective action problems because sustainability programs produce local, community-specific benefits such as the reduction of energy costs, pollution, and traffic congestion. Sustainability programs can also be a tool to attract economic development, protect environmental amenities, and enhance community health and livability.

In addition to taking advantage of these selective benefits, local governments are uniquely positioned in the U.S. federal system to address a range of activities that directly contribute to climate change, from land use to electricity consumption. Municipal governments have tools to directly address energy efficiency, conservation, and carbon emissions through their well-established role in regulation and service delivery. Despite local governments' ability to take the lead on energy and climate issues, there is very little scholarship examining what factors account for local adoption of sustainability programs.

At what scale or scales should climate policy be carried out? As the locus of research interest and policy activity shifted rapidly from the global to the local scale, researchers have overlooked the role of metropolitan regions. Energy-efficiency and sustainability programs produce benefits other than making the community more sustainable: they can attract green economic development; reduce air pollution, sprawl, and traffic congestion; and reduce energy costs for government, business, and residents. These additional benefits, or *co-benefits* as the academic literature refers to them, are considered the primary motivation for city sustainability. Nevertheless, many of these benefits of sustainability are realized at the regional scale, not the city scale, because the benefit for a particular city will depend on the actions of its neighboring governments. Cities, not regions, possess the zoning and land use powers necessary to address climate issues. This spatial mismatch produces a collective action problem for cities. Sustainability encompasses actors across city and county lines linked through shared infrastructure and communication networks.

Regional actions also improve the efficiencies of transboundary decisions, coordinating collective goods to achieve economies of scale and reducing the transaction cost of the sustainability programs a city enacts. Regional networks, organizations, and institutions are needed to address the co-benefits of sustainability to enhance positive externalities and provide potential institutional mechanisms to reduce negative externalities.

Policy Instruments

The second issue relates to the policy approach and instruments applied to addressing climate and sustainability problems. The first question to ask is, "Who is the target of sustainability efforts?" Policies and programs that are part of a sustainability program often have another primary goal, besides sustainability. For example, public transportation and smart growth development might be adopted to address traffic and infrastructure congestion, but they also produce sustainability benefits by reducing carbon emissions. Thus, an important issue is the alignment of the primary policy goals with sustainability. Local programs can be directed to individuals and individual behavior or to organizations and firms.

Extant research has not addressed the relationships between and among *supply-side* and *demand-side* policy instruments. These distinctions are central to public choice and welfare economics theories (Weimer and Vining, 2004). On the demand side, programs that seek to influence behavior can target voluntary consumer action through taxes and other incentives, or they can mandate behavior with regulation. Supply-side instruments target the energy production technologies of utilities and municipal governments.

Whether programs target government or the community has environmental and political consequences. Climate policies might be directed to inhouse governmental operations to increase the energy efficiency and reduce the emissions of local government facilities, transportation, and operations. Alternatively, they can be directed outward to promote or restrict the actions of nongovernmental actors in the larger community. For example, green building programs can be applied to government by requiring compliance with energy-efficiency standards or certification for public buildings. Green building can also be applied in the broader community by requiring or providing incentives for energy efficiency in permitted new development. The approaches that municipal governments take vary substantially (Bae and Feiock, forthcoming; Francis and Feiock, 2011). Both research and practice can benefit from a more informed understanding of the portfolio of sustainability policies available, the relationships among various policy instruments, and the political and distributional consequences of those relationships.

Governance, Institutions, and Sustainability

The third issue relates to the institutional structure of local government and the role of politics in sustainability decisions. Structure and governance matter internally in terms of political institutions for making policy decisions and externally in terms of linking cities to other governments in their region and beyond. Differences in forms of government, such as whether an appointed city manager or a strong elected mayor is present, are important because they shape the motivations, incentives, and constituencies of local decisionmakers. Professional city managers are presumed to emphasize efficiency over responsiveness, but a lack of systematic evidence exists on which to base this conclusion (Clingermayer and Feiock, 2001). This distinction is reflected in decisions to pursue cost saving in governmental operations or to target the constituencies of nongovernmental actors in the larger community.

The complexity of sustainability issues requires internal and external governance mechanisms to manage them. Within a single government, functional agencies such as planning, public works, transportation, environmental services, development, and energy services share responsibility for programs that can be part of a sustainability portfolio. Integration can sometimes take the form of a dedicated sustainability office, coordination through a mayor's or manager's office, or through formal or informal networks among agencies and employees.

Governance is further complicated by the complex nature of sustainability efforts that crosscut issues such as pollution, land use, transportation, and water use. In addition, because the geographic scale of even the most local sustainability problems encompasses the jurisdictions of multiple local governments, larger scale (for example, regional) governance to mitigate collective action dilemmas might be the critical link in activating cities to undertake individual initiatives and collaborative actions. Regional governance can both link actors in networks and create institutions, or rules, for how regional policy is structured. Mechanisms to mitigate collective action dilemmas among local governments range from informal policy networks to consolidated governments, and these alternatives differ in how much autonomy is accorded to individual cities. Although informal policy networks might be immediately effective for some purposes because they preserve the autonomy of involved policy actors, consolidated government resolves collective action problems by centralizing decision authority across scales. These extremes do not tell the whole story, however; as the articles in this symposium illustrate, governance mechanisms between these extremes that are adapted to specific local circumstances often provide more politically acceptable solutions and more effective resolution of sustainability problems.

Overview of This Symposium

Local governments are uniquely positioned to instigate a range of activities that directly address sustainability and climate change, from land use to electricity consumption. Municipal governments have tools to directly address energy efficiency, conservation, and carbon emissions through their well-established role in regulation and service delivery. Nevertheless, in their efforts to do so, they are certain to face challenges of scale, policy instrument design, and governance. The research articles in this symposium address the scale, policy instruments, and governance structures of local sustainability efforts from a variety of perspectives. James H. Svara, Tanya C. Watt, and HeeSoun Jang analyze the kinds of sustainability actions undertaken at the city scale based on a national survey by the International City/County Management Association. They identify the local sustainability policy instruments employed by cities and then investigate what governmental institutions, community demographics, and local policy priorities are associated with city sustainability efforts.

The next article, by Kent E. Portney, addresses the potentially false but pervasive polemic of sustainable development as conflicting with economic development. Portney refutes the claim that "any effort of local government to protect and improve the local biophysical environment represents a restriction on economic development" (Portney, 2013: 45–46). Portney's argument is central to efforts to reconcile the three Es and guide sustainability efforts to combine demand- and supply-side programs.

Christopher V. Hawkins and XiaoHu Wang explicitly test hypotheses based on demand- and supply-side approaches. They present evidence that cities integrate environmentalism into supply-side economic development (consistent with Portney's claims) and address the role of business in influencing policy and the mediating role of governance structures. Gregory S. Burge and Keith R. Ihlanfeldt then delve deeper into the relationships connecting sustainability to development by examining the role of impact fees on the internalization of development externalities. They "describe some ways in which local governments already commonly attempt to deal with development externalities, show how impact fee programs have already been used to correct for some of these problems, comment on the ways existing programs could be improved, and outline the most significant obstacles to using impact fee programs in this expanded capacity" (Burge and Ihlanfeldt, 2013: 83). Impact fees might prove to be a powerful policy instrument in localities where unregulated markets produce externalities. They describe how the tendency toward market mechanisms is intertwined with partisan and political forces in the community.

The next article, by Elisabeth R. Gerber, investigates the influence of party affiliation on sustainability by testing the role of political partisanship on local approaches to climate policy. Gerber notes that the absence of strong federal environmental policy has created a vacuum that local governments have filled. In this circumstance, partisan politics matters at the local scale. She demonstrates the influence of the partisanship of citizens and decisionmakers in the shaping of local sustainability choices. Her analysis suggests that support for sustainability will depend on the specific political constituencies that benefit. Rachel M. Krause explicitly analyzes these motivations to better understand what drives the composition and comprehensiveness of local climate initiatives. Cost savings and efficiencies are often touted as the primary rationale behind decisions to engage in climate-change planning. This stance certainly provides safer political cover, but Krause finds that an altruistic concern for global climate change leads cities to plan more comprehensively for it.

Dorothy M. Daley, Elaine B. Sharp, and Jungah Bae then investigate how the institutional governance structures of local political systems influence the approach cities take to sustainability. They examine why co-benefits such as cost savings are most often aimed at government operations and less often imposed on businesses and residents and why "co-benefits might be less likely to drive decisionmaking when sustainability initiatives are directed to the larger community" (Daley, Sharp, and Bae, 2013: 143). Daley, Sharp, and Bae find that a city's institutional structure is not a significant factor in determining if sustainability initiatives reach the community but that, instead, participation in "interlocal" networks is key to moving sustainability initiatives beyond an intragovernmental enterprise and into the wider community.

Whatever the motivations of the policymakers might be, the technical and administrative capacities of those policymakers' organizations determine the policy effect. Christopher M. Weible and Dallas Elgin examine the issue of capacity by contrasting individual and organizational capacities and examine how varied levels of capacity translate into collaborative and analytic techniques. They find these techniques to vary depending on the city, national, or international scale of involvement in climate and energy activities.

Philip Berke and Ward Lyles offer a solution that enables us to capture the momentum found in networks and collaborative techniques, to plan for climate adaptation in "the age of uncertainty." They note "… the traditional planning paradigm that is chronically deficient in addressing public risks" (Berke and Lyles, 2013: 181) and that a more contemporary conception, which melds collaborative and anticipatory governance, is likely the key to planning in the midst of so many unknowns with potential global consequences. The Berke and Lyles model allows for the flexibility needed as our knowledge of the progression and scope of climate change evolves with improved monitoring, enabling innovation unstifled by static processes and plans.

The coda to this collection is Anu Ramaswami's exploration of the role social actors and policy instruments play in mitigating cities' greenhouse gas footprints. The framework that she provides captures multiple scales by building on life-cycle analysis. Using the case of buildings and energy in Denver, she traces the influence of policy actors and infrastructure operators on sustainability outcomes. Ramaswami challenges the notion of neatly packaged effects by considering transboundary, life-cycle-based emission footprints. This approach once again raises decades-old, yet still salient, arguments concerning regional planning and collaboration and finding the "right" scales to address the causes of social and environmental degradation.

Together, these articles—authored by well-established and emerging leaders in climate-change planning and policy—offer a compendium of the policy instruments and governance structures necessary to understand the social complement to the science of climate change. After all, our ability to protect ourselves from harm is possible only through social action. Optimally, that action is informed by not only climate science but also social science research examining issues of scale, policy instruments, and governance.

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How Are U.S. Cities Doing Sustainability? Who Is Getting on the Sustainability Train, and Why?

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Abstract

Using information from a 2010 International City/County Management Association survey of 2,176 local governments, this article considers why and how counties, cities, and towns are pursuing sustainability objectives. The article first breaks down sustainability into 12 distinct areas, with discussion of the activities local governments are pursuing in each area, and then develops explanatory models to consider the factors that might motivate sustainability activities. Although most communities are participating in some sustainability activities, they are generally not taking advantage of the more innovative possibilities available to them. Multivariate analyses indicate that sustainability does not appear to be an issue associated with a "typical" division based on race, class, or community wealth. Our evidence also suggests that those communities that give a high priority to energy conservation achieve higher sustainability ratings than other communities.

Introduction

In 1987, the United Nations Brundtland Commission declared: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987a). The International City/County Management Association (ICMA) echoed this sentiment by noting that, for communities pursuing sustainability, the focus is on "development [that improves] quality of life, making a place more livable without harming the environment or creating financial burdens for future residents" (ICMA, 2007: 1).

Although sustainable development is a global concern, many reasons explain why it is pursued extensively at the local level. First, although growing international consensus indicates that *something* should be done, less consensus has been reached regarding *what* should be done to address sustainability concerns. Although its environmental impact is admittedly substantial, the United States has not signed on to any international agreement to reduce its footprint. In the absence of leadership at the national level, cities have emerged as both innovators pursuing broadly based environmental goals and efficient users of the reduced resources available to them as they seek to decrease their own energy consumption. Local executives are clearly aware of the importance of the effect they can have, because more than 1,000 mayors have signed on to the U.S. Conference of Mayors Climate Protection Agreement, in which signatories commit to pursuing Kyoto Protocol standards in their communities (United States Conference of Mayors, n.d.). Caitlin Geary, writing for the National League of Cities, further commented that "…local officials across the country are providing leadership and advancing economic strategies that incorporate environmental stewardship" (Geary, 2011: 1).

Pursuing sustainability at the local level also makes sense in terms of scope; the actions at this level significantly affect transportation, air quality, housing, water, and energy consumption. Because of the concentrated populations in cities, the activities that occur there have significant environmental ramifications that further motivate action at the municipal level. Konisky (2011) suggested that citizens desire that the level of leadership and responsibility for a particular policy area reflect the level of control the jurisdiction has over related issues. Individuals experience air quality, water quality, transportation, waste issues, and housing primarily in their daily lives, which might indicate that the local level of government is particularly well suited to addressing concerns in these areas. This emphasis on the importance of local activities undertaken in the pursuit of sustainability is not meant to minimize or dismiss the importance of federal and state regulation in ensuring that a consistent level of environmental protections is established and enforced, but it is to say that community members might seek stronger and more apparent leadership from their local government in areas related to sustainability because they experience the ramifications of sustainability initiatives (or lack thereof) in their daily lives. Although Young (2000) pointed out that typical governmental jurisdictions rarely encompass all the people affected by decisions they make, the local level is the most broad and consistent level at which decisions about sustainability might be made and evaluated, as Portney (2003) noted.

It is clear that efforts to promote sustainability have become important in local governments in the United States: "Sustainability is a familiar concept to local government professionals, many of whom trace its roots to the values and considerations inherent in the practice of community planning…" (ICMA, 2007: 1). The extent to which sustainability is pursued, the kinds of activities undertaken, and the reasons for pursuing them are not so clear, however. What sustainability efforts look like in practice, intent, implementation, and outcome appear to vary broadly. ICMA noted that, "For all the strong support for the broad principles, developing a consensus about what sustainability really means on the ground and how to reach agreement among community members with conflicting or competing goals can be something else altogether" (ICMA, 2007: 1). The adoption rate and the diffusion patterns of local sustainability policies vary widely. An indepth analysis of the variation in adoption levels must accompany an explanation of why some local governments have taken extensive sustainability actions, whereas others lag significantly behind what a typical innovation curve might suggest should be occurring.

Local government sustainability programs can be viewed in different ways depending on the scope of the program. Classic considerations of sustainability focus on the *three Es*: environment, economy, and social equity. ICMA extended this focus: "ICMA further defines the concept [of sustainability] as central to the professional management of local government, with four interdependent elements: balancing environmental stewardship, economic development, social equity, and financial and organizational viability" (ICMA, 2007: 2). Sustainability defined in this way requires a broad range of activities in which all levels of government, all sectors of the economy, and all members of the community must participate. City and county governments are well positioned to make a significant contribution to this effort for several reasons: (1) they are directly involved in providing or regulating many human activities that affect resource use, such as transportation, building construction, and land use; (2) they are actively involved in efforts to promote economic development; and (3) they provide services that help determine whether people from all socioeconomic levels and all racial and ethnic groups are protected and included. Whether, and how, all three classic aspects of sustainability are pursued, however, is a question that must be answered.

The effect of sustainability programs in local communities differs. Sustainability initiatives might be justified by their positive effect on the economy (Geary, 2011), and some activities produce immediate, tangible benefits to the locality in the form of reduced energy costs or commuting times. Other sustainability-related activities, such as reducing greenhouse gases (GHG) or improving air or water quality for those living downwind or downstream, have broader benefits that might help society as a whole but do not produce immediate or visible advantages for the government carrying out the activities. In addition, some activities might affect the general population within a jurisdiction and others might target particular groups with special needs. As a consequence, the perspectives on whether and how a sustainability program should be pursued differ widely. To some supporters, these programs are altruistic efforts to address a shared problem or advance a shared goal. Another view is that a commitment to sustainability can strengthen local economies and provide benefits to the jurisdiction. ICMA (2007) noted smart growth and conservation as two specific frames that different localities have used for pursuing sustainability. Mixed motivations are also possible, in two respects. Some local governments might explicitly seek to advance both local and broader goals, whereas others might pursue sustainability policies but address political opposition by stressing local benefits, even though the potential positive effects of actions they are taking extend beyond their jurisdictional boundaries.

Our analysis of the extent and kinds of sustainability activities that local governments have adopted is based on the ICMA Local Government Sustainability Policies and Programs survey, conducted in 2010, in which more than 2,000 local governments participated. This survey was a major effort to examine what local governments have done so far to address the sustainability challenge and how they partner with community members to change behaviors and advance shared goals.[1] The

[1] The survey was developed with input from ICMA's Center for Sustainable Communities, the Center for Urban Innovation at Arizona State University (ASU), ASU's Global Institute of Sustainability (GIOS), Alliance for Innovation, and others. Its distribution was conducted through a collaboration of ICMA, ASU GIOS, and the Sustainable Cities Network, a multi-jurisdictional partnership. The survey was provided in a print format because the local government response rate to print surveys is both higher and more scientifically representative than from an electronic survey. Approximately 12 percent of the responding governments chose to submit the form electronically. In total, 2,176 local governments responded, yielding a 25.4-percent overall response rate.

survey and additional data collected on the participating local governments covered 110 specific activities that the governments might have adopted and steps that they might have taken to plan and organize their sustainability efforts.

This article presents the analysis in two stages. The first stage examines what kinds of activities cities have adopted as they get on the sustainability train. The analysis groups the activities included in the ICMA survey into 12 areas, each of which is analyzed to determine the extent and range of their adoption. Activities are differentiated based on the nature of the benefit associated with the activity. The article footnotes report the analyses of the reliability of the indicators used in each area. Determining alpha scores for each area contributes to scale development for measuring sustainability policy.

The second stage develops and tests an explanatory model to investigate the influence of local institutions and community characteristics on the comprehensiveness of the sustainability efforts measured in the first stage. The analysis examines the effect of community characteristics such as education, number of young adults in the community, race, income, homeownership, housing value, and form of government. It then adds to the model survey-based indicators of the priority level assigned to environment, climate change, green jobs, and energy conservation. The community policy orientation and commitment indicate why governments get involved in sustainability. The analysis also controls for other factors likely to affect sustainability, such as population, density, metropolitan status, and region. Previous work summarized the ICMA survey results and reported bivariate relationships (Svara, 2011; Svara, Read, and Moulder, 2011). This more comprehensive model clarifies what kinds of communities are more active in sustainability and tests our explanation for why they get involved.

What Local Governments Are Doing To Advance Sustainability

The ICMA survey included specific indicators—policies, programs, and activities that local governments can take to advance sustainability—drawn from many sources.[2] A comprehensive set of 160 indicators was developed by the Alliance for Innovation and field tested by local governments in the Sustainable Cities Network of the Global Institute on Sustainability at Arizona State University. From that set, 110 indicators were included in the ICMA survey. The activities were chosen intentionally to cover commonly used techniques and rarely used activities. Following these choices, information about completion of Leadership in Energy & Environmental Design (LEED)-certified government buildings was added to the dataset. We grouped the specific activities into 12 areas by their purpose, and the percentage of activities adopted by the local government is the indicator

[2] The sources included SustainLane (http://grist.org/article/defining/), Visible Strategies: Framework Adapted from US Mayors (http://usmayors.visiblestrategies.com/), Portney (2003), Go Green Virginia Green Community Challenge (http://gogreenva.org/?/challenge/participate/id/1), and the ICMA Center for Performance Measurement.

of the level of commitment. The overall adoption rating—the average of the adoption rates for all 12 areas, which range from 0 to 100—captures both the amount and spread of activity across the major areas.[3] Exhibit 1 lists the 12 activity areas by average adoption rate.

The overall activity rating for all the responding governments is 18.1. Most governments are toward the low end on the rating scale, and 60 percent have an adoption rate that is less than the average for all the responding governments. On the other hand, some governments are undertaking many and a wide range of sustainability activities, with ratings reaching a high of 78.

We present each activity area with its component indicators in the following 12 exhibits. The graphs use the same scale to compare the relative levels of adoption within and across each area. We discuss the variation in adoption rates relative to (1) the nature of benefits; (2) focus on internal government operation versus activities that affect residents and the community; and (3) the effort level for residents, reflected in the political acceptance, commitment of resources, or change in behavior that the activity requires.

Exhibit 1

Major Sustainability Activity Areas

Major Activity Areas	Average Percent of Activities Used
Recycling	33
Water conservation	28
Transportation improvements	22
Energy use in transportation and exterior lighting	22
Social inclusion	21
Reducing building energy use	19
Local production and green purchasing	18
Land conservation and development rights	15
Greenhouse gas reduction and air quality	12
Building and land use regulations	12
Workplace alternatives to reduce commuting	8
Alternative energy generation	7
Overall adoption rating across all activity areas	**18**

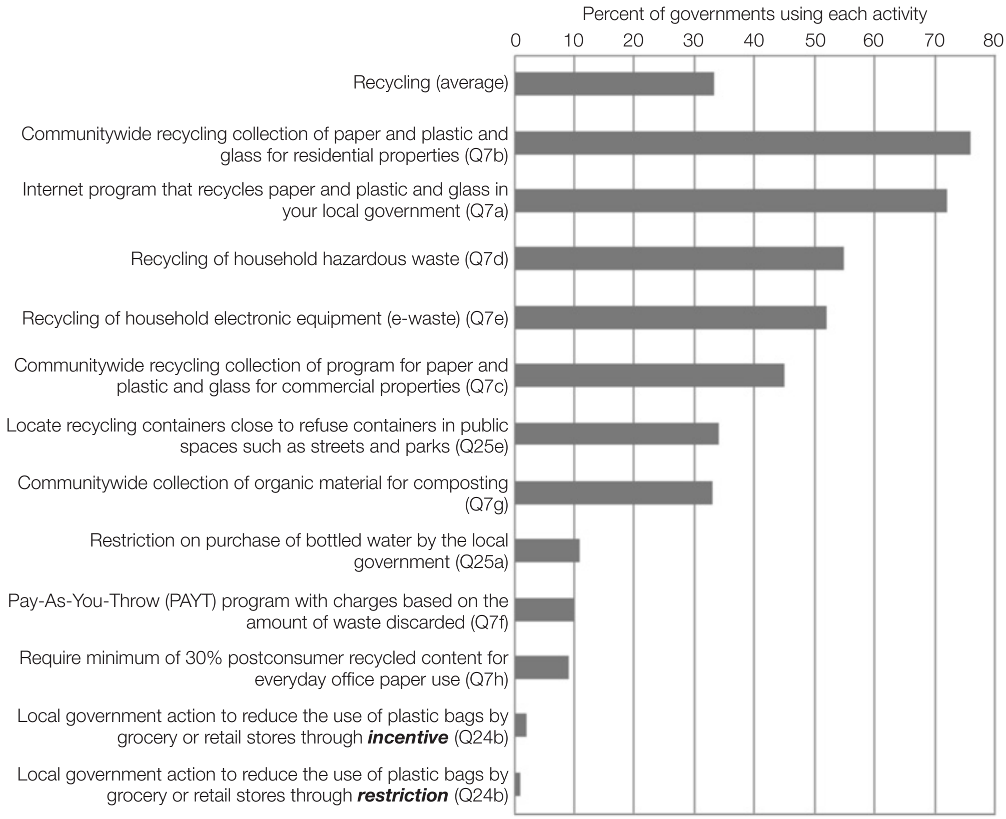
Recycling

The most commonly adopted activity area is recycling, which is important to sustainability because it reduces the amount of land devoted to landfills, eliminates hazardous materials from the waste stream, and recovers resources for reuse. Exhibit 2 indicates that most governments have community-wide residential collections of recyclable materials, collect internally, and offer recycling of hazardous

[3] Using a raw activity count as the measure of activity level would be somewhat misleading, because the number of specific measures differs across the activity areas. To provide an extreme example, a government that performed all 15 building energy activities but no other activities would have a rating of 13.8 (15/109). Performing 100 percent of the indicators in only 1 major activity area out of 12, on the other hand, would equal an overall activity rating of 8.3 (100/12), regardless of the number of activities in that area. Thus, governments that adopt activities across many areas have a higher rating than those with a concentrated effort in fewer areas.

Exhibit 2

Recycling



materials and e-waste.[4] One-third or more provide commercial recycling, colocation of trash and recycling containers, and collection of compostable materials. Other methods of promoting recycling directly and indirectly are still uncommon. Use of recycling methods has built up over a long period, but some methods are still rarely used. Although it seems conventional now, recycling was once dismissed as a noble goal that the public would never support. As Hopper and Nielsen (1991) noted, recycling was seen as costly and burdensome to individual residents. As pressure to find alternatives to landfills increased, cities worked to set up recycling centers, but residents still had to sort and transport their recyclables to them. The incentive for the individual to participate was minimal, and many studies pointed to altruism as the main motivator for those who did recycle. Over time, cities made the act of recycling second nature, particularly by improving the simplicity of the process and ease of accessibility for individual residents through residential collections.

[4] The alpha for recycling is .723, indicating that each activity listed in this category is contributing meaningfully to the overall score. The alpha increases to .726, however, if Pay-As-You-Throw (Q7f) or the reduction in plastic bags in grocery or retail stores through incentive (Q24b) is removed from the category. The alpha increases to .728 if the item regarding reduction of plastic bags through restriction (Q24b) is removed. The revised alpha eliminating these three activities is .739.

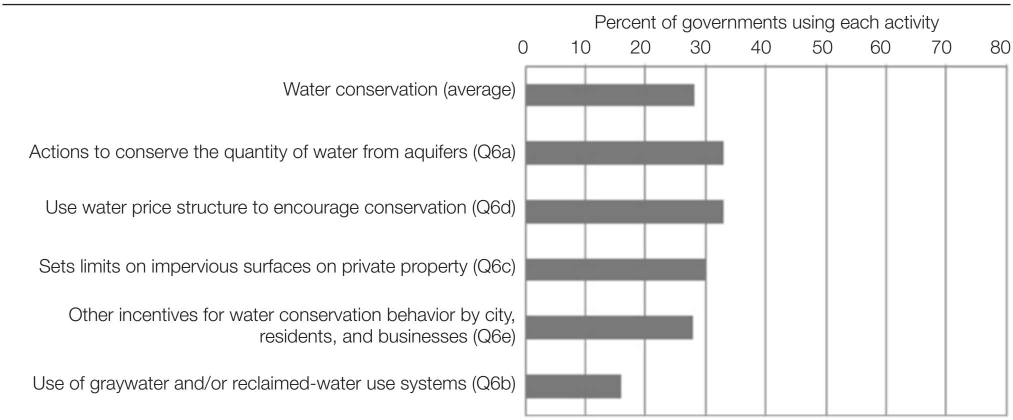
Six of the seven activities used by at least 30 percent of the responding local governments are services to residents, and the seventh is an internal program to recycle in government buildings. The scope of recycled materials and the range of collections from places where waste is generated continues to expand. As recycling has become more simple and convenient, residents no longer need an altruistic commitment to the greater good to participate. Still, the survey does not include use rates, and other sources of information need to be examined to determine whether charges for certain services and the extent to which residents are using them differ, especially for newer services such as collection of organic material.[5] Adoption of methods that involve requirements or restrictions, charges, or even incentives are still uncommon, used by no more than one in nine local governments. The limited adoption applies both to activities that affect residents, such as Pay-As-You-Throw and restrictions on the use of plastic bags, and to changes in governmental behavior, such as prohibiting the purchase of bottled water and requiring the purchase of office paper with recycled content. Recycling activities generally have benefits that are available to all residents and have a direct, immediate effect on the community in the form of improved appearance, some revenue generation from sale of recyclables, and reduced landfill costs, and they also have broader and longer term benefits that result from the reuse of materials.

Water Conservation

Approximately 30 percent of local governments use a cluster of activities to promote the conservation and quality of water resources, as exhibit 3 indicates.[6] These activities are conserving the quantity of water in aquifers, using water pricing to encourage conservation, setting limits on impervious

Exhibit 3

Water Conservation



[5] For example, some cities provide curbside recycling of household waste to all residents but require an additional fee for curbside pickup of yard waste.

[6] The alpha for water conservation is .663, which is not improved by removing any possible actions included in the survey. Although this alpha, in general, is high and indicates that each activity is contributing to the overall score, it is possible that this matrix of activities is incomplete, and perhaps the inclusion of other activities would improve the overall picture presented in this category.

surfaces on private property to reduce runoff, and other incentives for water conservation behaviors by city, residents, and businesses. Only one-half as many local governments have started using graywater or reclaimed-water use systems to expand water supply.

All these activities affect residents and the community and entail restrictions in behavior or require the expenditures of resources. Despite these characteristics, these water conservation measures have the second highest overall level of acceptance compared to other activity areas. The least accepted of these activities is reusing or reclaiming used water, which entails substantial front-end costs and therefore might generate resistance from residents. The benefits of water conservation apply to all residents and are both immediate and localized by protecting a community's water supply and having "downstream" and long-term benefits. The relatively high level of acceptance of these activities might be an extension of legally mandated water quality requirements.[7]

Transportation Improvements

Among a range of methods to improve and diversify transportation options in the local government, the most commonly adopted are related to expanded options for bicycling and walking, as exhibit 4 indicates. Of local governments, 20 percent expanded bus routes or provided transportation programs targeted at low-income groups. Other transportation improvements are rarely adopted.[8]

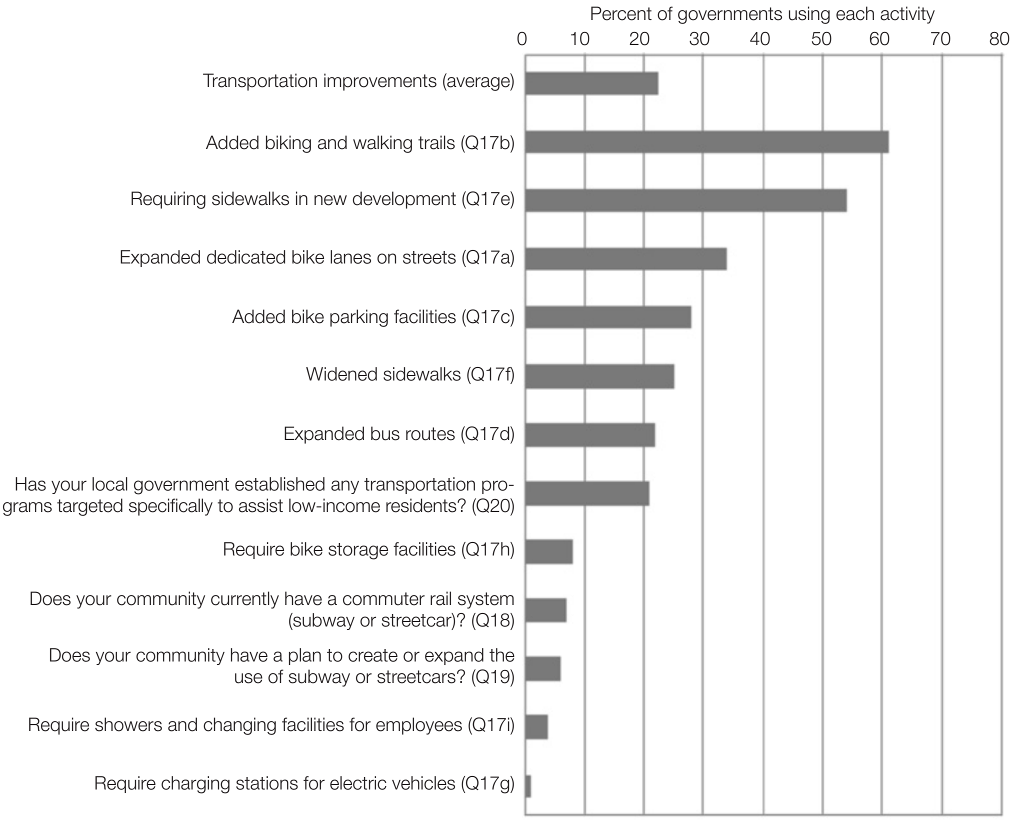
Most of the transportation improvements undertaken by those local governments surveyed yield internal benefits and can be described as beautification or livability improvements. Adding biking and walking trails and requiring or widening sidewalks increases the opportunities residents have to use nonmotorized transportation, but they also might be part of greater trends aimed primarily at traffic calming but also at reducing obesity through encouraging exercise (Project for Public Spaces, n.d.). Although any action taken by a local government that reduces the number of vehicles on the road might be considered positive in terms of sustainability, this example is an important illustration of the cross-collaborative nature of some sustainability activities and the multiple means by which some activities might be pursued and justified. Whereas removing motorized vehicles from the road yields both internal and external benefits, adding walking

[7] Federal regulations establish minimum guidelines for water quality, with states having some latitude in how they meet those guidelines. For details regarding federal guidelines, see http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm (accessed July 16, 2012). Because some uniform regulatory requirements are in place, cities presumably direct some attention to water conservation and quality issues, whether or not they are subsumed under a sustainability framework. With this assumption in mind, the more unusual conservation efforts (such as reclamation of gray water) that some cities undertake are of great interest.

[8] The alpha for transportation improvements is .701, indicating that each activity contributes to the overall score fairly evenly and, therefore, each is important in explaining the overall score. The alpha improves slightly (to .708) if the activity of transportation programs for low-income residents (Q20) is removed. It is interesting to note that removing consideration of whether the local government has a commuter rail system (Q18) increases the alpha to .704. Removing consideration of whether the local government requires a charging station for electric vehicles (Q17g) has no effect on the alpha. Overall, removing any activity from this category does not significantly affect the alpha, indicating that the overall scale is reliable. A reconsideration of the index yields an interesting result: if both transits (Q18) and charging stations (Q17g) are removed and the transportation programs for low-income groups (Q20) is moved to the social inclusion index, the alpha rises to .714. Although the alpha is reliable, it is clear that even greater reliability is gained through further refinement of the index.

Exhibit 4

Transportation Improvements



and bike trails and expanding sidewalks will yield greater benefits for those living in the locality and might reduce health costs.[9] The relative lack of adoption of more elaborate transportation initiatives might reflect community variation in resources and need; for example, mass transit is less necessary and feasible in small communities.

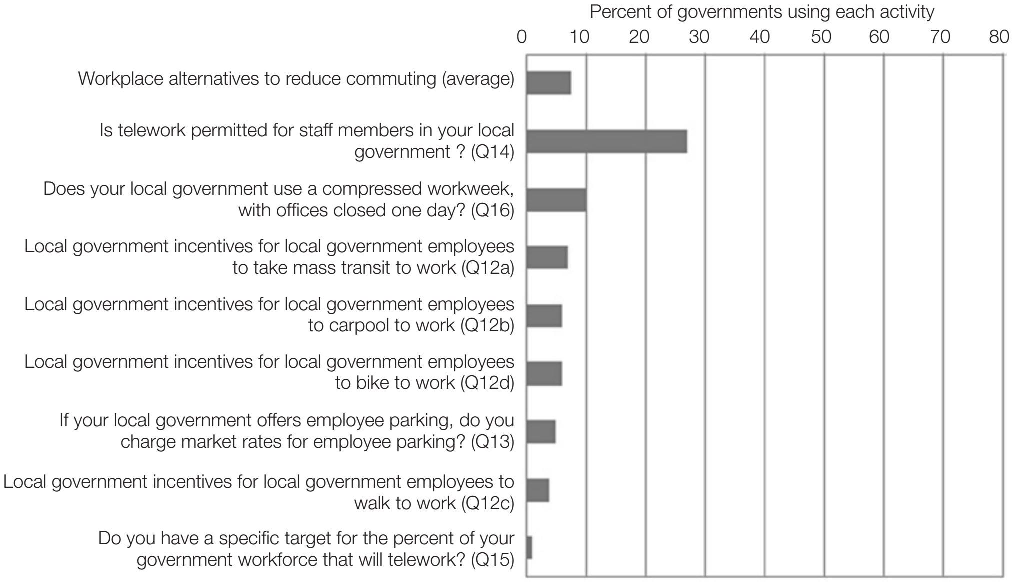
Workplace Alternatives To Reduce Commuting

Whereas certain transportation improvements are widely adopted for community benefit (as described previously), our survey indicates little provision of alternatives to traveling by car to worksites for government employees. Exhibit 5 indicates that working from home or another

[9] BlueCross BlueShield of North Carolina explained a contribution to biking and hiking trails in part to reduce health costs, claiming that the benefits exceed the cost of trail expansion by a three-to-one ratio. See http://mediacenter.bcbsnc.com/pr/bluecross/bcbsnc-invests-in-biking-and-greenway-236455.aspx (accessed July 20, 2012).

Exhibit 5

Workplace Alternatives To Reduce Commuting



location with an electronic connection to the office is permitted by only about 25 percent of governments, and other activities to encourage a change in the mode of transportation or commuting patterns for local government employees are still rarely used.[10]

It is somewhat remarkable that local governments use so few of the options for reducing employee commutes because they can adopt these activities internally by government action alone, without the need for public consent. It is not surprising, however, that teleworking is the most widely used activity in this category. Dubrin noted that "Flextime has grown in popularity because evidence suggests that it reduces turnover, improves morale, and helps recruit talent" (Dubrin, 2006: 120). As noted in the Transportation Improvements section, some activities are justifiable in many different ways, and teleworking is another example. The activities here primarily yield internal benefits, wherein the local government has the opportunity to reduce operating costs, improve employee morale, lead by example, and encourage a slight reduction in GHG emissions through modifying employee behavior by incentivizing desirable transportation choices.

[10] The alpha for workplace alternatives to reduce commuting is .675, which seems relatively high. Essentially, however, all activities in this category, except incentives for local government employees, could be removed to the benefit of the overall reliability of this measure. If telework for staff members (Q14) is removed, the alpha improves to .715; if compressed workweeks (Q16) is removed, the alpha improves to .696; if market rates for employee parking (Q13) is removed, the alpha improves to .692; if the establishment of a target percentage for government workforce that will telecommute is removed, the alpha improves to .689. Note in this circumstance that responses to Q12a through Q12d are correlated; if a city is providing incentives for alternative transportation in one area, it might be more likely to provide incentives in other areas, too. The other activities are likely also important, but their relative effects are more difficult to tease out given the high correlation among most of the incentive categories. If incentives for employees (to take mass transit, carpool, bike, or walk to work) are measured alone, the scale alpha is .862.

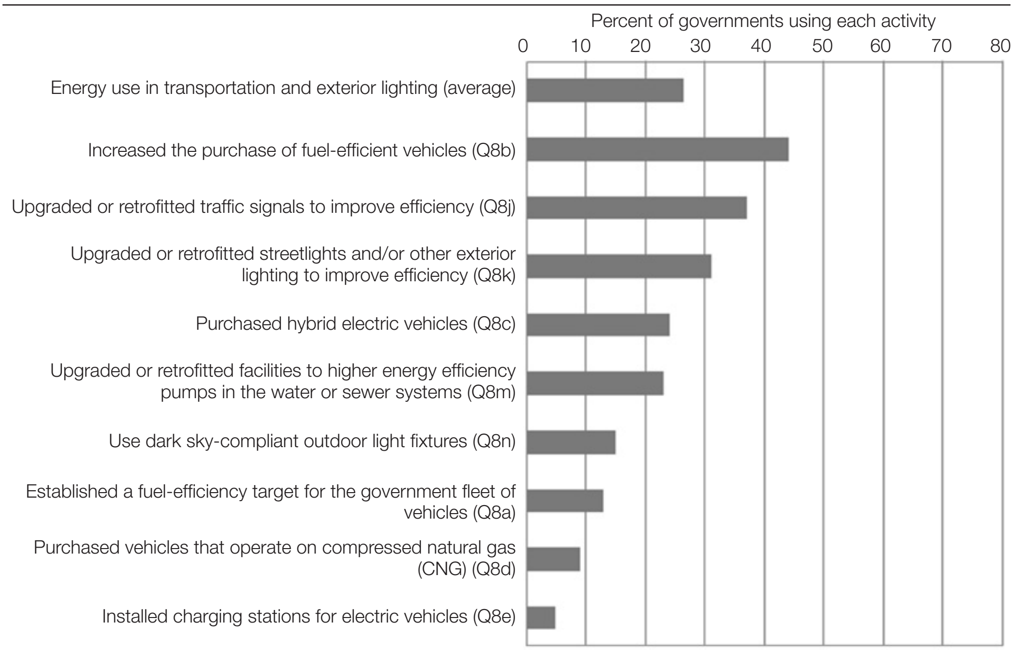
Energy Use in Transportation and Exterior Lighting

Exhibit 6 shows that a large proportion of local governments (44 percent) have taken the step of purchasing vehicles that are fuel efficient. This action has clear and immediately tangible benefits in the form of upfront cost savings, particularly as gas costs continue to be unstable. Of local governments, 37 percent have taken the step of improving their traffic signals to achieve greater efficiency, and 31 percent have upgraded their streetlights. These activities might be justified through cost savings, with sustainability as a side benefit. Fewer of the responding cities and counties have taken the more extensive activities of supporting hybrid vehicle purchase (24 percent) or upgrading their sewage pumps (23 percent), but these steps would seemingly also be justified through efficiency and cost-saving arguments. Very few local governments had established fuel-efficiency goals or chosen to use dark sky-compliant lighting. Supporting electric vehicle recharging was still an underdeveloped activity in 2010.[11] Whether this emerging technology is now beginning to spread more widely needs to be determined.

The benefits of using fuel-efficient vehicles and streetlights clearly span jurisdictional boundaries because air quality and traffic improvements are not neatly tied to one jurisdiction, but altruism is not the likely motivator in this case. Fuel and energy efficiency are very desirable in vehicles and lights, both in terms of cost savings over the life of the equipment and in emissions reduction.

Exhibit 6

Energy Use in Transportation and Exterior Lighting



[11] The alpha for energy use in transportation and exterior lighting is .716. The score is not improved by removing any activity listed, which indicates that the overall index of activities is reliable.

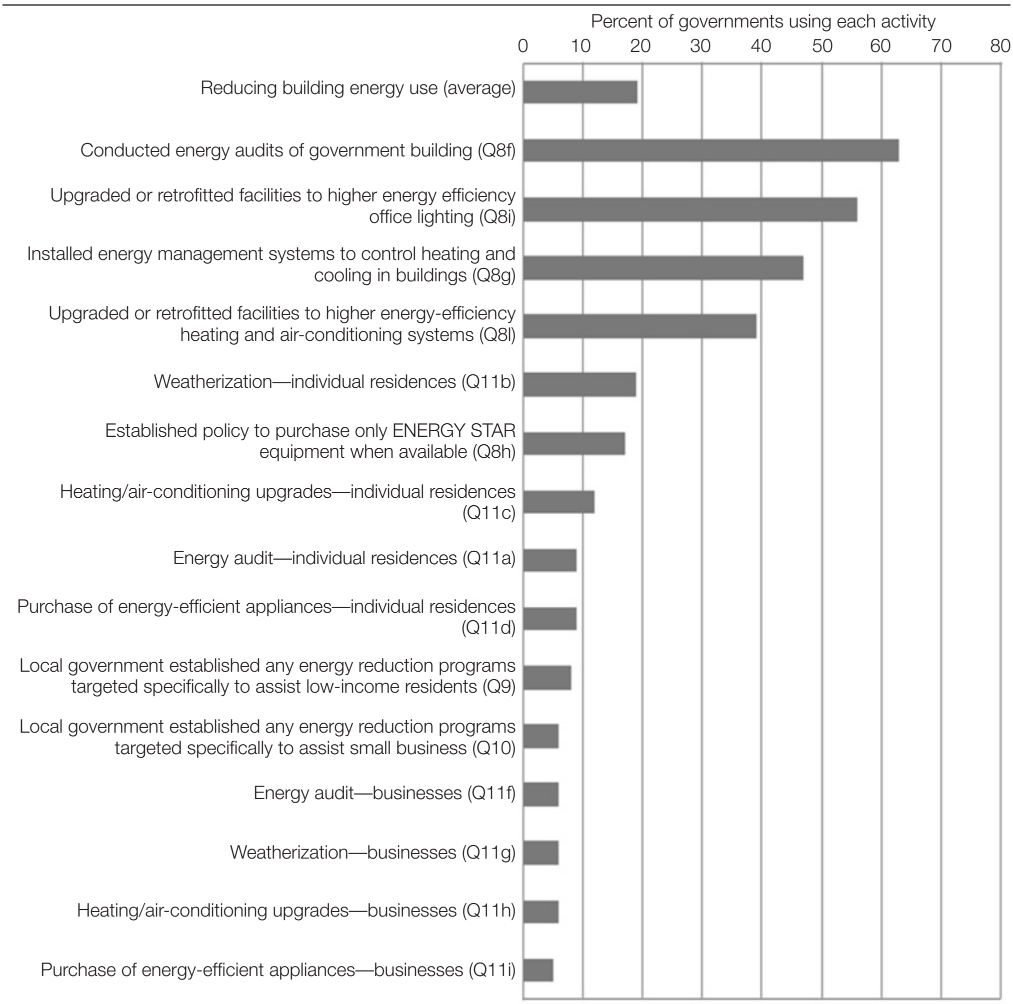
Despite the relatively common use of specific measures, broader strategic approaches and overarching targets are less common. As noted, emerging technologies have not been widely embraced. Dark sky-compliant fixtures that promote environmental objectives other than improved energy efficiency are also uncommon.

Reducing Building Energy Use

It is encouraging to see (exhibit 7) that 63 percent of the respondents have conducted an energy audit of government buildings, which seems to correspond with a high level of interest in both retrofitting lighting and more efficiently managing internal energy consumption. Only 9 percent

Exhibit 7

Reducing Building Energy Use



offer energy audit services for individual residences or assistance in the purchase of energy-efficient appliances, however. Only 6 percent offer energy audit services for local businesses, and 5 percent offer assistance for the purchase of energy-efficient appliances for businesses.[12]

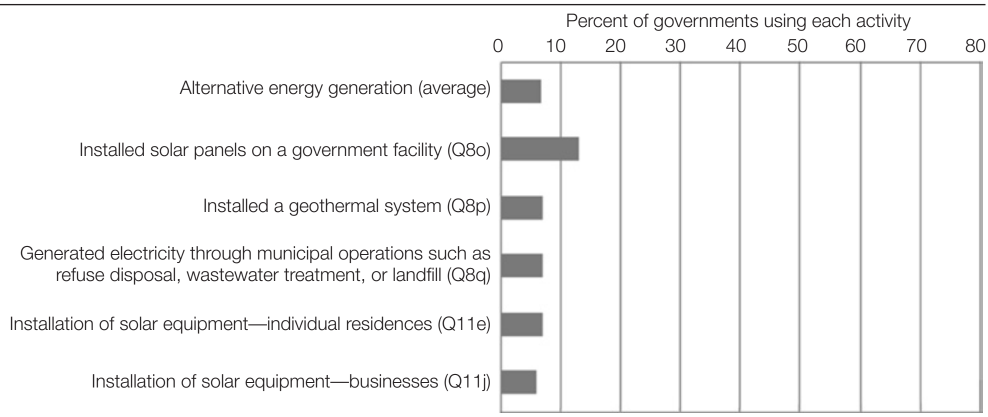
It is clear that the activities most frequently adopted by responding governments yield a direct, internal financial benefit. Focusing on internal energy efficiency reduces energy costs that the local government must pay. Beyond the limited scope of internal energy efficiency improvements, few governments are facilitating energy efficiencies for residents and fewer still are doing so for businesses. Although pursuing energy efficiency can deliver benefits beyond the boundaries of the jurisdiction, we can surmise from the kind of activities local governments are undertaking that their motivation is primarily to reap internal rewards. Subsidies and regulations entail greater fiscal and political costs, which is likely why they are underused.

Alternative Energy Generation

Only the most motivated cities and counties pursue alternative energy usage and development. Exhibit 8 shows that only 13 percent of local governments have installed solar panels on government facilities, and this activity was the most pursued of those listed. Less than 10 percent of respondents offer assistance to facilitate alternative energy usage for businesses, and the same number pursue geothermal energy usage for government facilities or the development of other alternative energy creation.[13]

Exhibit 8

Alternative Energy Generation



[12] The alpha for reducing building energy use is .812, which is extremely high. The score indicates that each activity is necessary in explaining the total score, which is underscored by the fact that if any activities are removed, the alpha varies from .792 to .809, indicating that no one activity contributes to the reliability of the index but, rather, that all activities taken together give this index its strength.

[13] The alpha for alternative energy generation is only .567, indicating that the reliability for this index is not very strong. The alpha improves to .583 if geothermal (Q8p) is not included and to .577 if generating electricity through municipal operations (Q8q) is removed. Each exclusion fails to bring the index into a high reliability range. Removing both exclusions yields a score of .629, which is a significant improvement. These results, however, seem to indicate the need for more research into how to accurately assess alternative energy generation activities cities are pursuing.

Alternative energy development can have high upfront costs that might be difficult to justify in times of recession. In addition, many anecdotes exist of public officials who misunderstand how alternative energy is created and used. (For example, an environmental commissioner in a local government reported in a recent interview that many of the commissioner's colleagues are suspicious of solar and wind energy because the sun does not shine and the wind does not blow all the time). With high upfront costs and a level of technical complexity that might be intimidating and difficult to explain, alternative energy development options remain mostly underused.

Building and Land Use Regulations

Zborel, writing for the National League of Cities, notes that "Nearly all stages of construction, operation and eventual disposal of buildings present significant financial investments and opportunities for savings. Employing green building principles during new construction or through retrofitting existing buildings can significantly reduce operating costs while increasing the overall property value" (Zborel, 2011: 6). Whether and how sustainability opportunities related to building development are pursued is of interest to those considering local sustainability efforts. More than one-third of the survey respondents have zoning codes that encourage mixed-use development (see exhibit 9), but the usage of regulations to pursue sustainability goals drops off sharply from that level. About 20 percent of respondents permit higher density development in existing infrastructure or near an existing transportation node. Only 3 percent of respondents offer reduced fees or tax incentives for environmentally friendly development, which is clearly a missed opportunity to encourage green economy in the locality. Only 12 percent require new government construction to be LEED or ENERGY STAR certified, and even fewer require this certification for government retrofits.[14]

Reviewing records of the U.S. Green Building Council reveals that 8 percent of the responding governments have a LEED-certified government building.[15] Among governments that have set a requirement to meet certification standards for their new buildings, 30 percent have a certified structure compared with only 5 percent of governments that have not set this requirement.

Although the benefits of building and land use regulations to facilitating a smart growth approach to development are primarily internal, external benefits would also accrue to the larger community as the regulations were implemented. Building restrictions that encourage more energy-efficient structures and denser development are meant to facilitate a more livable and efficient community for residents, but they would also produce benefits such as air pollution reduction through fewer single-passenger trips that exceed a jurisdiction's boundaries. Having noted that, communities that are pursuing building and land use regulations as part of a sustainability plan are likely motivated primarily by the local community benefits they expect it to yield.

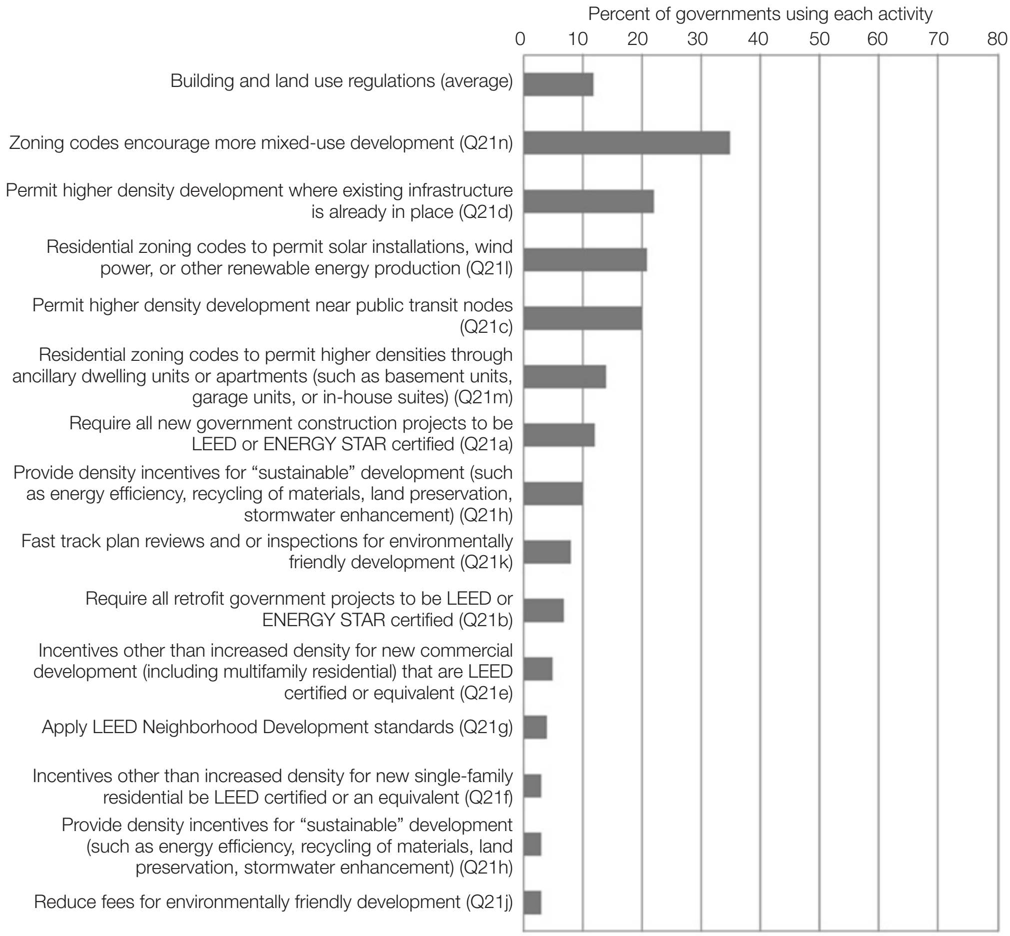
Nearly all the possible building and land use regulation activities included in this survey entail attempts to motivate activities desirable relative to sustainability goals; that is, they permit,

[14] The alpha for building and land use regulations is .761, and each activity area contributes to this score. Removing any activity area does not improve the overall alpha, indicating that this index of activities is reliable for addressing building and land use regulations for cities as regards their sustainability efforts.

[15] Sean Gause carried out the review of the U.S. Green Building Council inventory of certified buildings as part of his research for a senior honors thesis.

Exhibit 9

Building and Land Use Regulations



LEED = Leadership in Energy and Environmental Design.

encourage, or incentivize. Restrictions on activity are less popular; only 7 percent of governments require that all retrofits on their buildings be LEED certified, and (as noted previously) only 12 percent of local governments require that new government buildings be LEED certified. The incentives included in the survey demonstrate one means by which economic development and environmental sustainability can be achieved simultaneously. Mixed-use development might also facilitate the social equity goals that accompany a holistic sustainability perspective.

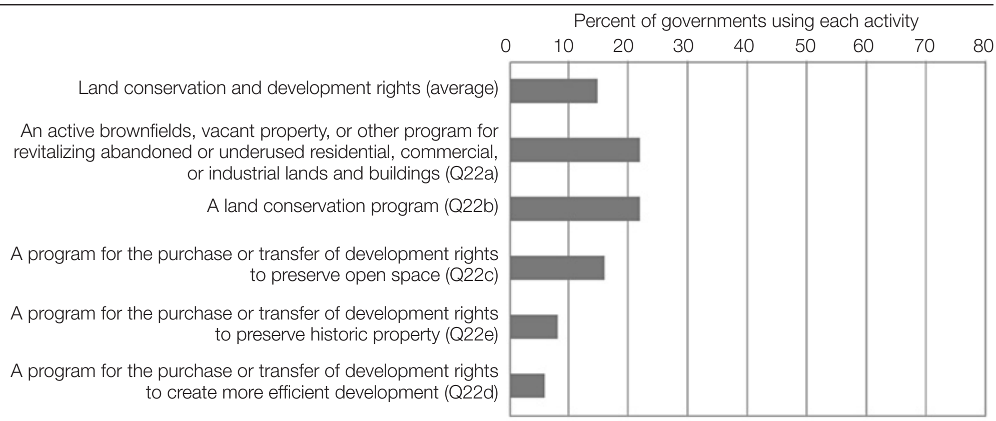
Land Conservation and Development Rights

Land conservation is evidently not a priority for most survey respondents. Less than 25 percent of the respondents have a land conservation program or an active program for revitalizing underused facilities, and only about 17 percent have a program for the purchase or transfer for development rights to preserve open space (see exhibit 10). Even fewer respondents have a similar program to preserve historic property or to acquire development rights to create more efficient development.[16]

By contrast to the immediacy of benefits that come from activities such as improved energy efficiency in buildings, sustainable land use policies and practices often take a long time to provide benefits, and they might generate opposition from affected interests in the short run. Similar to those of the building and land use regulations category, the benefits of pursuing land conservation through more efficient development or programs specifically meant to preserve some set-aside spaces will accrue internally and externally if pursued. A local government that is pursuing policies to conserve land over which it has jurisdiction is likely to be motivated primarily by the internal benefits that might accrue through smart growth strategies. The positive ramifications of those activities will exceed jurisdictional boundaries, however, either through reduced air pollution from fewer trips because of denser development or through public access to land set aside for recreational purposes. Each possible activities listed in this category requires a proactive approach to land management, and their rates of adoption tend to drop off sharply as the activities move to requiring a greater capacity to interface with the development community. For example, 22 percent of the governments offer programs for revitalizing abandoned and underused buildings, but only 6 percent have a program for purchasing or transferring development rights to create more efficient development.

Exhibit 10

Land Conservation and Development Rights



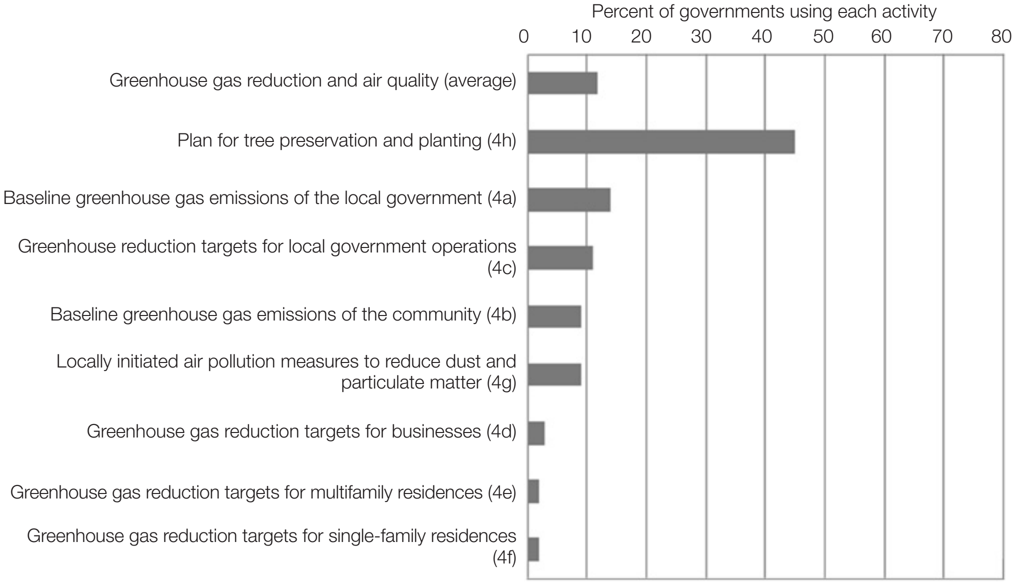
Greenhouse Gas Reduction and Air Quality

By far, the most commonly undertaken activity in the category of GHG emission reduction is a program for tree planting and preservation, with 45 percent of local government respondents pursuing this option (see exhibit 11). Such programs might be part of beautification or landscaping

16 The alpha for land conservation and development rights is .565 but improves to .620 when the question regarding programs for revitalizing brownfields (Q22a) is removed. Removing any other activity area decreases the alpha.

Exhibit 11

Greenhouse Gas Reduction and Air Quality



projects that have been rolled into the locality's sustainability plan. With regard to measures explicitly related to GHG, only 14 percent of respondents have determined their baseline GHG emissions, 11 percent have established reduction targets for local operations, 9 percent have determined reduction targets for the community at large, 6 percent have established targets for businesses, and 2 percent have established targets for single-family and multifamily residences.[17]

The effort to reduce GHG emissions is one of the core foci of sustainability,[18] yet few responding governments have enacted strategies to catalog and decrease local emissions. One might legitimately question how a local government plans to assess the quality of its sustainability plan if it has not measured its baseline emissions. With what will future measurements be compared? If sustainability programs are to focus on results, measures of current conditions are needed. The reduction of GHG emissions is not the only goal of the move toward more sustainable practices, but it is a core area that, it appears, has been underaddressed thus far.

[17] The alpha for greenhouse gas reduction and air quality is .693. Although already high, this score improves dramatically, to .757, with removing the plan for tree preservation and planting (Q4h). A less impressive increase (to .698) results from removing the question regarding locally initiated air pollution measures (Q4g). The alpha for this category is strong overall, but the scores indicate that some tweaking might improve the reliability of this index. The alpha increases to .798 if locally initiated air pollution measures (Q4g) and tree preservation and planting (Q4h) are both removed.

[18] "The 'greenhouse effect', one such threat to life support systems, springs directly from increased resource use. The burning of fossil fuels and the cutting and burning of forests release carbon dioxide (CO2). The accumulation in the atmosphere of CO2 and certain other gases traps solar radiation near the Earth's surface, causing global warming. This could cause sea level rises over the next 45 years large enough to inundate many low lying coastal cities and river deltas. It could also drastically upset national and international agricultural production and trade systems" (United Nations, 1987b: 3.24).

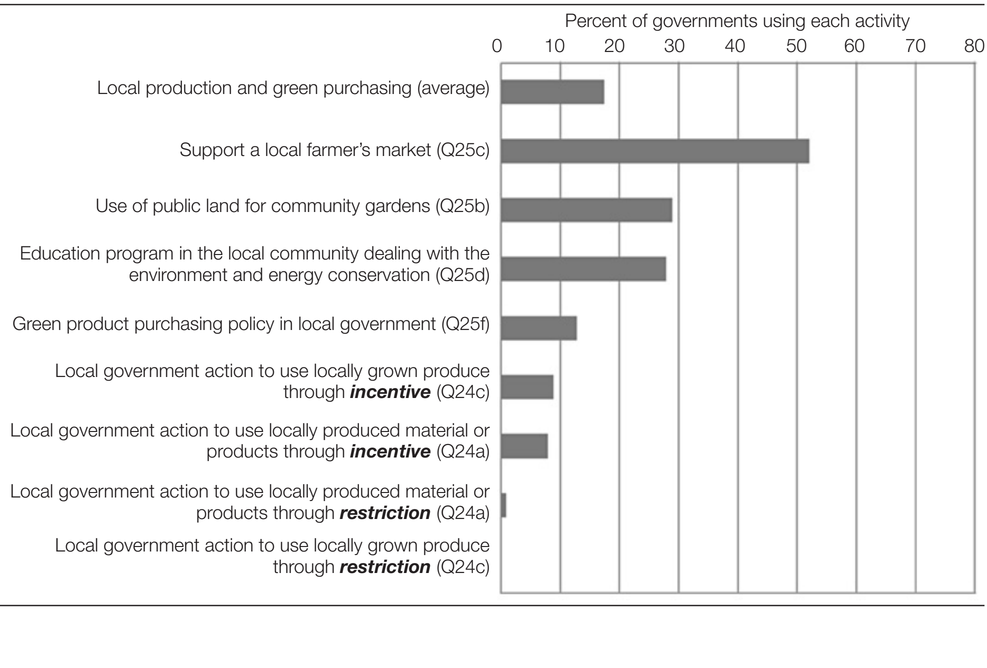
Local Production and Green Purchasing

More than one-half of the respondents indicated that they offer support for local farmer's markets (see exhibit 12). As with recycling and tree planting, this result might be a longstanding commitment by the local government rather than an action taken in response to the sustainability movement. On the other hand, community gardening seems to be a new idea, and nearly 30 percent of local governments are now engaging in it. About the same proportion offer community education regarding the local environment and energy conservation. Only 13 percent of responding governments have an internal green purchasing policy, however, and less than 10 percent use either incentive or restriction to encourage the use of locally sourced materials.[19]

The benefits of purchasing locally produced items and facilitating residents' ability to do so are numerous: supporting the local economy, reducing the requirement for transporting items across vast spaces, creating community through farmer's markets and community gardens, educating community members on many environmental issues, and so on. Farmer's markets often attract participants from beyond the local government's jurisdiction, whereas community gardens primarily seem to be based in particular neighborhoods.

Exhibit 12

Local Production and Green Purchasing



[19] The overall alpha for local production and green purchasing is .560, indicating room for improvement regarding the reliability of this index. The alpha increases to .570 when either of the restriction measures (Q24a or Q24c) is removed and to .591 if both are removed, but this slight increase does not yield a dramatic change to the reliability of the index. A different combination of activities might yield a better measure of local production and green purchasing activity. This list is more a collection of activities than a coherent scale.

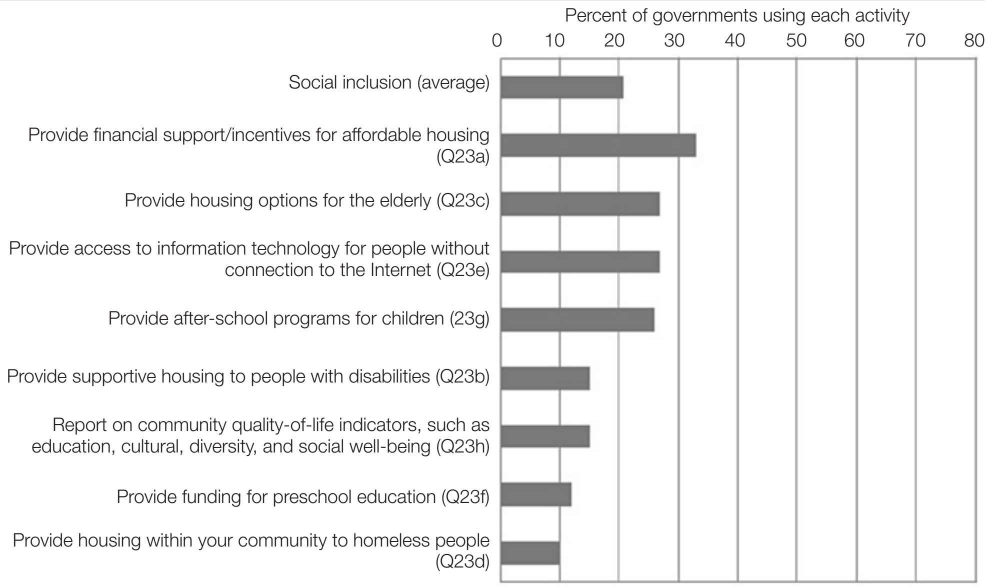
As local governments strive for financial savings, it is perhaps not surprising that they generally do not require those items that are purchased to be green, because these items often come with higher upfront costs. Because green items' benefits are often not immediate, they can become more difficult to justify. Also unsurprising given the likely reluctance of many communities to support high levels of local government regulation, efforts to incentivize or restrict individual behaviors are not commonly used. These activities are clearly underused but perhaps also the most politically difficult to develop and implement in this category.

Social Inclusion

In considering social inclusion, this survey asked questions about housing, access to technology, and education options for low-income individuals in the city. Exhibit 13 shows that more than 30 percent of responding local governments provide support or incentives for affordable housing, and about 27 percent provide housing options for elderly people, provide access to technology for those who do not have it, and offer after-school programs for children. Only 12 percent provide some sort of early preschool funding support, 15 percent provide supportive housing to people with disabilities, and 10 percent provide some sort of housing for homeless people.[20]

Exhibit 13

Social Inclusion



[20] The alpha for social inclusion is .783, which is very high. Furthermore, removing any activity does not improve the score but also does not drop it dramatically; the range of scores if an item is removed is from .747 to .771, indicating that each item in this category has an effect on the overall score and that the index is reliable. It is interesting to note that, although removing the low-income transportation assistance item (Q20) from the transportation improvements index yields a slight increase in the alpha, adding it to the social inclusion index results in a slight drop, to .777.

Social inclusion activities are clearly meant to facilitate greater equity among members of the local community, such that everyone's most basic needs are met. These activities might be classified under many different policy prerogatives, again demonstrating the cross-collaborative nature that sustainability activities can take. Although the benefit of many of these activities is local in the short term, it is generally understood that activities such as facilitating education attainment provide long-term benefits to society as a whole. Providing housing assistance to the most vulnerable populations in a community provides both economic and social benefits to that community (Norman-Major and Wooldridge, 2011). Still, these activities might be perceived as handouts that benefit only low-income people at the expense of relatively wealthy people. The activities listed in this category are explicitly services provided by the local government and do not restrict individual action in any way. One's preference for the kinds of social services provided by government are often tied to one's ideological preference, and further research will help determine the role ideology plays in the pursuit of social inclusion sustainability objectives.

Summing Up the Activities: Glass Still Empty or Starting To Fill Up?

This extended review of the general patterns and specific choices of activities reinforces the view that most governments are slow to commit to sustainability and are using only a small range of the possible approaches considered in this survey. As noted, some of the most commonly used activities might be longstanding and adopted for reasons other than a commitment to sustainability. Such activities are important as part of an integrated sustainability strategy, but they do not necessarily indicate a commitment to promoting sustainability as an explicit policy goal. This interpretation is reinforced by the fact that the lack of an overall sustainability program is typical of most of the survey respondents. Fewer than 3 in 10 governments have set goals, and only 19 percent have set targets.

When activities are divided into those with an internal or an external focus, it would seem intuitive that the internal activities that change governmental operations would be more commonly adopted than those that target residents or businesses or that affect the community generally. Our research shows this intuition to be accurate in some areas; for example, audits and energy-efficiency improvement are more common in government buildings than in residences and privately owned buildings. Still, many steps that governments could take to change staff behavior (for example, incentives for carpooling or using means other than cars to get to work) or operating practices (for example, use of recycled office paper) are still rarely used. When comparing the adoption rates of the 38 internally focused activities and the 72 community-focused activities, no difference emerges. The governments in the survey adopted approximately 20 percent of both sets of activities.[21]

[21] The rate for internal activities is 20.2 percent and the rate for external activities is 21.0 percent. Examples of internal activities are a recycling program in the local government, energy audits of government buildings, telework for government staff, requiring all new government construction projects to be LEED or ENERGY STAR certified, and having purchased hybrid electric vehicles. Examples of external activities are a communitywide recycling collection program for residential properties, charging stations for electric vehicles, energy audits of individual residences, incentives other than increased density for new commercial development (including multifamily residential) that are LEED certified or an equivalent, a land conservation program, and a program for the purchase or transfer of development rights to preserve open space.

Another indication of an explicit commitment to promoting sustainability is joining a national or international campaign. In 2005, the United States Conference of Mayors endorsed the Climate Protection Agreement.[22] To reduce global-warming pollution levels, the agreement urges action on the national and local government levels. Among the city governments responding to the International City/County Management Association's sustainability survey, 281 (13 percent) have adopted the agreement.[23] (Virtually no counties have signed it.) The signees have an overall sustainability rating of 30 compared with the rating of 18 for all governments (Svara, 2011). One association that local governments can join is ICLEI—Local Governments for Sustainability (formerly, the Council for Local Environmental Initiatives) with more than 1,200 local government members internationally.[24] ICLEI members become part of the Cities for Climate Protection (CCP) campaign by passing a resolution to reduce GHG emissions from their local government operations and throughout their communities by undertaking specific activities.[25] More than 600 local governments in the United States are ICLEI members. Among governments responding to the ICMA survey, 10 percent are members. The signees have an overall sustainability rating of 34 (Svara, 2011).

It appears that up to one-fourth of local governments have gotten on the sustainability train for the long haul with the intent of traveling to an explicitly chosen destination. Even these governments could do much more, but they are exploring a fairly wide range of options. The remaining local governments are adopting some prominent activities or identifying existing practices that are related to sustainability. In effect, they stay on the train for a few stops but have not yet committed to making the journey.

Who Is Adopting Sustainability Activities?

A previous study based on bivariate analyses of this survey revealed three factors associated with differences in the overall level of sustainability action: (1) form of government, (2) population, and (3) region. We build on this foundation by expanding the range of city characteristics to explain local government sustainability efforts and estimating multivariate models of their influence on the scope of sustainability programs that cities adopt.

We draw on the literature and previous studies to identify a more comprehensive set of factors that might explain why some local governments engage in more sustainability activities than others. The factors include community demographic and socioeconomic attributes, governmental institution, and local policy priorities. We also account for population, density, metropolitan status, and region. Exhibit 14 lists the variables included in our explanatory models.

[22] Available at http://usmayors.org/climateprotection/documents/mcpAgreement.pdf.

[23] In addition, 7 cities using commission, town meeting, and representative town meeting forms of government and 4 counties have signed the agreement.

[24] See http://iclei.org/.

[25] The organization was founded in 1990 as the "International Council for Local Environmental Initiatives." The CCP campaign was launched in 1993 as a successor to the organization's initial Urban CO2 Reduction Project. The five milestones of the CCP are (1) conducting a baseline emissions inventory and forecast, (2) adopting an emissions reduction target for the forecast year, (3) developing a local action plan, (4) implementing policies and measures, and (5) monitoring and verifying results. Information about CPP is available at http://iclei.org/index.php?id=810 (accessed January 14, 2011).

Exhibit 14

Measurements and Summary Statistics of Independent Variables

		Measurement	Mean (Standard Deviation)	Min/Max
Institution	Manager	1 = cities with council manager form of government, 0 = mayor-council or other form (ICMA, 2010)	0.62 (0.48)	0/1
Community Attributes	Education	Percentage of population with bachelor degree or higher (2006–2010 American Community Survey 5-Year Estimates)	28.0 (16.0)	3.3/86.1
	Young adults	Percentage of population age between 25 and 44 (2006–2010 American Community Survey 5-Year Estimates)	25.50 (4.58)	2.70/50.40
	White	Percentage of population that is White (2006–2010 American Community Survey 5-Year Estimates)	80.2 (17.6)	3.3/99.3
	Income	Median family income (2006–2010 American Community Survey 5-Year Estimates)	66,552 (28,651)	23,690/ 250,001
	Home-ownership	Percentage of owner-occupied housing (2006–2010 American Community Survey 5-Year Estimates)	65.4 (13.0)	20.3/97.5
	Housing value	Median housing value (2006–2010 American Community Survey 5-Year Estimates)	221,510 (181,335)	28,200/ 1,000,001
Policy priority	Environment	0 = not a priority, 1 = somewhat a priority, 2 = priority, 3 = high priority (ICMA, 2010)	1.75 (0.83)	0/3
	Climate change	0 = not a priority, 1 = somewhat a priority, 2 = priority, 3 = high priority (ICMA, 2010)	0.76 (0.87)	0/3
	Green jobs	0 = not a priority, 1 = somewhat a priority, 2 = priority, 3 = high priority (ICMA, 2010)	1.02 (0.87)	0/3
	Energy conservation	0 = not a priority, 1 = somewhat a priority, 2 = priority, 3 = high priority (ICMA, 2010)	1.89 (0.79)	0/3
Control variables	Metro	1 = central city, 0 = otherwise (ICMA, 2010)	0.09 (0.29)	0/1
	West	1 = West region, 0 = otherwise (ICMA, 2010)	0.21 (0.40)	0/1
	Density	Population density in square miles (2006–2010 American Community Survey 5-Year Estimates)	2,169 (1,971)	18.4 (27,012)
	Population	Log of total population (ICMA, 2010)	9.50 (1.15)	6.43/15.91

ICMA = International City/County Management Association.

Urban scholars argue that city policy adoptions are a response to the demands of residents, particularly if they entail high upfront investment cost from new program implementation, as is often the case with sustainability programs (Krause, 2010; Lubell, Feiock, and Handy, 2009; Saha, 2009; Sharp, Daley, and Lynch, 2010; Wang et al., 2012). This literature provides valuable insights into how community attributes affect the policy decisions of local governments. Hence, we argue that the cities with residents who perceive greater localized benefits relative to costs are more likely to pursue sustainability activities.

We expect that young adults and people with higher education levels will favor adoption of a broader set of sustainability programs (Lubell, Feiock, and Handy, 2009; Portney, 2003; Sharp, 2005). Race will also be an important factor affecting policy preference, with evidence that minorities support measures to advance sustainability (Pike and Herr, 2011). Income, homeownership, and housing value are socioeconomic characteristics that have been considered to capture community policy orientation and city interest (Peterson, 1995). Cities with strong homeownership might be disinclined to support sustainability policies of the investment of resources for achieving long-term benefits that will possibly be diffused without immediate localized benefits. We also acknowledge, however, that these factors can measure community financial resources to be used for long-term returns. In general, communities with greater resources are more likely to support the adoption of innovations (Kearney, 2005; Kearney, Feldman, and Scavo, 2000; Moon and deLeon, 2001).

Two additional variables included in the analysis warrant additional discussion: form of government and variations in policy priorities. First, we expect cities with professional city managers to have more sustainability adoptions. Council-manager cities have a track record of earlier and more extensive adoption of innovations than do mayor-council cities (Kearney, 2005; Kearney, Feldman, and Scavo, 2000; Moon and deLeon, 2001; Svara, 2011). Although newly elected executives in mayor-council cities are more likely than their counterparts in council-manager cities to initiate policy changes (Wolman, Strate, and Melchior, 1996), mayors in council-manager cities who provide visionary and facilitative leadership can strengthen goal setting (Nelson and Svara, 2012). With regard to sustainability, Bae and Feiock (in press) argue that council-manager cities exhibit a stronger internal focus and mayor-council cities exhibit a stronger community focus; that is, managers make changes within the administrative arena. When the activities covered in the ICMA survey were divided by internal versus community emphasis, however, council-manager cities and counties were conducting demonstrably more activities of both the internal and community types than were the governments with elected executives.[26] Still, it is not clear whether the importance of form of government will persist when the demographic and socioeconomic characteristics of the community are included in the analysis.

The motivations to undertake activities meant to advance sustainability presumably relate to policy priorities about the social, economic, and environmental concerns that underlie the

[26] See footnote 21 and the discussion of activities in the first part of the article. In general, internal activities focus on government operations, and community policies affect residents or organizations in the community. Mayor-council cities had an average of 4.6 internal and 12.8 community activities; council-manager cities had an average of 7.3 internal and 18.4 community activities. The difference is not as great in counties, but the council-manager governments are doing more in that setting, as well.

movement. The ICMA survey measured the priority assigned in the respondent's jurisdiction to eight policy areas that could be related to sustainability (Svara, 2011). We propose that the nature of the policy priorities established in a community make a difference in the level of sustainability action. Four areas are included in the analysis: environment, energy conservation, green jobs, and climate change. These issues differ in that energy conservation and green jobs are areas in which the locality can directly benefit from taking action, whereas improving the environment and undertaking activities to offset climate change might have broad effects but little direct benefit to the jurisdiction or its government in the short run. It is possible, however, that the priorities reflect the makeup of the population and other community characteristics.

We present two models of sustainability ratings. The first includes community characteristics and the second adds the four policy priorities to assess their effect on the sustainability activity level. For more meaningful interpretation of the effect of separate variables, we used the Clarify program of STATA to produce the predicted probabilities for each statistically significant independent variable from our second model of regression analysis (Tomz, Wittenberg, and King, 2001). Exhibit 15 reports the results of predicted probability of sustainability rating affected by the change in each independent variable from its minimum (or 25th percentile) to maximum (or 75th percentile) range.

The regression models fit the data well (R^2 = .44/.53). Adding the four policy priorities does not produce any substantial change in any of the coefficients from the first model, as exhibit 15 presents. Thus, the results of the coefficients and predicted probabilities confirm that the primary

Exhibit 15

Sustainability Rating Models of Regression Estimates and Predicted Probabilities

	1st Model (N = 1,612)		2nd Model (N = 1,519)			
	β	t	β	t	Predicted Probability	Difference
Manager	1.95***	3.73	2.139***	4.25	19.8 (manager)/ 17.2 (otherwise)	2.6
Education	.1173***	3.90	.0723**	2.47	17.8 (25p)/19.1 (75p)	1.3
Young adults	.1260*	2.16	.1000*	1.80	18.4 (25p)/18.9 (75p)	0.5
White	.0500**	3.19	.0482**	3.19	18.2 (25p)/19.3 (75p)	1.1
Income	– .0001***	– 4.27	– .00008**	– 3.27	20.0 (25p)/17.9 (75p)	– 2.1
Homeownership	– .0842**	– 3.14	– .0698*	– 2.68	19.2 (25p)/18.1 (75p)	– 1.1
Housing value	.00002***	6.59	.00001***	5.05	17.0 (25p)/19.1 (75p)	2.1
Environment	—	—	1.390***	3.98	16.2 (min)/20.40 (max)	4.2
Climate change	—	—	.681*	1.85	18.1 (min)/20.2 (max)	2.1
Green jobs	—	—	1.292***	3.68	17.3 (min)/21.2 (max)	3.9
Energy conservation	—	—	2.289***	6.29	14.4 (min)/21.2 (max)	6.8
Metro	3.88***	4.03	3.565***	3.90	21.8 (central)/ 18.3 (otherwise)	3.5
West	3.89***	5.63	3.669***	5.56	21.4 (West)/ 17.7 (non-West)	3.7
Density	– .0003*	– 1.83	– .0003**	– 2.10	19.9 (25p)/18.5 (75p)	– 1.4
Population	4.510***	15.62	4.148***	14.93	14.7 (25p)/21.8 (75p)	7.1
Constant	– 29.07***	– 8.78	– 39.10***	– 11.90	—	—
	R square = .44		R square = .53			
	Adj R square = .43		Adj R square = .52			

** p < 0.1. **p < 0.05. ***p < 0.01.*

factors in our framework predict the level of sustainability activities undertaken by a city.[27] The result demonstrates that form of government matters; cities with the council-manager form of government are more likely to engage in sustainability activities than cities with other forms. Our probability analysis reports the predicted probability of a sustainability rating is 19.8 if a city operates under council-manager form and drops to 17.2 if a city has a mayor-council form of government, when the other variables in the model are held at their mean.

In terms of community attributes, three demographic factors are associated with the level of sustainability activities. Consistent with the prediction, cities that have younger and more educated populations have a higher level of sustainability activity. Racially homogeneous communities with greater White populations give slightly greater support to sustainability. Race is a predictor of sustainability ratings, but contrary to expectations, our data suggest that a more homogeneous White population, not greater diversity, is linked to greater sustainability activity. The predictions about socioeconomic status are mostly confirmed. Moving from the 25th to the 75th percentile, median family income decreases the sustainability rating by 2.1. Sustainability initiatives are less in high-homeownership communities, although moving from the 25th to the 75th percentile of homeownership decreases the sustainability rating by only 1.1 points. The significant and negative effects of income and homeownership suggest that sustainability is not an approach limited to affluent communities. An affluent community with a high proportion of homeowners might resist sustainability programs, perhaps because of the high investment costs and diffused benefits. When it comes to housing value, the direction of the effect is positive and significant. Note also that these community characteristics make a difference but for the most part not a substantial one. Thus, future research will need to address the dynamic effect of community characteristics on the sustainability initiatives.

The estimates of the second model show interesting and potentially important results regarding the effect of the four policy priorities: (1) environment, (2) climate change, (3) green jobs, and (4) energy conservation. We found that after controlling for structural, demographic, and socioeconomic characteristics, each one of these policy priorities has a significant influence on the number of sustainability activities undertaken by local governments. In exhibit 15, the importance assigned to energy conservation affects the number of activities undertaken to a greater degree than the other three areas of policy preference. Those local governments that indicated that energy conservation is a high priority will achieve, on average, a 6.8-point higher sustainability rating than a local government that does not give the same importance to energy conservation, holding all other variables at their mean. The other policy priorities also have positive but lesser effects. Whereas bivariate analysis shows that emphasis on climate change has a stronger association with the sustainability rating than any other policy priority (Svara, Read, and Moulder, 2011), when other characteristics and priorities are held constant it has the least effect.[28]

[27] The socioeconomic variables are available only for cities and other municipal-type governments that are included in the American Community Survey.

[28] The atypical community that emphasizes climate change has a sustainability rating of more than 30. These communities are highly likely to also emphasize the other more widely accepted policy priorities and to share other characteristics linked to higher ratings. Holding these variables constant, a high priority for climate change does produce a very high predicted probability score.

In addition, the analysis indicates that a higher adoption rate of sustainability activities is significantly associated with population, density, metropolitan status, and region, as exhibit 15 indicates. Metropolitan status provides additional reinforcement to taking action on sustainability, as does being in the West region.

Conclusion

Local governments in the United States are taking a tentative and uneven approach to embracing sustainability. The general level of adoption of sustainability measures tends to be low, and most activities are not being pursued. Based on activities adopted through the year 2010, approximately one in six governments have relatively high overall sustainability adoption ratings, although those governments at the low end of the high group are adopting only 30 percent of the surveyed activities. This proportion is about what one would expect of earlier adopters and higher adopters in the population of local governments if sustainability matched the typical pattern of diffusion of innovations (Rogers, 2003). What is unusual is that three in five governments are below average in their adoption of sustainability activities. The later adopters and the laggards represent a supermajority that is holding down the extent of commitment for the local government sector as a whole. Perhaps the most blatant indicator of limited commitment is the absence of goals and targets for most local government sustainability programs.

The variation in use of activities from the 12 categories measured indicates that experience, control, resources, and the extent of local benefit influence the activities used most commonly undertaken. The most commonly used areas are recycling and water conservation—areas in which local governments have long records of involvement that presumably often preceded formulating a unifying sustainability goal. In these areas, 33 and 28 percent of the measured activities, respectively, are being used. Still, the implementation of new activities, such as the purchase of recycled products or reuse of gray water, are unusual. Four of the next five areas in frequency of adoption—18 to 22 percent of the activities are used—are mostly controlled by local governments and provide benefits to the local government in the short term. These areas are transportation improvements, energy use in transportation and exterior lighting, reducing building energy use, and local production and green purchasing. Local governments benefit from using these practices, which can be adopted without much public involvement or resistance. The final area in this group is social inclusion, which includes activities that are potentially controversial. More research is needed to determine whether the activities adopted in this area are recent decisions taken as part of a comprehensive sustainability plan or, rather, are longstanding government policies or programs. For the remaining five areas—workplace alternatives to reduce commuting, alternative energy generation, building and land use regulations, land conservation and development rights, and greenhouse gas reduction and air quality—15 percent or less of the activities have been adopted. Local governments must regulate the behavior of residents or businesses to adopt these activities and, in some cases, invest substantial resources to provide incentives for change. The exception is promoting alternatives to commuting for government employees, which need not be costly or difficult to implement. For these activities to be as rare as installing solar panels suggests that many governments have not explored their options in sufficient depth or have a limited commitment to sustainability.

The multivariate test of our explanation for why some cities adopt more sustainability policies than others confirms that form of government, community attributes, and policy priorities each play an important role. These factors explain differences in the level of sustainability activities even when controlling for important factors such as population, density, metropolitan status, and region. Demographic and socioeconomic characteristics influence sustainability in complex ways. Cities with homogeneous White populations and highly educated residents are more likely to pursue sustainability activities, but increasing income and homeownership rates has negative effects. Sustainability does not appear to be an issue associated with a "typical" division based on race, class, or community wealth. Strong homeownership in affluent communities might create an interest group that represents the reluctance of the community about spending on sustainability policies and regulations placed on their properties. On the other hand, higher education levels and higher populations of young adults produce a more favorable setting for sustainability initiatives. The results from multivariate analyses warrant further discussion of the dynamic effect of community characteristics on sustainability initiatives.

In addition, commitment to the larger issues addressed by the sustainability movement appears to be a key factor that distinguishes local governments that lead others in taking action to promote sustainability. It seems less important whether the issue entails policies that directly benefit the community or those that benefit the greater society. Assigning a high priority to promoting energy conservation has a direct and immediate benefit to the local government, but its effect on the level of sustainability action is similar to that of improving the environment, which has more general and long-term benefits. In a similar way, giving a very high priority to green jobs and reversing climate change both are associated with more sustainability action, although they differ in the nature of the benefits they generate. The second model estimation shows that the importance of each policy priority can increase the level of sustainability activities, controlling for other factors.

The presence of a group of early and extensive sustainability policy adopters that are not being followed by a larger group that would fill out the early majority suggests that motivational factors are particularly important in developing a broad and coherent commitment to sustainability. A substantial boost in sustainability action is linked to greater support for addressing issues related to sustainability—protecting the environment, economizing on the use of energy, promoting green jobs, and reversing climate change. Whereas the lower and the slower adopters might be acting primarily to derive local benefits,[29] the governments that adopt more activities sooner are likely to be influenced by a normative commitment to advance sustainability and provide benefits to people outside their jurisdiction. They are acting to promote the greater good in not only the present, but also the future. This explanation might offer insights regarding the difference between leaders and followers, in general, in the diffusion of innovation.

[29] These governments are also likely to be influenced by the other factors that influence governments to conform to emerging practices—coercive, mimetic, and normative isomorphism (DiMaggio and Powell, 1983).

Appendix

Exhibit A-1

Sustainability Activities Used by Most Governments in At Least One Population Category (1 of 6)

	500,000 or More	100,000–499,999	50,000–99,999	10,000–49,999	Less Than 10,000	All
Internal program that recycles paper and plastic and glass in your local government (Q7a)	83	89	87	76	61	72
Communitywide recycling collection program for paper and plastic and glass for residential properties (Q7b)	78	80	81	79	71	76
Added biking and walking trails (Q17b)	86	81	73	65	50	61
Conducted energy audits of government buildings (Q8f)	97	89	81	68	48	63
Upgraded or retrofitted facilities to higher energy efficiency office lighting (Q8i)	100	86	72	60	41	56
Recycling of household hazardous waste (Q7d)	78	80	71	59	42	55
Support a local farmer’s market (Q25c)	50	56	65	55	47	52
Increased the purchase of fuel-efficient vehicles (Q8b)	94	76	68	50	26	44
Recycling of household electronic equipment (e-waste) (Q7e)	69	73	70	54	42	52
Requiring sidewalks in new development (Q17e)	67	61	65	60	45	54
Installed energy management systems to control heating and cooling in buildings (Q8g)	97	76	66	49	32	47
Upgraded or retrofitted facilities to higher energy-efficiency heating and air-conditioning systems (Q8l)	94	71	58	40	26	39
Upgraded or retrofitted traffic signals to improve efficiency (Q8j)	72	59	58	42	22	37
Expanded dedicated bike lanes on streets (Q17a)	78	61	55	38	19	34
Provide financial support/incentives for affordable housing (Q23a)	81	60	56	33	20	33
Plan for tree preservation and planting (Q4h)	56	53	56	47	38	45
Purchased hybrid electric vehicles (Q8c)	81	65	50	25	7	24
Education program in the local community dealing with the environment and energy conservation (Q25d)	56	52	41	30	18	28
Communitywide recycling collection program for paper and plastic and glass for commercial properties (Q7c)	53	47	49	45	43	45
Upgraded or retrofitted streetlights and/or other exterior lighting to improve efficiency (Q8k)	53	42	46	31	23	31

Exhibit A-1

Sustainability Activities Used by Most Governments in At Least One Population Category (2 of 6)

	500,000 or More	100,000–499,999	50,000–99,999	10,000–49,999	Less Than 10,000	All
Added bike parking facilities (Q17c)	61	46	46	29	18	28
Other incentives for water conservation behaviors by city, residents, and businesses (Q6e)	56	41	32	29	21	28
Is telework permitted for staff members in your local government? (Q14)	60	45	36	27	19	27
Provide housing options for the elderly (Q23c)	53	44	43	27	20	27
Provide access to information technology for people without connection to the Internet (Q23e)	53	43	34	26	23	27
Provide after-school programs for children (Q23g)	58	44	44	27	17	26
Upgraded or retrofitted facilities to higher energy efficiency pumps in the water or sewer systems (Q8m)	58	33	32	24	18	23
A land conservation program (Q22b)	58	41	32	23	15	22
An active brownfields, vacant property, or other program for revitalizing abandoned or underused residential, commercial, or industrial lands and buildings (Q22a)	50	42	30	22	16	22
Permit higher density development near public transit nodes (Q21c)	61	40	36	22	8	20
Established policy to purchase only ENERGY STAR equipment when available (Q8h)	53	30	29	17	11	17
Use of graywater and/or reclaimed-water use systems (Q6b)	64	35	28	16	9	16
Provide supportive housing to people with disabilities (Q23b)	53	35	28	16	7	15
Installed solar panels on a government facility (Q8o)	50	35	22	12	6	13
Require all new government construction projects to be LEED or ENERGY STAR certified (Q21a)	56	26	24	12	6	12
Provide housing within your community to homeless people (Q23d)	64	39	26	7	2	10
Purchased vehicles that operate on compressed natural gas (CNG) (Q8d)	64	31	17	7	2	9
LEED-certified building projects (added after survey)	67	32	18	4	1	8
Local government incentives for local government employees to take mass transit to work (Q12a)	69	28	14	5	1	7

Exhibit A-1

Sustainability Activities Used by Most Governments in At Least One Population Category (3 of 6)

	500,000 or More	100,000–499,999	50,000–99,999	10,000–49,999	Less Than 10,000	All
Does your community currently have a commuter rail system (subway or streetcar)? (Q18)	59	14	11	7	3	7
Local government incentives for local government employees to carpool to work (Q12b)	64	23	15	4	1	6
Does your community have a plan to create or expand the use of subway or streetcars? (Q19)	58	22	13	5	1	6
Actions to conserve the quantity of water from aquifers (Q6a)	47	41	41	35	28	34
Report on community quality-of-life indicators, such as education, cultural, diversity, and social well-being (Q23h)	47	35	29	15	7	15
Baseline greenhouse gas emissions of the local government (Q4a)	47	36	32	13	6	14
Generated electricity through municipal operations such as refuse disposal, wastewater treatment, or landfill (Q8q)	47	26	14	6	2	7
Locate recycling containers close to refuse containers in public spaces such as streets and parks (Q25e)	44	45	46	37	26	34
Expanded bus routes (Q17d)	44	49	43	23	10	22
Permit higher density development where infrastructure is already in place (utilities and transportation) (Q21d)	44	35	37	24	14	22
A program for the purchase or transfer of development rights to preserve open space (Q22c)	44	29	19	16	10	16
Zoning codes encourage more mixed-use development (Q21n)	42	46	46	41	26	35
Use of public land for community gardens (Q25b)	42	46	41	30	21	29
Weatherization—individual residences (Q11b)	42	32	30	11	10	16
Green product purchasing policy in local government (Q25f)	42	35	26	12	6	13
Use water price structure to encourage conservation (Q6d)	39	35	37	33	32	33
Established a fuel-efficiency target for the government fleet of vehicles (Q8a)	39	31	18	13	6	13
Greenhouse gas reduction targets for local government operations (Q4c)	39	27	21	11	6	11
Baseline greenhouse gas emissions of the community (Q4b)	39	22	23	7	3	9

Exhibit A-1

Sustainability Activities Used by Most Governments in At Least One Population Category (4 of 6)

	500,000 or More	100,000–499,999	50,000–99,999	10,000–49,999	Less Than 10,000	All
Residential zoning codes to permit solar installations, wind power, or other renewable energy production (Q21l)	36	31	26	22	16	21
Provide funding for preschool education (Q23f)	36	27	20	12	7	12
Locally initiated air pollution measures to reduce dust and particulate matter (Q4g)	33	20	11	9	5	9
Local government established any energy reduction programs targeted specifically to assist low-income residents (Q9)	33	23	14	6	5	8
Has your local government established any transportation programs targeted specifically to assist low-income residents? (Q20)	32	44	36	19	14	21
Local government incentives for local government employees to bike to work (Q12d)	31	18	14	4	2	6
Installed charging stations for electric vehicles (Q8e)	31	15	12	4	2	5
Communitywide collection of organic material for composting (Q7g)	28	36	35	34	30	33
Sets limits on impervious surfaces on private property (Q6c)	28	32	35	36	24	30
Widened sidewalks (Q17f)	28	28	35	27	19	25
A program for the purchase or transfer of development rights to preserve historic property (Q22e)	28	12	6	9	6	8
Residential zoning codes to permit higher densities through ancillary dwelling units or apartments (such as basement units, garage units, or in-house suites) (Q21m)	25	21	20	14	10	14
Restriction on purchase of bottled water by the local government (Q25a)	25	22	14	10	7	11
Require minimum of 30% postconsumer recycled content for everyday office paper use (Q7h)	25	24	17	8	5	9
Require all retrofit government projects to be LEED or ENERGY STAR certified (Q21b)	25	13	14	7	4	7
Use dark sky-compliant outdoor light fixtures (Q8n)	22	20	21	15	13	15
Installed a geothermal system (Q8p)	22	14	11	6	4	7
A program for the purchase or transfer of development rights to create more efficient development (Q22d)	22	11	6	6	4	6
Local government incentives for local government employees to walk to work (Q12c)	22	13	9	3	2	4

Exhibit A-1

Sustainability Activities Used by Most Governments in At Least One Population Category (5 of 6)

	500,000 or More	100,000–499,999	50,000–99,999	10,000–49,999	Less Than 10,000	All
If your local government offers employees parking, do you charge market rates for employee parking? (Q13)	20	14	3	3	5	5
Fast track plan reviews and or inspections for environmentally friendly development (Q21k)	19	19	14	9	4	8
Does your local government use a compressed workweek, with offices closed one day? (Q16)	17	17	14	11	6	10
Energy audit—individual residences (Q11a)	17	18	16	6	5	8
Require bike storage facilities (Q17h)	14	14	23	8	3	8
Heating/air-conditioning upgrades—individual residences (Q11c)	14	17	13	8	6	8
Incentives other than increased density for new single-family residential to be LEED certified or an equivalent (Q21f)	14	9	5	3	1	3
Installation of solar equipment—individual residences (Q11e)	14	9	7	3	2	4
Local government established any energy reduction programs targeted specifically to assist small businesses (Q10)	13	15	8	5	4	6
Installation of solar equipment—businesses (Q11j)	11	8	6	2	2	3
Energy audit—businesses (Q11f)	11	10	8	4	4	5
Weatherization—businesses (Q11g)	11	10	8	4	4	5
Provide density incentives for “sustainable” development (such as energy efficiency, recycling of materials, land preservation, stormwater enhancement) (Q21h)	11	16	13	11	6	10
Heating/air-conditioning upgrades—businesses (Q11h)	11	14	12	5	5	6
Incentives other than increased density for new commercial development (including multifamily residential) that are LEED certified or an equivalent (Q21e)	11	12	8	6	2	5
Purchase of energy-efficient appliances—individual residences (Q11d)	8	14	10	5	5	6
Pay-As-You-Throw (PAYT) program with charges based on the amount of waste discarded (Q7f)	8	14	15	9	10	10
Local government action to use locally grown produce through incentive (Q24c)	8	9	10	9	9	9

Exhibit A-1

Sustainability Activities Used by Most Governments in At Least One Population Category (6 of 6)

	500,000 or More	100,000–499,999	50,000–99,999	10,000–49,999	Less Than 10,000	All
Local government action to use locally produced material or products through incentive (Q24a)	8	14	13	8	7	8
Purchase of energy-efficient appliances—businesses (Q11i)	8	13	7	3	4	5
Apply LEED Neighborhood Development standards (Q21g)	8	5	6	5	2	4
Provide tax incentives for “sustainable” development (such as energy efficiency, recycling of materials, land preservation, stormwater enhancement) (Q21i)	8	2	4	3	2	3
Reduce fees for environmentally friendly development (Q21j)	8	6	8	3	1	3
Require showers and changing facilities for employees (Q17i)	6	8	10	4	2	4
Greenhouse gas reduction targets for businesses (Q4d)	6	5	8	2	1	3
Require charging stations for electric vehicles (Q17g)	6	3	3	0	1	1
Greenhouse gas reduction targets for multifamily residences (Q4e)	3	2	6	1	1	2
Greenhouse gas reduction targets for single-family residences (Q4f)	3	3	7	2	1	2
Local government action to reduce the use of plastic bags by grocery or retail stores through restriction (Q24b)	3	0	1	1	1	1
Do you have a specific target for the percent of your government workforce that will telework? (Q15)	3	1	1	1	0	1
Local government action to use locally produced material or products through restriction (Q24a)	3	1	1	2	1	1
Local government action to reduce the use of plastic bags by grocery or retail stores through incentive (Q24b)	0	2	4	2	2	2
Local government action to use locally grown produce through restriction (Q24c)	0	0	0	0	0	0

LEED = Leadership in Energy and Environmental Design.

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Local Sustainability Policies and Programs As Economic Development: Is the New Economic Development Sustainable Development?

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Abstract

Common wisdom suggests that local efforts to protect or improve the biophysical environment will inevitably undermine efforts to engage in economic development. Using research on the effects of smart growth and the Environmental Kuznets Curve as the foundation, this article examines the empirical relationship between cities' pursuit of sustainability and their economic growth. Results suggest that cities that take sustainability policies and programs the most seriously, particularly if they have relatively large "creative class" populations, tend to be the cities that have experienced the greatest growth in personal incomes since 1990. Cities that have done the least to pursue sustainability tend to have experienced the least growth in personal incomes, which is taken as evidence that a new model of local economic growth may well be emerging—a model that emphasizes quality of life as a driver of economic development.

Introduction

One central political challenge to advancing the cause of sustainability in cities is rooted in understanding the relationship between the pursuit of sustainability and local economic development. Traditional approaches to local economic development have typically accepted the idea that development depends on limited government and policy restrictions. Any local policies or programs, including zoning and land use policies, that restrict the way land is used undermine the ability of the local economy to grow. Moreover, so the argument goes, any effort of local government to protect and improve the local biophysical environment represents a restriction on economic development. The result of restrictive policies is less economic development, a smaller employment base, lower property tax revenues, lower local public goods expenditures, and, ultimately, a lower quality of life. On the other hand, local environmental advocates seem to accept this tradeoff, as well. Such advocates seem willing to accept lower levels of economic growth if such levels are required to protect the biophysical environment. The no-growth sentiment has long been associated with proenvironmental interests and policies.

Although the tradeoff between local economic development and environmental protection may well have previously served as an accurate description of the realities that local governments face, evidence suggests that this description has changed. Perhaps starting with the seminal works of Jacobs (2001, 1970), understandings of the potentially symbiotic relationship between the quality of the biophysical environment and local economies began to emerge. For at least the past 20 years, advocates have suggested an alternative prescription that unfettered growth (with environmental degradation) and no growth (with environmental protection) are not the only two alternatives. Focusing on what has become known as *smart growth*, arguments emerged that local economic growth is still possible, even at fairly high levels, without sacrificing the quality of the biophysical environment. Smart growth represents one key policy mechanism underlying the nexus between sustainability and local economic development (Blakely and Leigh, 2010; Greenwood and Holt, 2010; O'Connell, 2008). If cities are going to protect their biophysical environments without forgoing economic growth, so the argument goes, they must pursue economic development through smart growth. Although the local pursuit of sustainability has numerous components (including protecting and improving the biophysical environment, environmental equity, and energy efficiency, to name three), the smart growth component speaks most clearly to the connection between environmental protection and economic growth (Saha and Paterson, 2008).

Met with much initial skepticism, smart growth approaches to economic development seem to have increasingly taken hold in practice as an alternative model of sustainable economic growth. In short, the relationship between the pursuit of sustainability and economic growth seems to have changed. This article represents an effort to investigate this apparent fact. It starts by addressing the nature of the relationship between environmental protection and economic growth and discussing the various traditional theories of local economic development. It then contrasts these traditional theories with smart growth and sustainable economic development theories and examines the nature of the empirical relationship between cities' pursuit of sustainability and local economic growth. Finally, it attempts to develop a deeper understanding of this relationship by offering a multivariate model of local economic growth. The analysis provides evidence that, when cities adopt and implement programs to pursue sustainability, economic growth does not seem to suffer. Indeed, the cities most aggressive in their public policy pursuit of sustainability seem to have experienced greater economic growth than other cities. The character of the local culture seems to bolster this relationship substantially, wherein cities with larger "creative classes" seem to be the same cities that pursue sustainability policies and that experience greater economic growth.

The Economic Development-Environmental Protection Tradeoff

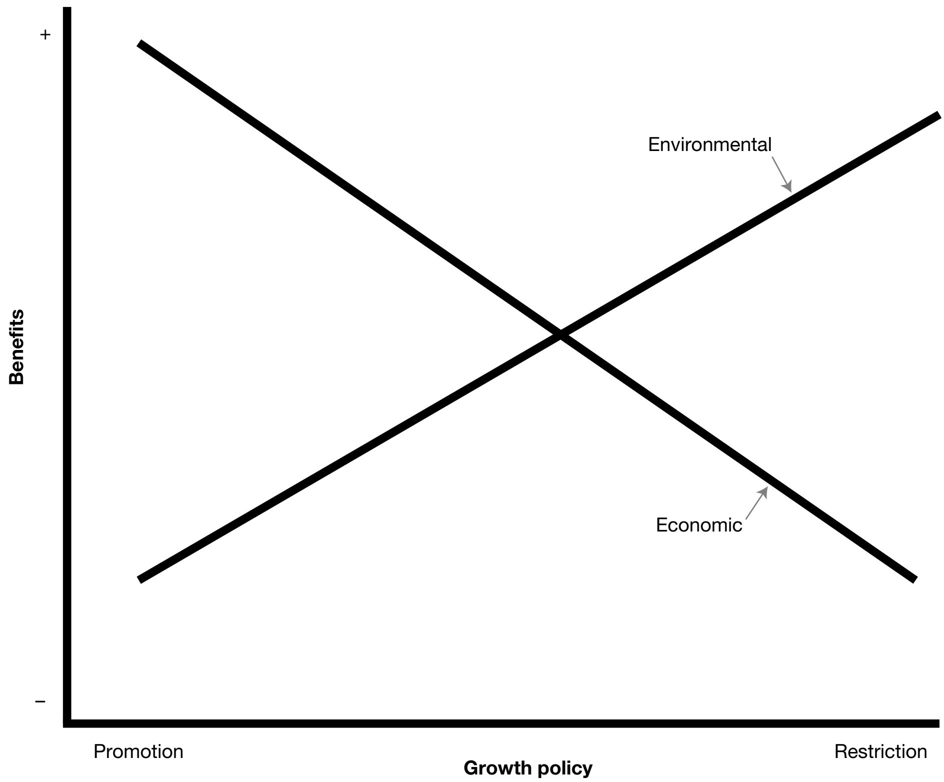
The traditional understanding of local economic development, perhaps like that of economic development broadly, suggests a tradeoff regarding the quality of the biophysical environment. By and large, economic development leads to environmental deterioration; environmental protection impedes economic growth. In cities, the tradeoff between growing the economy and protecting the environment certainly seems to have been true when manufacturing industries were the foundation of economic development and growth. Manufacturing processes, usually very energy intensive, inevitably produced a lot of noxious air emissions and toxic liquid and solid wastes that, when disposed of, despoiled the environment. Efforts to control or limit the production or emission and disposal of such materials necessarily undermined local efforts to grow the economy. Indeed, local efforts to regulate the private sector, whether in terms of zoning and land use or any number of other restrictive policies, are thought to undermine economic growth and efficiency. This proposition was not merely theoretical; the empirical literature focusing on the relationship between economic growth and the quality of the environment seemed to support this idea.

The tradeoff has also been well represented in the empirical literature examining local efforts to protect the environment. What happens to the local economy when cities decide to try managing growth to minimize environmental effects? In a line of inquiry that parallels that of the effect of city sustainability policies on economic growth, many studies have examined the effect of growth management policies on local housing prices. Presumably, growth management policies are important to the pursuit of sustainability because sustainability requires that development will not take place in environmentally sensitive places and that, when housing growth does occur, it must seek to be denser. In general, common wisdom suggests that anything that impedes the market for land undermines economic growth. In the case of housing prices, such wisdom suggests that growth management (if effective) reduces the supply of housing, which in turn drives up prices. When such policies are accompanied by improved environment, however, they could produce an *amenity effect*, whereby the demand for housing goes up as people increasingly want to live in a cleaner environment (Engle, Navarro, and Carson, 1992). Either way, however, prices rise. Not all growth management, however, is effective. As Levine (2006: 121) showed, given the mobility of capital, growth management "… cannot compel developers to build densely … in the presence of alternative development opportunities in the metropolitan region or elsewhere."

This idea has been borne out in other studies of growth management. A study of Florida cities adopting and implementing smart growth measures suggests that this aspect of sustainability may well be a negative economic driver (Feiock, 1994). The conceptual framework presented by Feiock illustrates the expected relationship fairly succinctly. Exhibit 1 shows that the expectation is of a tradeoff between the pursuit of economic benefits and the pursuit of environmental (protection) benefits. Moreover, when cities adopt policies (such as land use controls) that restrict rather than promote economic development, more environmental benefits will be produced at the expense of economic benefits. Thus, the expectation is that growth management policies (more restrictive policies) will be associated with reduced property values (lesser economic benefit). Indeed, his analysis of data from Florida cities seems to confirm this expectation. Other research suggests that

Exhibit 1

Environmental and Economic Impacts of Growth Policy



Source: Feiock (1994)

whether the effects of growth management are negative depends on the specific policies used to manage growth (Feiock and Stream, 2001). The argument that the pursuit of smart growth or other sustainability-related policy goals might actually contribute to greater local economic growth seems foreign, however.

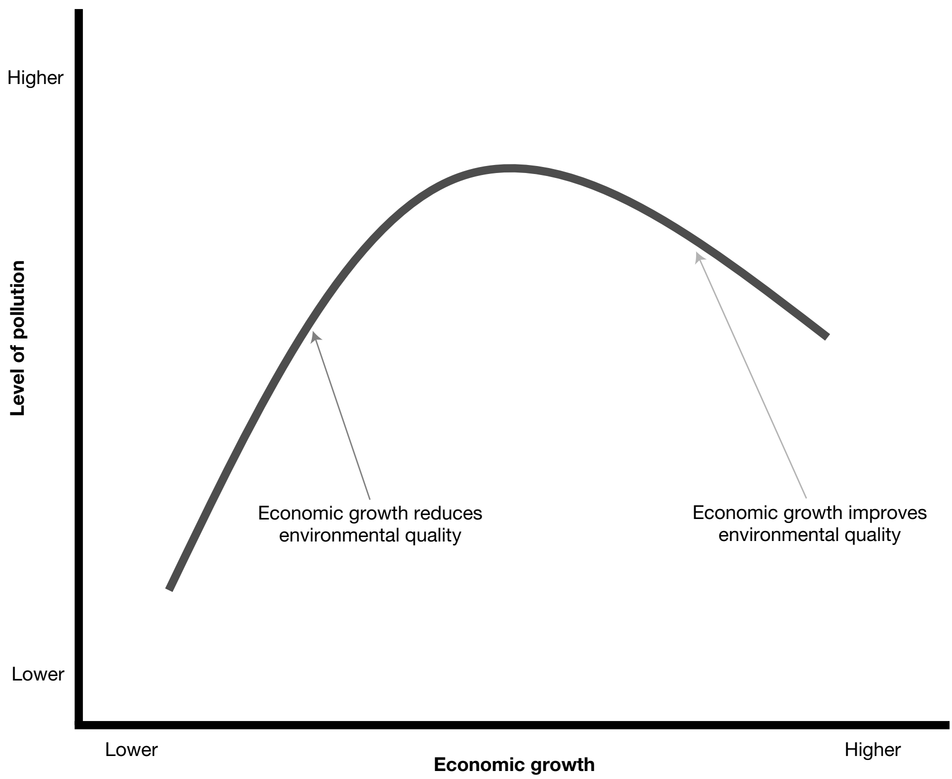
Economic Development As a Driver of Environmental Protection: The Local Environmental Kuznets Curve

The usual description of the dynamic relationship between economic growth and the environment treats economic growth as the independent variable and the quality of the environment as the dependent variable. Thus, models describe the relationship in terms of the tradeoff discussed previously: greater economic growth depletes natural resources and the quality of the environment; less economic growth reduces environmental degradation. This description of the relationship does not tell the entire story, however. In recent times, the Environmental Kuznets Curve (EKC) has also been used to describe an aspect of this dynamic relationship. The EKC describes this hypothesis: as economies grow, environmental degradation occurs, but only up to some point. At that point, the relationship begins to change; at high levels of economic development, environmental degradation starts to decline. The simple graph in exhibit 2 shows the hypothetical EKC as depicted by Kahn, presumably showing a point at which the relationship between economic growth and environmental quality turns positive; that is, more economic growth leads to decreased pollution.

Thus, what had been described as a primarily linear relationship now is described as curvilinear. Although this relationship has been applied most frequently to economies of nations, Kahn (2006) suggests that the same pattern holds true for cities. Despite the fact that surprisingly little of his data are for cities, per se, Kahn's analysis of economic growth and carbon emissions in cities led him to conclude that an urban EKC describes the relationship (Kahn, 2006). This analysis raises the question—what happens at the point at which the relationship changes? What are the drivers that influence the shape of this relationship? Are social, political, and economic processes responsible for such a change, if it indeed occurs? Kahn focused his analysis on the growth of consumer, resident, and voter demand for local *green* public policies, by which he means policies and programs that protect and improve the quality of the environment, including but not limited to increased support for smart growth policies.

Exhibit 2

The Environmental Kuznets Curve



Source: Adapted from Kahn (2006: 31)

In nearly all conceptualizations of the EKC, environmental degradation is thought of as a sort of dependent variable that economic growth influences or causes. In short, this view of the relationship has frequently been used to justify a prescription for less developed nations to engage in very rapid economic growth, so that they can reach the point of maximum pollution as quickly as possible. Clearly, this view is driven by an understanding that income growth creates pollution, not the other way around—the idea that greater pollution can actually contribute to reducing local economic growth. This notion will be discussed in more detail.

Few, if any, discussions of the EKC elaborate on the intermediate processes and results that would conceivably yield a change in the relationship between the quality of the environment and income or economic development. Typically, discussions of the reasons underlying this change focus on increased demand for environmental amenities or improved environmental results. At some point, people start to demand cleaner air, less pollution, better quality water, and so on. Kahn presents one of the few discussions of the intermediate results. He concentrates on the "demand for green policies" (Kahn, 2006: 70–71) and the "demand for green governance" (Kahn, 2006: 71–92). He does not, however, directly address the empirical details concerning what constitutes green policies and green governance. The analysis that follows here uses the number of local public sustainability-related policies and programs to indicate how much demand exists for green policies. An alternative conceptualization also explains the curvilinear relationship, if it indeed exists. Many conceptions of sustainable development suggest that the causation works in the opposite direction. In other words, as pollution gets worse, that pollution increasingly begins to impede economic growth. At some point, further economic growth requires reduced pollution, which, indeed, is one foundation of the concept of sustainable development (see, for example, Rogers, Jalal, and Boyd, 2008).

Smart Growth and Local Sustainable Development

Smart growth represents one of the green policies to which Kahn refers. Like other sustainability-related policies and programs, it encompasses an effort to promote economic development, but it does so without accepting the inevitability of associated negative environmental effects. Some conceptions of sustainable development accept an idea previously thought to be incorrect—that, at some point, environmental degradation actually impedes local economic growth and development. The dynamic this conception describes goes something like this: cities engage in traditional economic development activities and, as a result, the environment gets polluted. At some point, the pollution becomes so severe and so unacceptable that people begin moving out of the city. Cities lose their population base and the associated economic resources. When people do not want to live in, or move into, the city, then economic development becomes increasingly difficult. Although the exact nature of the causal process is debatable, much anecdotal evidence supports the existence of such a process. Chattanooga, Tennessee, perhaps provides a good case in point. In the 1960s and 1970s, with much of the city's employment base in manufacturing, which included two large steel production facilities, air pollution became extreme—perhaps the worst in the country. The city began losing population. Local leaders doubtlessly understood that the deteriorating environmental conditions drove the population loss (Yanarella and Levine, 2011). Subsequently, the manufacturing industries responsible for the extreme air emissions closed and moved overseas, and the air quality improved drastically. Not wanting to return to the days of an economy based on environmental degradation, city leaders embarked on an ambitious effort to engage in smart growth and sustainability, and the population of the city began to grow again.

Although specific cities serve as cases illustrating the dynamics underlying smart growth efforts, little systematic empirical evidence yet supports the idea that such efforts actually produce greater, rather than less, economic growth. As noted previously, Feiock's (1994) study seems to suggest that smart growth policies generally carry negative economic impacts. In other words, when cities engage in smart growth activities, they impede rather than improve their local economies. One way of interpreting this finding is that, in cities where demand for sustainability is relatively great, there is a willingness to live with lower levels of economic growth.

Green Economic Development: An Emerging New Model

With some exceptions, most conceptions of economic development in the context of sustainability seem to accept a tradeoff between protecting the environment and livability on the one hand and economic growth (measured in traditional ways) on the other. Lower levels of economic growth are okay, so the argument goes, if they mean doing a better job of protecting and improving the environment. Perhaps because of the decline in manufacturing industries and employment based in such industries, however, in nearly every major city in the United States, a new model of economic development seems to be emerging (Portney, 2007). In short, this model seems to be rooted in many of the programs and approaches described previously.

As discussed previously, in traditional models of local economic development, local officials engage in "attract, retain, and expand" activities oriented around using extensive tax and fee incentives to lure a major anchor employer to the city, then working hard to retain this employer while encouraging it to expand. Because this approach commonly targets manufacturing industries, it has become increasingly difficult for local governments to successfully follow this strategy. When local officials ceased to be able to attract manufacturers, primarily because manufacturing industries increasingly moved off shore to other countries, they turned their attention to large retailers, such as Wal-Mart Stores, Inc., and Home Depot U.S.A. A few cities, such as Wichita, Kansas, where The Boeing Company is a major employer, have practiced economic development by hanging onto the old model. Even in Wichita, however, Boeing's decision to close its manufacturing plant after receiving substantial assistance from city government illustrates the challenges of this old model. A dilemma this old model raises for local officials, however, is that the jobs that these retailers offer tend to be mostly minimum wage, and sales by these retailers take local money and ship it out of the city, out of the state, and even out of the country. As an economist might say, local expenditures ceased to create the income multiplier effect that once characterized local economies.

Urban economists' prescriptions for promoting local economic growth may also focus on investing in human capital—developing a well-educated and well-trained workforce (Blakely and Leigh, 2010). Even in the information economy, major employers looking for new locations will likely gravitate toward cities with an educated and skilled workforce. This human capital model, too, presents a dilemma for local officials, however. Investing in human capital requires spending public funds on schools and on worker training and retraining, all of which cost a lot of money and produce returns that accrue later, sometimes much later. Investment in human capital certainly does not offer a quick fix. Attracting educated and skilled workers from other places may be a city's only other option but is also difficult and often costly. As a consequence, local officials have increasingly turned to cluster green economic development strategies and looked for other drivers of local economic development. Sustainability, in many cases, has become such a driver. Many advocates of local sustainability, however, are skeptical that such green economic development, even if successful, represents progress toward becoming more environmentally sustainable (Yanarella and Levine, 2011).

An analysis of cities' targeted efforts at green economic development suggests that it is not easier or more successful than traditional forms of economic development. Fitzgerald (2010) provided an extensive array of case studies and examples of ways that cities have striven to attract specific businesses and industries, such as solar panel manufacturers, that have minimal ecological imprints and produce green products. Her analysis covers green economic development activities in cities around the world, including Freiberg, Germany, and numerous cities in the United States. She suggests that cities, including relatively small ones like Syracuse, New York, and Toledo, Ohio, can benefit from strategic economic planning, whereby efforts are made to build on existing comparative advantages.

The challenges of building a green economy are illustrated by the experiences of Phoenix, Arizona, which embarked in the mid-to-late 2000s to work with Arizona State University, the state government, and the business community to make a broad-based commitment to sustainable development. The effort primarily involved a strategic focus on solar and related green technologies and relied on the infusion of funds from the state and federal governments (Fink, 2011). Much of the effort centered on a strategy of recruiting a major solar panel manufacturer to Phoenix, presumably using as its foundation the traditional "attract, retain, and expand" model. In other words, the effort did not represent a new model of economic development except to the extent that it was directed toward attracting a different type of manufacturer than would have been the case 20 or 30 years ago. As one might expect, competition among cities and states for solar panel manufacturers got intense, and many of the actors and policymakers involved (including state legislators) became concerned about what they considered excessively generous subsidies. When this concern combined with ideological objections that "all sustainability initiatives are somehow connected to 'socialistic' climate change conspiracies" (Fink, 2011: 89), the comprehensive strategy began to unravel. An even more critical analysis of Phoenix suggests that the city never has been able to politically come to grips with the challenges of sustainability, and perhaps it was never really fully committed to the pursuit of green economic development (Ross, 2011).

With the widespread skepticism regarding whether such a new model could actually work, the question becomes an empirical one. Succinctly put, if the skeptics are correct that the pursuit of sustainability gets in the way of economic development, then cities that make the greatest commitments to trying to become more sustainable should experience less economic growth than cities that make weaker commitments. If, on the other hand, sustainability has become an effective mechanism for economic development, then cities doing more should experience greater economic growth. If sustainability is a nonfactor, then economic growth should be unrelated to how extensively a city pursues sustainability. As noted previously, efforts have been made to understand the economic effects of land use regulation, including smart growth regulation, on housing prices, but, perhaps surprisingly, very little research has been conducted on the economic effects of the broader pursuit of sustainability.

Measuring Economic Growth, Development, and Sustainable Development

The analysis in exhibit 1 focuses on a specific measure of economic growth: change in housing prices, reflecting the idea that when the local economy is growing, the price of housing will increase. Unlike the analysis of nations, which typically relies on measures of change in gross domestic product or gross national product, cities within a nation do not find such direct, comprehensive, or unambiguous measures of economic growth; they have many ways of measuring the degree of economic growth and development.

One approach for measuring the degree of sustainable development as a special form of economic growth, adopted by Rogers and Srinivasan (2007), is to develop single measures of sustainable development based on the idea of income elasticities. In short, these measures examine specific policies or programs thought to improve the quality of the environment and assess how much they contribute to income growth. A policy or program that seems to produce more income elasticity can be said to contribute more to sustainable development than one that seems to produce less income elasticity. The computation of such income elasticities for individual cities combines data about the policies and programs and about changes in (usually per capita) income over time. Although an income elasticity measure carries little specific information about the nature of the relationship between income and some environmental quality, greater elasticities might be said to represent stronger relationships, and lesser elasticities might be said to represent weaker relationships.

Another approach, pursued by the United States Conference of Mayors (2008) and by Muro, Rothwell, and Saha (2011) in a Brookings Institution report, attempts to count the number of green jobs in metropolitan areas and to document growth in this sector. With an emphasis on metropolitanwide growth in this sector, this approach has not (to date) disaggregated the geography of job locations to enable estimates of the size of city-specific green employment. In addition, no effort has been made to explain the amount of growth across metropolitan areas. Even so, to the extent that the concept of a green job has been adequately operationalized, documenting growth in this sector will ultimately provide the linkage between the pursuit of sustainability and economic growth.

The approach in this article distinguishes the two variables that are combined in Rogers' income elasticity analysis. Specifically, it conceptualizes the dependent variable as dollar changes in per capita income over time, in this case from 1990 to 2009. This time span provides a fairly long-term estimate of the economic performance of the city. The key independent variable is the degree to which cities seem to pursue sustainability as a matter of local public policy. The measurement of this key independent variable is discussed in the following section.

Measuring the Pursuit of Sustainability

As noted previously, the relationship between income growth and the environment most frequently focuses on environmental conditions or results. Much research, however, also focuses on the economic impacts of adopting local public policies to protect the environment. This section addresses public policies used in the pursuit of sustainability. Previous research argued that cities in the United States adopt and implement at least 38 different, specific policies and programs to try to become more sustainable. Cities that pursue many of these policies and programs can be said to take sustainability more seriously than those that adopt fewer. In terms of the local EKC, the number of policies and programs might be said to represent the level of demand for sustainability. Cities that have adopted and implemented more policies and programs have populations that demand greater sustainability than cities that have adopted fewer.

Simply counting the total number of policies and programs results in an index of sustainability programs, or Sustainability Index (SI). Exhibit 3 shows a list of the 54 largest U.S. cities (as of

Exhibit 3

2011 Sustainability Rankings and Scores for the 54 Largest U.S. Cities, Plus Pittsburgh

Rank	City	Sustainability Score	Rank	City	Sustainability Score
1	Portland, OR	35	26	Raleigh, NC	26
1	San Francisco, CA	35	26	San Antonio, TX	26
1	Seattle, WA	35	31	Baltimore, MD	25
4	Denver, CO	33	31	Louisville, KY	25
5	Albuquerque, NM	32	33	Cleveland, OH	24
5	Oakland, CA	32	33	Fort Worth, TX	24
7	Chicago, IL	31	33	Milwaukee, WI	24
7	Columbus, OH	31	36	Atlanta, GA	23
7	Minneapolis, MN	31	36	El Paso, TX	23
7	Philadelphia, PA	31	36	Jacksonville, FL	23
7	Phoenix, AZ	31	39	Honolulu, HI	22
7	Sacramento, CA	31	39	Houston, TX	22
13	New York, NY	30	39	Long Beach, CA	22
13	San Diego, CA	30	39	Mesa, AZ	22
13	San Jose, CA	30	43	Arlington, TX	20
16	Austin, TX	29	43	Memphis, TN	20
16	Charlotte, NC	29	43	Tampa, FL	20
16	Nashville-Davidson, TN	29	46	Omaha, NE	19
16	Tucson, AZ	29	46	St. Louis, MO	19
16	Washington, DC	29	48	Oklahoma City, OK	18
21	Boston, MA	28	48	Tulsa, OK	18
21	Los Angeles, CA	28	50	Detroit, MI	17
21	Kansas City, MO	28	50	Virginia Beach, VA	17
24	Dallas, TX	27	52	Pittsburgh, PA	16
24	Indianapolis, IN	27	52	Santa Ana, CA	16
26	Fresno, CA	26	54	Colorado Springs, CO	15
26	Miami, FL	26	55	Wichita, KS	7
26	Las Vegas, NV	26			

Source: Author's analysis

the 2010 Census) and their respective SI values. Portland (Oregon), San Francisco, and Seattle are at the top of the list, each having adopted and implemented 35 of the 38 programs. Wichita is at the bottom of the list, having adopted and implemented only 7 of the programs. This simple count of the number of programs represents city efforts as of 2010. It also represents change in the number of programs since 1990, because none of the 55 cities had enacted any of these programs at the earlier point. Other efforts have been made to measure how sustainable U.S. cities are, although they typically focus on measures of environmental quality rather than on public policies and programs. A simple comparison between this index and the scores reported by another city sustainability ranking, the SustainLane scores, shows substantial similarity, however.[1] The index developed in this article and that developed by SustainLane reveal that Portland, San Francisco, and Seattle are at the top; Virginia Beach, Tulsa, and Oklahoma City are near the bottom. As another indication of the internal validity of the index developed in this article, the correlation between this index and the Siemens (2011) environmental performance index for 21 cities is .772 (significant at the .000 level), suggesting that both indexes are likely measuring the same underlying policy commitment to sustainability and the environment.

Pursuing Sustainability and Income Growth

Although this topic of sustainability and income growth deserves much more intensive research, the simple question remains, "What is the relationship between pursuing sustainability and income growth?" If sustainability is simply a manifestation of the same underlying principles that the analysis of the economic effects of smart growth and environmental protection policies imply, the pursuit of sustainability should produce the same pattern of relationship. Moreover, because many policies and programs related to the pursuit of sustainability indeed seek to restrict economic activity in some way, it is not a stretch to imagine that the aggressive pursuit of sustainability should undercut local economic growth. To examine this relationship, a simple bivariate analysis in exhibit 4 shows the scatterplot for the 55 largest U.S. cities between the SI score, as the independent variable, and change in per capita income between 1990 and 2006, as the dependent variable. With these data, it is not possible to be sure that the establishment and implementation of the sustainability programs predated the changes in income, so potential directions of causation are speculative. Many cities' sustainability programs were already in place by the end of the 1990s, however. The scatterplot shows a fairly strong relationship between these variables. Contrary to the expectation illustrated in exhibit 1, more restrictive policies (higher SI scores) are strongly associated with greater, not less, improvement in economic conditions. The scatterplot shows that many of the cities experiencing the greatest improvement in personal incomes—Portland, San Francisco, and Seattle, for example—are indeed the cities that have been most aggressive in pushing for sustainability. Many cities that have struggled economically are those that have made the weakest efforts on sustainability—Detroit, Santa Ana (California), and Wichita among them. To be sure, these cities' struggles likely have much to do with national and international influences; on the surface, however, this pattern of relationship is unmistakable. Is this pattern some sort of proof that sustainability policies pay off economically?

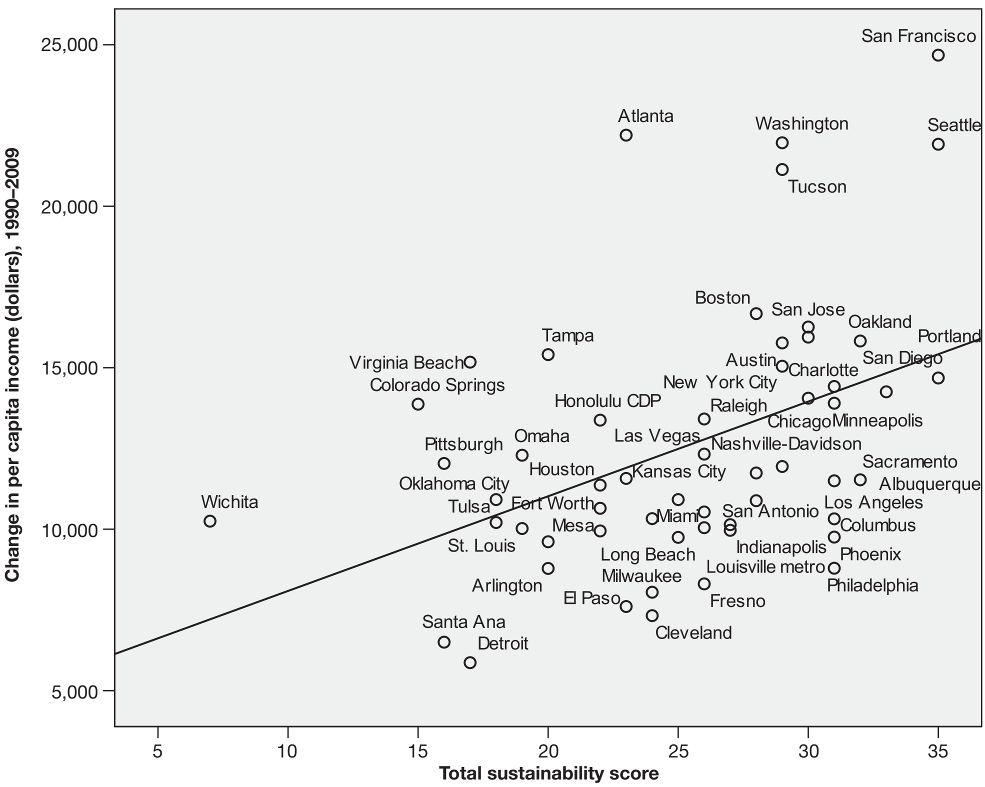
[1] The SustainLane website does not provide actual sustainability scores; it presents only rankings. Karlenzig (2007) provides index scores, but for 2006 only.

It absolutely is not. It is a little piece of evidence that establishes the need to conduct more extensive analysis to understand the nature of this relationship. If the expectation is that cities investing in sustainability do so at the risk of sacrificing economic growth, however, it does not seem to be true. We cannot know with the data at hand whether these cities might have experienced even greater economic growth had they not invested in sustainability, but that seems on its face to be unlikely.

The finding of a positive relationship between the pursuit of sustainability and growth in personal incomes raises the broader issue of what kinds of local policies, programs, and practices influence local economic development. To the extent that the relationship between cities' sustainability policies and improvement in economic growth (as measured by change in per capita income over time) exhibit a pattern, then the question that must be addressed is whether these policies, per se, can be said to improve local economies. Is this relationship spurious, wherein other related factors really explain economic growth? As important as this question might be, presenting a fully developed model of local economic development is beyond the scope of this article. Even so, a brief bit of analysis takes a step in that direction. The common wisdom about local economic

Exhibit 4

Scatterplot Showing the Relationship Between Sustainability and Growth in Per Capita Personal Income, 1990–2009, for the 54 Largest U.S. Cities Plus Pittsburgh



Notes: Y = 5,156 + 293.2 x (sustainability score) significance = .001. R^2 *= .166.*

Source: Author's analysis

growth is that human capital is the key. For cities, having a well-trained, educated, and creative workforce attracts employers and fuels growth in economic activity. Alternative efforts to explain local economic growth, including those that focus on what economists often call *amenities* such as a high-quality environment (Glaeser, Kolko, and Saiz, 2001), eventually yield to human capital as the important foundation.

The model presented in this article is designed to make a first effort at examining whether the pursuit of sustainability policies can be said to positively influence local economic growth when other possible influences are controlled. Is the bivariate relationship depicted in exhibit 4 a reflection of some underlying causal process, or is it merely spurious? Exhibit 5 presents a simple multivariate model to investigate this issue. The dependent variable is the total dollar change in per capita income between 1990 and 2009. Cities that experienced greater positive change experienced greater economic growth, and cities that experienced less positive change or negative change experienced less economic growth. The key independent variable, as described previously and shown in exhibit 4, is a composite index measure of the number of city sustainability programs adopted and implemented.

Perhaps the most important control variable to include in any effort to understand local economic growth is one that measures human capital. The concern with human capital comes out of the persistent finding that investments in human capital seem to drive economic growth. Although human capital can be measured in many different ways, it is clearly related to the level of education (schooling) in the city. This analysis therefore uses the percentage of residents 18 years or older who are high school graduates as the measure of human capital. Also included in this model is a measure of the age distribution of the population; in this case, the percentage of the resident population that is 5 years or younger. Because young people are obviously not part of a city's workforce, the larger the size of this age group, the less the per capita income would be expected to be. The ordinary least squares regression results of model 1 in exhibit 5 suggest that, even controlling for the education and age variables, the pursuit of sustainability is significantly related to income growth. When cities elect to adopt and implement more sustainability policies and programs, they experience greater income growth regardless of how well educated the population is.

Exhibit 5

Ordinary Least Squares Regression Results Explaining Change in Per Capita Personal Income, 1990–2009

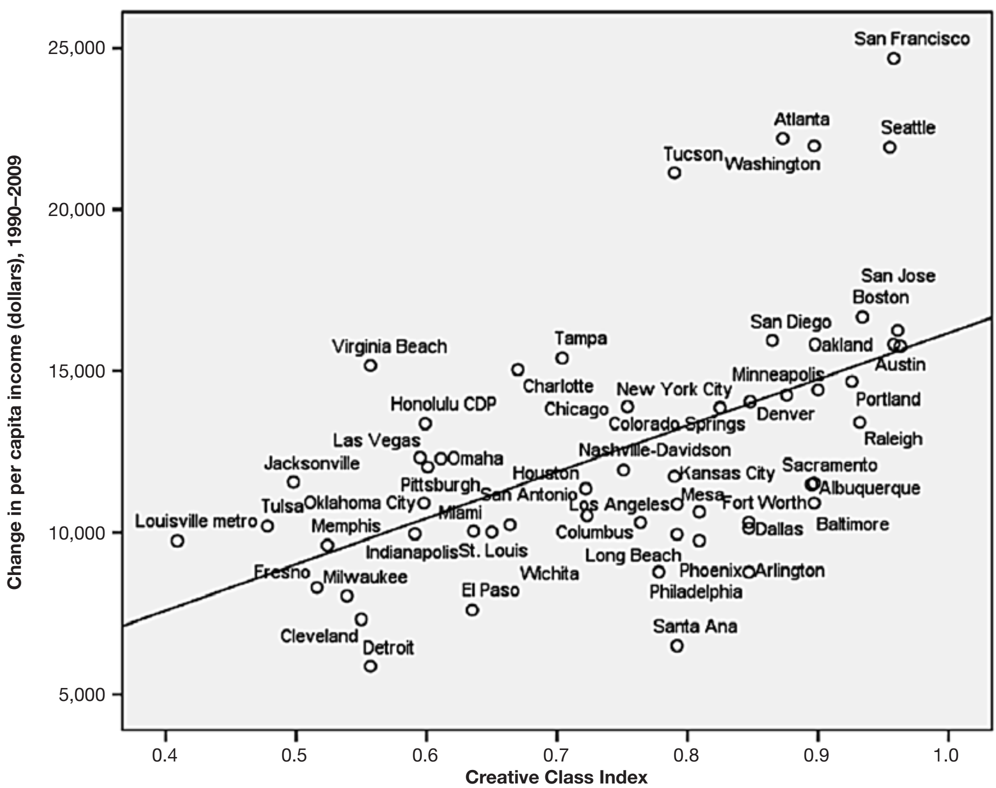
Independent and Control Variables	Model 1		Model 2		Model 3		Model 4	
	β	Significance	β	Significance	β	Significance	β	Significance
Sustainability Index	163.2	.032	32.7	.675	207.9	.001	388.0	.001
% high school graduate	98.4	.055	90.3	.053	—	—	– 252.4	.074
% age 5 or younger	– 1,866.8	.000	– 1,784.5	.000	94.9	.046	84.7	.069
Creative Class Index	—	—	9,762.2	.001	– 1,656.2	.000	– 1,698.7	.000
Constant	14,285.9		10,324.8		13,146.8		17,131.7	
Adjusted R^2	.522		.613		.588		.615	
Significance	.000		.000		.000		.000	

Source: Author's analysis

In recent times, the human capital-based understanding of local economies was at least tweaked by the works of Florida (2004a, 2004b, 2003), who argued that local economic growth and development is not about only human capital, but also the size of what he calls "the creative class." Cities with more people who are part of this creative class do tend to experience much higher rates of economic growth than cities with fewer people in the creative class. Much debate has occurred about whether Florida's measure, the Creative Class Index (CCI)—which contains information about the relative size of the labor force employed in creative occupations and about aspects of the local social culture, primarily based on 2000 census information—is really a measure of human capital by another name (Glaeser, n.d.). The bivariate relationship between the CCI and change in per capita income appears in exhibit 6. This scatterplot clearly shows a strong, positive, statistically significant correlation. Comparison of the two bivariate relationships suggests that the pursuit of sustainability, by itself, is not more closely related to cities' economic growth than is the size of the

Exhibit 6

Scatterplot Showing the Relationship Between the Creative Class Index and Growth in Per Capita Personal Income, 1990–2009, for the 54 Largest U.S. Cities Plus Pittsburgh



Notes: Y = 1,865 + 14,317 x (Creative Class Index) significance = .001. R^2 = .285.

Source: Author's analysis

creative class.[2] The fact, however, that the pursuit of sustainability and economic growth exhibit a positive relationship, rather than the expected negative relationship, suggests that the pursuit of sustainability policies probably plays a role in influencing local economic development. Clearly, this area of research deserves much more attention.

Model 2 adds the CCI to the regression analysis, producing substantial changes. The CCI is highly correlated with change in per capita personal income, and the SI becomes statistically insignificant. On first blush, this result seems to support an interpretation that the bivariate relationship between sustainability and income growth is spurious. It seems unlikely, however, that the character of the creative class would be unrelated to the pursuit of sustainability. Certainly, a strong bivariate relationship (.55) exists between the CCI and the SI. This relationship raises several alternative possibilities, especially the possibility that an interaction effect may well exist between the size of the creative class and the public policy pursuit of sustainability. To investigate this possible effect, model 3 substitutes an interaction term for the original SI and CCI, and the interaction term is highly significant. To separate the effects of the interaction term from the effects of the SI, model 4 introduces both the interaction term and the SI, which continues to show that the interaction term is statistically significant. This result suggests that, when a city has a relatively large creative class and decides to make a major commitment to the pursuit of sustainability in its local policies, it can expect significantly greater economic growth than cities without a large creative class can expect.

Discussion

This article has provided some foundational information about how the public policy pursuit of local sustainability affects local economic growth. Whereas theory and analysis seem unequivocal that the pursuit of sustainability should reduce economic growth, this article's analysis finds very little evidence of this relationship. Indeed, the evidence is either that the pursuit of sustainability contributes to greater economic growth or that it has no effect on economic growth. The most salient finding is that the size of the creative class of cities and the aggressive pursuit of sustainability seem to interact in such a way that, when cities with large creative classes decide to get serious about sustainability policies, they indeed experience higher levels of income growth.

The finding regarding the possible interaction of the size of the creative class and the pursuit of sustainability raises several possible interpretations. The most obvious interpretation is that the creative class likely comprises people who demand greater attention to sustainability from their public officials. Thus, when a city's creative class is relatively large, the city's policymakers respond by enacting and implementing more sustainability policies. This relationship also might suggest that businesses that employ more people in creative-class occupations, and people who might be said to belong to the creative class, find that cities that aggressively pursue sustainability are more attractive places in which to locate. Either way, evidence suggests that when cities have relatively

[2] The partial correlation between the SI and change in per capita income from 1990 to 2009, controlling for the percentage of the population that has at least a high school education (a measure of human capital), is .460, significant beyond the .01 level. The partial correlation between the SI and change in per capita income, controlling for Florida's CCI, however, is .220, which is not statistically significant.

large creative classes and opt to enact many sustainability programs, personal incomes grow more rapidly. What might this finding prescribe for local policymakers who wish to promote greater economic growth? This issue deserves much more analysis, but these results suggest that cultivating a larger creative class, by itself, might not be enough. Enacting and implementing sustainability policies may well be a part of the dynamic process that produces greater economic growth.

Any analysis of this sort faces methodological challenges. Even with the modest models presented in this article, an endogeneity problem is possible. This problem is conceptually compounded by the obvious observation that many other variables could conceivably influence local economic growth. Moreover, it is quite difficult to know with any precision what the direction of causation might be in the relationship between the pursuit of sustainability policies and personal income. The most frequent, albeit weakly supported empirically, hypothesis about what influences cities to become aggressive in pursuit of sustainability is that income is a primary driver. Many studies have found that the relationship is much weaker than one would expect, but it is certainly possible that income influences sustainability policies rather than the other way around. More likely, this case could well represent reciprocal causation. The analysis and data used in this article, however, are sorely inadequate to addressing such issues.

For public officials who worry that decisions to adopt and implement an aggressive array of sustainability-related policies might undermine their economic development activities, little evidence supports their worry. At least as practiced in larger American cities to date, sustainability seems to have been pursued in ways that are consistent with, and not in opposition to, local economic development. Is a new model of local economic development emerging? The evidence presented in this article strongly suggests so. More definitive answers will require additional research.

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Policy Integration for Sustainable Development and the Benefits of Local Adoption

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Abstract

The concept of sustainable development has evolved from a focus primarily on environmental issues to a more balanced approach that consists of environmental, economic, and societal elements. Local efforts to promote environmentalism and economic growth are not mutually exclusive, but questions remain on the types of policies that integrate these efforts. In this article, we explain the adoption of policies that aim to reduce development costs for businesses that integrate environmental protection and energy conservation measures into their investments. The empirical analysis is based on a national survey of local sustainability policy conducted in 2010. A series regression model provides evidence of business interests and the mediating influence political institutions have on policy adoption.

Introduction

Within academia and professional associations, relatively strong agreement exists on the need for local governments to design and implement policies that are oriented toward sustainability (Leuengerger and Bartle, 2009). The concept of *sustainability* focuses on the long-term policy and planning goal of maintaining a social-environmental system that is in balance (Campbell, 1996; Jepson, 2004). Sustainable development—as a guiding principle for local growth policies—has evolved from a focus primarily on environmental issues to a more integrated approach that consists of environmental, economic, and societal dimensions (Fiorino, 2010; Mazmanian and Kraft, 2009).

Understanding local sustainable development policy is important, because cities represent the principal jurisdictional unit that develops governance structures that affect local growth and the environment (Bulkeley and Betsill, 2003; Portney, 2003). Local governments have long been active in designing and implementing policies to improve their economic competiveness. Cities have also become increasingly active in crafting policies that provide economic opportunities for all who are eligible and supporting economic growth that consumes limited resources efficiently. Reconciling these objectives is not easily accomplished. Among the reasons are the intense competition and conflict over policy benefits among local interests that play out in political arenas (Hawkins, 2011).

Even with such conflict, economic growth and environmentalism do not have to be mutually exclusive objectives (Feiock and Stream, 2001; Portney, 2003). In this article, we focus on policies that are commonly associated with a supply-side approach to development but that aim to reduce development costs for businesses that integrate environmental protection and energy conservation measures into their investments. Through incentives that promote green technology, onsite renewable energy systems, and Leadership in Energy and Environmental Design (LEED) certification, environmentalism and development do not represent an either/or proposition. Rather, cities can integrate environmental objectives into their pursuit of economic growth with policies that encourage new building and with land development that minimizes resource consumption.

Unlike most previous research on sustainable development, this study specifically identifies policies that integrate environmental and energy issues into development incentives. Our main objective is to explain the variation in the use of these policies by U.S. cities. Tradeoffs, however, can occur between a policy instrument and the extent to which a local government can capture the resultant benefits. To demonstrate how these tradeoffs may factor into policy decisions, we discuss the policies in this study as having the potential to (1) provide place-based benefits that address structural conditions of a locality, (2) shape the benefits provided to different local interest groups, and (3) generate symbolic benefits for local elected officials.

To frame our discussion on these points, we turn to the literature on local governing institutions and interest groups (Feiock, Tavares, and Lubell, 2008; Hawkins, 2011; Lubell, Feiock, and Ramirez, 2005; Ramirez, 2009). This literature suggests that sustainable development efforts at the local level are influenced by the demands placed on appointed and elected officials and by the responsiveness and political behavior of different governing institutions. Depending on the institutional arrangement and the activity of local interests, some sustainable development policy tools are likely to be used more or less frequently. Feiock, Tavares, and Lubell (2008) suggest that the adoption of policies that shape the benefits to business interests takes place in a "political market," in which these private interests seek to change the policy environment. Political institutions mediate the demands of private actors and the willingness of public officials to supply the policies these interest groups desire (Clingermayer and Feiock, 2001; Jeong, 2006; Lubell, Feiock, and Ramirez, 2005). We apply this theoretical explanation to sustainable development to improve our understanding of the challenges and opportunities cities face in pursuing the objectives posed by Campbell (1996) and others: Do environmentalism and city development efforts have to work in opposite directions?

In the next section, we discuss common approaches to economic development and the ways in which cities integrate environmental objectives into development policy. We subsequently describe the localized benefits that potentially shape decisions on policy adoption. We then discuss our data collection, variable measures, and model specification. We then present the results, and the conclusion addresses implications for theory and avenues for future research.

Sustainable Development Policy

The concept of *sustainable development* often refers to physical, social, and economic development that avoids problems such as exhaustion of natural resources, ecosystem destruction, and pollution (Wang et al., 2012; Wheeler, 1998). In this article, we adopt Wheeler's (1998: 438) simple and relatively straightforward definition of sustainable development—"development that improves the long-term health of human and ecological systems." Of the three commonly referenced dimensions of sustainable development (social, environmental, and economic), this article focuses primarily on the economic dimension, but, as we discuss in this section, categorizing local policies along these lines and according to policy subcategories can be fraught with difficulty. Nonetheless, this approach provides some organizing structure to a concept that is likely to become more complicated in the future as local governments expand their activities and become more sophisticated in developing and applying sustainable development policy.

Approaches to Economic Development

Local governments are perceived to have a strong interest in economic development for a wide variety of reasons. Growth can be strongly tied to a city's fiscal well-being, development supports the provision of adequate public services, and private-sector investment improves job opportunities and diversifies the local employment base. Previous research has also argued that local leaders mobilize public resources to move their locality up within a "system of cities" and to portray a friendly image to businesses (Lewis and Neiman, 2009; Pagano and Bowman 1998). In more instances than not, cities pursue economic development in a competitive fashion with neighboring government units.

Provided this context, cities continue to use what are commonly referred to as "supply-side" policies as part of their economic development efforts (Eisinger, 1988; Reese, 2006; Reese and Rosenfeld, 2004). A *supply-side approach* is recognized primarily as government attempts to stimulate investment by reducing the production costs incurred by a business in a specific locality. These efforts come in the form of tax incentives, subsidies and abatements, loan guarantees, industrial revenue bonds, infrastructure development, and less restrictive regulatory policies. Tax incentives and subsidies have been used extensively to stimulate economic growth and have garnered a great deal of attention in the policy literature. Incentives continue to outpace spending for other economic development strategies (Peters and Fisher, 2004), and development subsidies and the improvement of land to spur private business investment remain popular policy tools (Blakely and Leigh, 2010).

This approach is not without its critics (see Bartik, 2005), who argue that tax incentives merely relocate investment across a region, are an only marginal factor in firm location decisions, and escalate competition among communities. These strategies may also increase the costs of economic development efforts and redirect public resources away from social or educational programs. Moreover, tax incentives tend to benefit higher income groups disproportionately.

A more comprehensive approach to economic development pursued by local governments is to employ "demand-side" policy tools in conjunction with supply-side strategies (Eisinger, 1988). A *demand-side approach* aims to develop new local capital and markets and to enhance economic growth by promoting a well-prepared labor force and the development or expansion of indigenous firms. This approach is also associated with public-sector activism aimed at lower income groups and a more bottom-up or social-capital path to economic prosperity. Human capital development policies, for example, attempt to build the skill levels and work-related aptitudes of the local labor force through job training, entrepreneurship support, apprenticeship programs, and basic school system reform. The assumption is that improved skills will lead to better wages and the creation of businesses that add value to the economy.

Economic development, of course, is no different than most policy areas in which local activities and tools work in tandem. Many argue, in fact, that for local governments to be successful in business recruitment and retention, they should employ policies as a bundle rather than as distinct and mutually exclusive efforts (Blakely and Leigh, 2010). Previous research has noted that shifts in policy focus are quite noticeable in economic development (Reese and Rosenfeld, 2004). Many local officials have moved from emphasizing the cost of doing business in their community to focusing on creating a good business climate and establishing partnerships arrangements with private-sector and nongovernmental organizations to support local growth. Many communities have also moved toward taking a broad and holistic approach that focuses on quality-of-life issues. Thus, the distinction between various approaches to economic development is often blurred because of the varied mix of tools that are likely to be employed simultaneously for a specific development project.

For some development policy, however, common underlying characteristics remain. It is necessary to isolate these characteristics to determine the extent to which environmental concerns are being integrated into their use. Reese (2006: 368) wrote, for example, that "because it is impossible to create typologies that match all conditions and that all researchers find useful and acceptable, it is valuable to provide new perspectives that can serve as the basis for further exploration." To accomplish this objective, she employed cluster analysis to create typologies of cities based on the intensity of use of 34 economic development policies during a 5-year period for 752 U.S. cities and 45 communities in Canada. She eventually developed six conceptually different categories, with many cities (195) classified as having a "traditional" policy profile. These cities rely heavily on tax abatements and incentives.

Applying these tools without conditioning their use and the resultant development effects on the environment can undermine local sustainability efforts. Thus, the continued emphasis on incentives that best characterize the supply-side approach raises the question of how local governments integrate these policies with environmental protection and energy conservation. Local governments, through their regulatory powers, have considerable influence on land use planning, codes, ordinances, and standards for new construction that can encourage energy efficiency and conservation. Improving these efforts has implications for sustainability because economic incentives are commonly associated with development projects that alter land use patterns and can have negative effects on the environment. We discuss this concept in greater detail in the following section.

Integrating Policy for Sustainable Development

The concept of sustainable development suggests that local governments should consider ways to integrate environmental issues with development policy within and across policy domains. For example, in a review of studies on sustainable development, Saha and Paterson (2008: 25) categorized "tax incentives for environmentally friendly development" as an economic development strategy. Thus, even within one policy area, such as economic development, specific actions can serve what may appear to be competing objectives. Based on a national survey of local governments, Wang et al. (2012) considered 23 economic-sustainability measures that focus on the need for cities to maintain economic competitiveness while using less energy and fewer resources. The policies in their study reflected the local government's strategic investments in businesses and economic development programs that focus on resource protection and energy conservation.

Land development is one critical component in improving sustainability because of the associated resource use and potential environmental effects. Buildings, for example, accounted for 39 percent of energy consumption and 68 percent of electricity consumption in 2002, and because construction is expected to increase (by 2030, approximately one-half of buildings will have been built after 2000, according to some estimates), it has a significant effect on the natural environment (Nelson, 2004). Integrating energy resource and environmental protection measures into development policies is a key element of sustainable development. For example, based on a survey of U.S. cities with populations of more than 50,000, the American Institute of Architects identified a variety of green building programs and local sustainability efforts tied to economic development. Expedited permit processing (Gainesville, Florida), loans and grants for green improvements (Washington, D.C.), density bonuses (Acton, Maine), permit fee waivers (San Antonio), subsidizing fees for green building certification (Las Vegas), property tax abatement (Baltimore County, Maryland), and subsidizing efficient appliance or building system components are examples of specific community policies identified in the report (Rainwater, 2007; Retzlaff, 2008).

One way for local governments to pursue sustainable development is to integrate environmental and energy issues into development policies by promoting more green development through LEED. Building assessment systems, such as LEED, provide standardized information for local officials to measures the sustainability of buildings and are commonly used to rate, rank, or assess how buildings address environmental concerns (Retzlaff, 2008). Buildings recognized as meeting sustainability goals based on such an assessment system enable communities and property owners to promote and market the building's energy efficiency, water conservation, site selection, materials, waste management, and indoor environmental quality. Integrating energy use in the development and operations of buildings should have a positive effect on the environment and long-term health of a community. LEED rating systems are now available for new commercial construction and major renovation, existing building operations and maintenance, commercial interior projects, and core and shell development projects (Rainwater, 2007; USGBC, 2007).

Other research evidence has suggested that some cities are active in integrating environmental and energy issues into development policy (although they leave much room for using financial incentives). For example, the results of a national International City/County Management Association survey reported by Svara, Read, and Moulder (2011) indicate that 7 out of 10 cities assign a very high priority to the economy but have only modest sustainability activity. Approximately 70 percent of respondents to Feiock and Francis' (2011) survey of midsized cities indicated that attracting green industries was at least "somewhat important" to their city's overall economic development strategy. Respondents, however, indicated only modest support for green-sector development in the form of financial incentives that encourage the use of energy-efficient technologies in new development. Of the responding cities, only 19.5 percent provided such incentives. Fewer cities in that sample were also willing to alter permitting practices for industries that promote green practices (11.0 percent) or to relax regulatory or review processes for private developments that incorporate energy-efficient technologies (6.0 percent). Based on a sample of 215 cities, Saha and Paterson (2008) found that only 9 percent of the cities used tax incentives for environmentally friendly development. These studies suggest that cities are beginning, albeit with what appear to be only modest attempts, to integrate economic development efforts with environmental protection and energy conservation.

It may be unlikely that researchers will ever identify a comprehensive set of indicators of sustainable development activities at the local level. One challenge is that local governments are continually improving their activities and implementing innovative tools and governance mechanisms that fit their unique context. Moreover, the concept of sustainable development has undoubtedly seeped into different policy areas, so that significant overlap is likely among local policy issues. At one point in time, a policy may have been recognized strictly as an economic development policy. Now, it may be considered a mechanism to minimize environmental harm and reduce energy consumption. Because of the continued use of business tax abatements and financial incentives, it is important to identity whether cities are incorporating environmental issues into these policies. In the following section, we discuss how the localized benefits that may accrue from these policies may influence local decisions.

Localized Policy Benefits: Explanations for Adopting Sustainable Development Policies

The localized nature of some sustainable development policies may influence their use, because the policy (1) provides place-based monetary benefits to a locality, (2) provides benefits to different local interest groups, and (3) generates symbolic benefits for local officials. In this section, we discuss these explanations in greater detail and provide corresponding hypotheses.

Place-Based Benefits

Building consensus on sustainable development is a challenge, because containing the benefits of local efforts wholly within municipal borders is extremely difficult (Sharp, Daley, and Lynch, 2011). Equitable access to resources and economic opportunity that improve one's livelihood, for example, are key aspects of the social dimension of sustainable development. The benefits are likely to be difficult for a single city to capture on a consistent and long-term basis, however. New jobs in a locality may not go to local people who receive job training and may not go to the community's residents at all. Investments in sustainable development policy that emphasize the social aspects of economic opportunity may simply lead to an improved entrepreneurial capacity or a more skilled and educated workforce that does not remain within the jurisdiction making the investment.

By comparison, local governments may ease development approvals for projects that reduce energy consumption, or they may provide tax incentives for manufacturers of green economy products and that invest in alternative forms of energy production. Such policy tools can provide direct monetary benefits to the community in the form of taxes and transaction-related revenue. Moreover, buildings are constructed within a jurisdiction, support services and suppliers may emerge, and additional investment in the immediate area may also appear. Such benefits are *localized* because they can be contained or captured primarily within the jurisdiction that provides the incentive. Because many incentive policies are oriented primarily toward businesses, we assume the city that makes the financial or regulatory investment will receive direct benefits in the form of a business relocating or remaining and expanding in the community. Thus we expect that, as local economic need increases, cities will pursue more sustainable development policies that reduce costs to business.

Local Interest Group Benefits

The benefits of a particular policy may be distributed—intentionally or unintentionally—among groups or individuals. The urban governance process, which blends and coordinates public and private interests, is influenced by not only structural conditions but also the political pressures on local officials from private interests (Pierre, 1999). Organized groups that engage in the decision-making process can exert great influence over local officials to enact policies that conform to their economic or other interests (Judd and Swanstrom, 1994; Logan and Molotch, 1988). Research has shown businesses, real estate groups, and development interests to be particularly active in shaping policies that promote sustainability at the local level (Hawkins, 2011; O'Connell, 2009).

The *growth-machine* model of politics, for example, suggests that groups that will benefit directly from development policies will promote them and mobilize in favor of them (Logan and Molotch, 1988; Molotch, 1976). From this perspective, development interests use their political power to affect the costs and benefits of growth by manipulating policy decisions. Among the benefits captured by land-based interests are higher rents and greater opportunities for investment. Moreover, many policy tools reflect businesses and affiliated organizations working closely with local elected officials on policy decisions (Stone, 1989). This model, however, can result in the targeting of benefits to specific geographic areas and narrow constituencies aligned with the urban governance regime.

Whereas residents often want a greater share of the local budget to go toward municipal and social services, the growth coalition presses for more money to go toward physical infrastructure and investments in policies that aid development (Logan and Molotch, 1988). Sustainable development policy that focuses on incentives is likely to provide direct benefits for existing businesses, because new private investment may result in greater demand for business support services (for example, construction, building materials, and so on). Sustainable development policies may also provide benefits through positive externalities to surrounding businesses when land is developed or businesses expand. We expect that cities that work closely with businesses on sustainability issues will adopt more sustainable development policies that reduce costs to businesses.

Symbolic Benefits

Closely linked with the role of local interest groups in policymaking is how governing structures influence the performance and decisions of political actors (Clingermayer and Feiock, 2001). The discretion in policy choices and the opportunities and incentives of public officials are constrained by the municipal form of government. In a council-manager system, professional administrators are responsible for managing the day-to-day affairs of city government. This governance structure is intended to insulate centralized executive power from political influences and interest-group pressures (Sharp, 1991). Although a council-manager form of government replaces political "high-powered" incentives with "low-powered" incentives (Frant, 1996), the profession is very much political in nature and managers are highly engaged in policymaking (Nalbandian, 1999; Nelson and Svara, 2010).

For example, promoting new administrative initiatives or being seen as a leading policy reformer can enhance one's reputation within professional networks (Feiock et al., 2001). In addition, research has suggested that cities with a full-time city manager are more receptive to innovative administrative techniques and policy than cities with a mayor-council form of government. Cities with a council-manager form of government are found to apply fiscal impact analysis to evaluate development projects more stringently than cities with a mayor, reflecting their focus on the efficient and innovative management of the local economy (Ha and Feiock, 2012). Svara, Read, and Moulder's (2011) report indicated that cities with a council-manager form of government are generally doing more to promote sustainability than cities with alternative forms of government.

Whereas appointed managers' tenures and careers are generally insulated from symbolic politics, mayors may not be willing to take political risks when they present little opportunity for credit claiming. Although some sustainable development policies may produce visible results, they may also be relatively new and untested. Thus, cities with a council-manager form of government are expected to adopt more sustainable development policies that reduce costs to business.

Depending on the political institutional arrangement and the activity of local interests, some development policy tools are likely to be used more or less frequently. Feiock, Tavares, and Lubell (2008) suggested that the adoption of policies that shape the benefits for business interests takes place in a "political market," in which these private interests seek to change the policy environment. Political institutions mediate the demands of private actors and the willingness of public officials to supply policies that these interest groups desire (Clingermayer and Feiock, 2001; Jeong, 2006; Lubell, Feiock, and Ramirez, 2005).

Coupled with responding to pressures from the business community, elected officials may pursue and endorse policies to tout successful implementation. Elected officials can accrue individual benefits by supplying the policy that supports the economic interests of the business community (Sharp, Daley, and Lynch, 2011). Sustainability is a long-term agenda, however. Pursuing sustainable development can be risky because policy outcomes can be difficult to measure and may require cities to assume significant upfront costs. The use of financial incentives can be particularly costly, both in financial terms and when outcomes or results do not match expectations. Thus, we expect that more sustainable development policies that reduce costs to business will be provided under a council-manager form of government and when business interests are active in planning and the policymaking process. In the following section, we describe the data used to test these hypotheses.

Data and Method of Analysis

To collect data on local policies, we mailed a questionnaire in 2010 to the city manager (or mayor in the absence of a city manager) of every U.S. city with a population of at least 50,000. Of the 601 cities in the sampling frame, 263 responded to the survey, a 44-percent response rate. The council-manager and mayor-council forms of government are present in 66.0 and 31.0 percent, respectively, of the responding cities. These figures are similar to the 62.0 and 35.9 percent, respectively, in all U.S. cities with populations of more than 50,000 (ICMA, 2010). Of the respondents, 40 percent identified themselves as city managers, chief executive officers, or chief administrative officers; 28 percent were sustainability managers; and 7.2 percent were planning directors. Other respondents included environmental policy directors, energy and environmental directors, economic development directors, public works directors, and solid waste directors. Tests were conducted to determine whether the responding cities are significantly different from nonresponding cities on key socioeconomic characteristics. Only the average median household incomes for responding ($45,241) and nonresponding cities ($42,396) were significantly different (t = 1.961; p = .05).

Of the 263 cities in the final sample, 57 (21 percent) are in California. The sample includes some of the largest cities in the state, such as Los Angeles, Anaheim, and Riverside, and 25 (nearly one-half) have populations greater than 100,000. Another one-fourth of the respondents are from four states: 27 (10 percent) from Florida, 18 (7 percent) from Texas, 14 (5 percent) from Illinois, and 11 (4 percent) from North Carolina. Our sample also includes large cities, such as Austin, Texas; Denver; Portland, Oregon; and San Francisco, and smaller cities such as Grand Rapids, Michigan, that are considered the most serious in terms of their commitment to sustainability (Karlenzig, 2007; Portney, 2003). Some cities that Portney notes are taking sustainability seriously, such as Chicago and Seattle, are not included in the sample, however. In addition, no cities responded in Louisiana, Mississippi, and Wyoming, which previous research has suggested tend to lag behind other states in their commitment and capacity to environmental protection (Rabe, 2006).

Survey respondents were asked to identify if the policies listed in exhibit 1 are used by their city. We specifically asked: "To practice economic sustainability, our city has…" After this question, we provided a list of policies. In exhibit 1, the number in parentheses indicates the percentage of cities in the sample that use the policy. The policies emphasize integrating traditional development incentives (for example, financial incentives, expedited permit process, tax credits, loans, and fee waivers) with efforts to reduce energy consumption and minimize environmental effects.

Exhibit 1

Sustainable Development Policies Adopted by Cities in the Sample

To practice economic sustainability, our city has...	Percent Yes
Linked environmental goals to publicly financed development projects	74
Established a brownfield redevelopment fund	73
Zoning or regulations that allow for onsite renewable energy systems	67
Low-interest loans for energy efficiency measures and building materials	60
Priority permitting and fee waivers for installing green technologies	43
Designated locations for alternative energy generation, R&D, and manufacturing	41
Incentives that lower financial barriers to energy-efficiency gains	35
Density bonus for buildings achieving LEED certification	28
Fee reductions to cover costs of LEED certification	20
Expedited application and permit process for alternative energy facilities	20
Property tax credit to commercial building achieving LEED certification	12

LEED = Leadership in Energy and Environmental Design. R&D = research and development.

Note: One hundred-eighty five cities have adopted at least one policy.

Most cities in the sample have adopted linking environmental goals to publicly financed development projects (74 percent) and establishing a brownfield redevelopment fund (73 percent). As in the survey results reported by Feiock and Francis (2011), fewer cities in the sample offer financial incentives, including property tax credit to commercial building achieving LEED certification (12 percent). Of course, many types of development policies excluded from this analysis also provide incentives to land developers and businesses and incorporate energy issues and other environmental objectives (for example, incentives for open space protection in a residential development). This study represents only a narrow set of policies that focus on achieving the overarching goals of sustainability by reducing resource use and mitigating environmental degradation while maintaining economic and social outputs (Betsill and Bulkeley, 2007).

We are interested primarily in explaining the number of policies adopted by cities in our sample. We expect that local business interests are likely to have a positive effect on the adoption of those policies that tend to align with their demands for reducing costs. To measure this variable, we first provided the following statement to the survey respondent: "To implement sustainability initiatives, our city has…" We then provided a binary (yes or no) choice: "... involved business groups in developing a sustainable vision of the city." We also expect that cities operating under a reformed governing institution will have a positive effect on the number of policies adopted. Cities with a council-manager form of government are measured with a binary variable. We include an interaction term between the interest group variable and the local form of government variable. This interaction term is used to test whether the effect of the business interest group variable is conditional on the local political institution.

A locality experiencing the effects of economic stagnation, higher unemployment, or increasing poverty often prompts policymakers to consider an array of policies to address these structural issues. Previous research on development policy has used a variety of local characteristics as indicators of economic need, including population size and population growth rate (Johnson and Neiman, 2004; Mills and Lubuele, 2000). Other indicators of need include the size of the minority population, personal income level, and fiscal conditions (Clingermayer and Feiock, 2001; Hawkins, 2011; Portney, 2003). Portney (2005) identified the local employment base as potentially affecting sustainability initiatives. The variables used in this study to account for these factors include population size (log), median household income, percent African American, and the percentage of total jobs in manufacturing.

We also expect that political pressure from highly educated and younger citizens, who tend to support environmentalism and a propensity to think green, may shape local actions (Portney, 2003). These factors are measured with median age and percentage with a bachelor degree. Because competition for private investment tends to drive policy decisions, we expect that communities that are experiencing less growth than the region as a whole will be more active in pursuing business investment. Pursuant to this hypothesis, we measure development competition as the difference between local population change and metropolitan-area population change between 2000 and 2010. Exhibit 2 provides a description along with the mean, standard deviation, and minimum and maximum values for the independent variables.

Exhibit 2

Descriptive Statistics of the Independent Variables

Independent Variables	Mean	Standard Deviation	Minimum	Maximum	Description
Metropolitan growth difference	– 1.91	13.00	– 95.07	66.99	Difference between local population growth and population growth of the metropolitan area between 2000 and 2010.
Population (log)	5.090	0.342	4.67	6.58	Total population (log).
Percent African American	69.62	15.86	16.7	94.4	Percentage of the total population that is African American.
Household income	53,052	17,910	24,525	119,483	Median household income.
Education	32.11	13.89	9.7	78.7	Percentage of the total population with a bachelor degree.
Percent manufacturing	9.78	5.10	1.5	41.1	Percentage of total employment in manufacturing.
Age	34.82	4.44	22.1	52.9	Median age of the population.
Business involvement	0.34	0.47	0	1	1 if businesses are actively engaged in crafting a sustainable development vision for the city; else 0.
Form of government	0.67	0.46	0	1	1 if the city operates under a council-manager form of government; else 0.

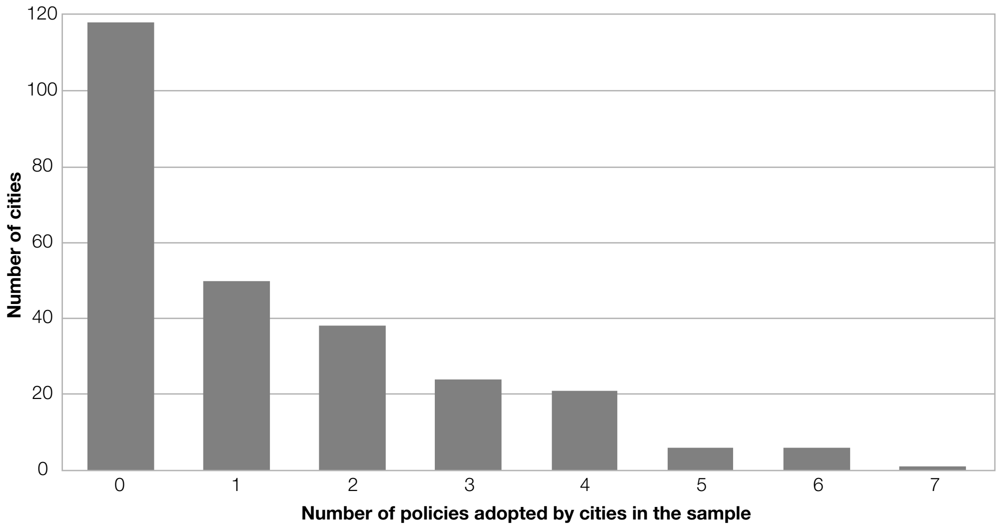
Exhibit 3 displays the count of the sustainable development policies adopted by cities in the final sample. Because not every city in the sample has adopted one or more of the policies in exhibit 1, zeros comprise a large proportion of counts in the data. To address this issue, we use a zero-inflated Poisson regression model as the method of analysis. The Poisson process includes first fitting a logit model that determines membership of the city in a latent or unobserved group with an outcome of 0. The probability of each count (including zeros of the number of policies) is then determined by a Poisson regression.

From a theoretical perspective, we specify a model in which the structural characteristics of a city belong in the logit model. The use of incentives and other sustainable development policies may not be an issue in some communities that have little demand for a progrowth agenda because of a sound fiscal base or robust employment. In other communities, local economic need can be an obstacle to a city's adoption of sustainable development policy because adoption requires high startup costs. In this study, local conditions create the need for a city to pursue the types of sustainable development policies listed in exhibit 1.

The interest group and governing institution characteristics, on the other hand, determine the outcome. Local interest groups and governing institutions create the conditions through which policies are then adopted and shape the benefits that are expected to accrue. The dependent variable in the Poisson model is the number of policies adopted by a city, which ranges from 0 to 7.

Exhibit 3

Distribution of Sustainable Development Policies Adopted by Cities in the Sample



Results

Exhibit 4 presents the estimated regression model. The second column presents the results without interaction terms. The bottom rows of the table include the variables in the logit model. Substantively, the sign of the coefficient in the binary process is predicting membership in the group that must have a zero count. The negative and significant effect of age, for example, suggests that older populations negatively affect the chances of the city being in the group where zero counts are

Exhibit 4

Zero-Inflated Poisson Model for Sustainable Development Policies

Independent Variables	Coefficient	Standard Error	*p* Value
Poisson model			
Business involvement	.461	.105	.000
Form of government	– .103	.107	.336
Population (log)	.326	.141	.021
Metropolitan growth difference	– .004	.004	.246
Logit model			
Percent manufacturing	– .114	.057	.047
Percent African American	.016	.017	.348
Household income	.00003	.00001	.092
Education	– .049	.023	.037
Age	– .124	.058	.031
Population (log)	– 2.088	1.095	.057
Constant	14.101	6.309	.025

Notes: Sample size = 263. Nonzero observations = 185. Zero observations = 78. Model statistics: LR chi² = 36.53. Probability = .000.

possible. In other words, an increase in the age of the population increases the odds of pursuing sustainable development policies. The percentages of total employment in manufacturing and with a bachelor degree have similar effects.

The top rows in the table present the coefficients for the Poisson model. The results indicate that business interests have a positive and significant effect on the number policies adopted. This finding provides support for the notion that more development policies that integrate environmental and energy issues, of which the benefits are mainly oriented toward businesses, are likely to be adopted when businesses are involved in developing a sustainable vision of the city. Also of theoretical interest is whether the variation in the number of policies adopted by jurisdictions in our sample can be attributed to the structure of local political institutions. The results suggest that form of government does not have a significant effect on the number of policies adopted.

In exhibit 5, we report only the Poisson results for the model with the interaction term and include percentage change for ease of interpretation. This analysis tests the hypothesis that local institutions mediate the demands of business interests on the number of policies adopted. Underlying this hypothesis is that the incentives of local officials operating under different governing arrangements will affect the supply of policy (and thus the associated benefits) to various interests. The positive effect of the interaction term indicates that when cities operate under a council-manager form of government, and when business interests are engaged in planning for sustainable development with the city, the expected number of sustainable development policies adopted increases 48.4 percent.

The results indicate the important role of the structure of political institutions, consistent with the findings of other research that has suggested that managers are not less favorable than mayors to growth. Feiock, Tavares, and Lubell (2008), for example, found that managers work closely with prodevelopment interests to provide the conditions for economic development. Similarly, analysis by Lubell, Feiock, and Ramirez (2005) suggested that professional administrators become vulnerable to development interests, especially when rapid growth is occurring.

Exhibit 5

Percent Change for Sustainable Development Policies (Poisson Results)

Independent Variables	b	z-Score	*p* Value	Percent Change
Business involvement	.199	1.114	.265	22.1
Form of government	– .291	– 1.986	.047	– 25.3
Form of government x business involvement	.394	1.843	.065	48.4
Population (log)	.390	2.551	.011	47.8
Metropolitan growth difference	– .004	– 1.135	.257	– 0.5

Discussion

One surprising finding of our analysis presented in exhibit 5 is the negative and significant effect a council-manager form of government has on the number of polices adopted. Kwon, Berry, and Feiock (2009) found, for example, that having a council-manager form of government has a strong positive effect on cities' early adoption of policy. One explanation they suggested is that green incentive strategies are new, and thus pushing for investments in these more specialized development areas is risky. Managers tend to be less risk averse and are likely to push for policy adoption earlier than elected officials such as mayors. Their results point to the pursuit of efficiency and effective management rather than touting policy success.

Our analysis focuses on integrating environmental objectives into development policy through incentives that promote energy conservation by reducing development costs to businesses. In mayor-council governments, in which shorter time horizons from ongoing election cycles pushes elected officials to become risk adverse, political leaders tend be more attentive to political rather than economic incentives for policy adoption (Steinacker, 2004). Although the policies in our analysis focus on economic incentives, they emphasize LEED certification and expedited permitting and fee waivers for incorporating energy efficiency into buildings. As Lubell, Feiock, and Ramirez (2009: 662) suggested, however, "there remain many doubts about whether green building truly delivers environmental benefits rather than being a symbolic marketing label." Thus, this result may be a function of the incentives targeting these relatively narrow environmental objectives, which are more symbolic than having a relatively significant effect on sustainability. The findings point to the high-powered political incentives of mayors leading to policies that reflect "getting on the bandwagon" rather than actually addressing a real need (Kwon, Berry, and Feiock, 2009: 16).

The results also support the hypothesis that the structure of local political institutions determines the number of policies when it combines with local interests (Clingermayer and Feiock, 2001; Feiock, Tavares, and Lubell, 2008). In this case, the analysis provides evidence of the mediating effect a council-manager form of government has on business interests. The results may indicate that cities are likely to respond favorably to the demands and expectations of businesses because they generate revenue that enables cities to supply adequate public services without imposing high taxes on business (Wolman and Spitzley, 1996). It is also important for local governments to generate support from businesses on sustainable development because these local interests can help to address resource constraints that present significant challenges for policy implementation (Feiock and Francis, 2011). When businesses are engaged in the planning process of crafting a vision of sustainability, cities with a council-manager form of government can effectively negotiate with these interests and supply policy that aligns with their demands. The results of this analysis also point to the argument that, for cities to be successful in achieving goals of sustainability, local officials must establish partnership initiatives with local businesses to improve resource efficiency (Bulkeley and Betsill, 2003).

It is certainly possible that the results reflect city leaders taking the initiative to engage business leaders in their sustainability policymaking or vision simply because they want to build this economic sector. A collaborative and participatory approach to planning and policymaking increases the chances that sustainability programs and policies are implemented (Hawkins and Wang, 2011). Moreover, a collaborative framework for developing local sustainability efforts can build stronger consensus on long-term sustainable development actions by raising the awareness of local issues and diffusing conflict and controversy (Innes and Booher, 2001). It can also lead to "an alliance of key players and leaders" (Innes, 1992: 450) who can become advocates for program implementation.

Given the evidence presented in this study, one challenge for local officials is to highlight the benefits some groups may receive from sustainable development policy while negating threats posed by other interests (Sharp, Daley, and Lynch, 2011). Research on the involvement of cities in climate protection networks, for example, has emphasized the importance of cost savings as a co-benefit of participation (Kousky and Schneider, 2003: Krause, 2011). Framing the issue and the resultant benefits thus become essential with competing claims to what sustainability entails and how best to achieve it (Betsill and Bulkeley, 2007). If an inclusive and collaborative process is undertaken, a greater share of the benefits can be distributed to more groups. This process may also reduce conflict and build consensus on what sustainability may look like and how best to achieve local goals.

Conclusion

This study sought to answer two questions. First: Are cities integrating environmentalism into economic development? Generally speaking, the results provide a qualified *yes*. Among the types of policies that cities in our sample adopted are linking environmental goals to publicly financed development projects, low-interest loans for energy efficiency, funding brownfield redevelopment, and crafting zoning or regulations that allow for onsite renewable energy systems.

Pursuing development without conditioning the resultant effects on the environment can undermine sustainability practices. Most of the literature on development policy at the local level, however, has treated the specific tools in isolation from environmentalism and the broader framework of sustainable development. The descriptive results reported in this study suggest environmentalism and development are not an either/or proposition. Rather, through a variety of incentives, cities can integrate environmental objectives into their pursuit of economic growth. The results of this study may, in fact, reflect how some suggest sustainable development ought to be framed; that is, becoming more sustainable is strongly tied to a city's competitive advantage for economic development (Portney, 2003).

The second question this study sought to answer: What explains the adoption of these policies? Sustainable development undoubtedly requires public investments, but some mechanisms yield quicker returns and more visible results. Policy decisions are made when local officials respond to the demands of interests that seek to alter policies and enact policies that provide benefits that align with their economic or other interests. Depending on the type of governing structure, the demands translate into policy that distributes benefits to some interests over others. The objectives of the sustainable development policies analyzed in this study are meant primarily to reduce business costs, with the assumption that resultant private investment occurs within the locality.

Regarding local interest groups, business involvement in crafting a sustainable development vision for the city has a positive effect on the number of policies adopted. Although business interests can influence a reduction in resource use while maintaining economic and social outputs, the policies developed with their participation are mediated through governing arrangements. The evidence in this study supports this hypothesis: when business interests are involved in the planning and policy development process and when cities have a reformed governing arrangement, the local governments in our sample tend to adopt more sustainable development policies. This study provides evidence to complement findings from previous research that managers assume a pronounced leadership role and take on the position of a broker or negotiator in policymaking (Nalbandian, 1999). In particular, managers may play an essential entrepreneurial role in crafting sustainable development policy (Feiock and Francis, 2011; Svara, Read, and Moulder, 2011).

Systematic evidence is needed regarding how cities will minimize environmental effects while maintaining a strong fiscal base and employment opportunities for residents. The results of this study provide some evidence of how local governments are responding to these seemingly conflicting objectives and identify factors that may influence these decisions. More research, however, is undoubtedly needed. When fiscal or employment issues become more pressing, will cities abandon an environmentalist approach with the hope that the abandonment will contribute to growth? If cities perceive greater competition for private investment from surrounding communities, will they respond by engaging in more economic development activities that are inconsistent with the policies presented in this study? To what extent would this response undermine a sustainable development agenda that is needed to demonstrate meaningful and measureable results? A longitudinal study may help answer these questions.

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Promoting Sustainable Land Development Patterns Through Impact Fee Programs

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Abstract

Sustainable urban growth is generally defined as development that meets the need of current residents without compromising the ability of future residents to meet their development needs. Rapid growth can place pressures on local public infrastructure systems, fail to preserve open-space amenities, increase traffic congestion, and degrade local environmental quality. If these problematic outcomes occur, current and future residents bear a burden that is external to the new construction market. Effectively managed economic development is something local and regional governments vigorously pursue, however. We argue that efficient outcomes occur when developers and other decisionmakers face market prices that reflect the full social costs and benefits of their actions. This article outlines the nature of five types of externalities associated with rapid development, describing how each can compromise the long-term sustainability of communities. We advance the idea that properly structured development impact fee programs can internalize dynamic externalities and encourage more sustainable growth patterns. We describe some ways in which local governments already commonly attempt to deal with development externalities, show how impact fee programs have already been used to correct for some of these problems, comment on the ways existing programs could be improved, and outline the most significant obstacles to using impact fee programs in this expanded capacity.

Introduction

The term *sustainable development* means different things to different people. In 1987, the United Nations defined it as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987: 8). The 25 years that have followed have seen unprecedented levels of attention devoted to topics such as urban sprawl, sustainable growth, intergenerational equity, climate change, and environmental justice. Although national and international bodies have played important agenda-setting roles, local governments have led the way in terms of policy implementation, mostly because they have control over building and land use codes. This article considers how rapidly growing cities and their suburbs can use development impact fees to grow in a sustainable manner.

The prominence of cities in the quest for sustainability seems appropriate in light of the role cities have long played in accommodating population growth. When world population surpassed 1 billion in 1800, only 3 percent of humans lived in urbanized areas. This rate increased to 14 percent by 1900 and to more than 30 percent by 1950. World population now sits at about 7 billion, and the United Nations has reported that, for the first time in human history, more than one-half of the world's population lives in urban areas (United Nations, 2010). Estimates from the same study predict this rate will grow to 60 percent by 2030 and 70 percent by 2050. In the United States, four out of five people already live in urban areas, and forecasts predict this ratio will continue to increase. Simply put, developing sustainable cities is the key to long-term sustainability on a larger scale.[1] Our focus on cities is by no means novel. Berke and Conroy (2000: 23) argued, "Sustainable development is a dynamic process in which communities anticipate and accommodate the needs of current and future generations in ways that reproduce and balance local social, economic, and ecological systems."

An ongoing debate in the literature pits local regulatory planning-based approaches against the unregulated free market. Advocates of widespread land use planning and regulation claim that unregulated development leads to urban sprawl, environmental damage, and a diminished quality of life for all residents. The counterargument points out that such policies may sacrifice the power and allocative efficiency of the pricing allocation mechanism (Holcombe, 2004).

We contend that both sides of this issue base their arguments on valid claims and see impact fees as an obvious compromise between the seemingly divergent views. We frame our analysis around the concept of market failure driven by new construction externalities, and we define sustainable development as construction projects that do not impose external costs on third parties in the present or the future. We review five categories of development externalities that the literature has identified. For each, we discuss the nature of the externality and the appropriate policy response. We compare and contrast impact fees with other regulatory interventions that local governments use to respond to these problems. We argue that development impact fees enable local governments to correct for development-driven externalities while retaining the power of the market pricing mechanism. Hence, impact fees represent a compromise in the ongoing debate between comprehensive land use

[1] We focus on regions facing threats to long-run sustainability because they are rapidly expanding. A different set of problems threatens the long-run sustainability of cities such as New Orleans and Detroit, which have lost more than one-fourth of their residents since the 2000 census.

regulation and planning and the laissez-faire approach. We also summarize several weaknesses of impact fee programs as they have typically been implemented and suggest that higher levels of government address global pollutants and other externalities with a large geographic reach.

Market Failure, Externalities, and Sustainability

It is common to characterize suboptimal social outcomes as forms of market failure. We argue that unsustainable development patterns are those that create significant negative externalities. Externalities occur when a decisionmaker carries out an action that imposes a cost on society for which the market pricing mechanism does not account. The resulting market failure associated with negative or positive externalities is that the competitive market equilibrium results in too much or too little of the activity creating the externality. Theories of externalities and market failure flow from both the Pigouvian and the Coasian traditions. Under the Pigouvian approach, the recommended action for avoiding market failure is to levy a tax on the producer of the negative externality equal to the size of the external harm at the socially optimal level of output. The intuition is that, with a properly sized Pigouvian tax in place, private decisionmakers should willingly make decisions that bring about the socially optimal outcome. Coase (1960) noted that inherent coordination interdependencies are generally present among parties, and he advanced the understanding of market failure by framing externality problems as often driven by poorly defined property rights and incomplete markets. This framing supports the well-known argument that conflicts over scarce resources are reciprocal in nature, and that corrective taxation may not produce a socially optimal outcome.

Using the basic market failure model as a starting point, we define development as sustainable if it does not generate significant external costs in the present or the future. This definition can be applied to individual construction projects, but can also be applied more broadly to policy decisions made by governments. Exhibit 1 introduces five categories of development-related externalities

Exhibit 1

Summarizing the Nature and Preferred Policy Solution for the Five Identified Categories of Externalities That Pose Threats to the Long-Run Sustainability of Urban Areas

Externality Threatening Urban Sustainability	Dynamic Reach of the Externality	Geographic Reach of the Externality	Preferred Policy Solution
Nonconforming land uses	Occur immediately and extend over time if competing activities persist	Localized	Usage-based zoning and legal institutions; impact fees for major rezoning and variance cases
Open-space amenities	Primarily dynamic	Localized	Impact fees, local
Congestion externalities	Occur immediately and extend over time	Most relevant at the regional level	Impact fees, local and regional
Compromised local public infrastructure	Occur immediately and extend over time	Localized but may extend to the regional level	Impact fees, local and regional
Degraded local environmental quality	Occur immediately and extend over time	Local, regional, and global	Impact fees, local and regional; global pollutants handled by higher order governments

that pose long-term threats to urban sustainability, which we review in the discussion that follows. Our discussion should not be viewed as exhaustive and we readily acknowledge that individual construction projects may produce more than one type of externality. The interdependency of certain externality pairings complicates our choice to discuss each independently. When the link between categories is particularly strong, we note the connection.

Nonconforming Land Uses

"A bad neighbor is a misfortune, as much as a good one is a great blessing."

— *Hesiod, Greek poet, circa 800 BC*

Scholars, including Coase (1960), Ellickson (1973), and Fischel (1980), have noted the influence of localized externalities that arise from nonconforming land use patterns in determining the overall efficiency of a given urban environment. The idea is that, when developing a previously unoccupied parcel of land, new construction could harm (or enhance, in the case of positive externalities) the well-being of nearby property owners. For example, negative externalities would plague households living in a quiet residential neighborhood if an automobile repair shop opened directly in their midst. In practice, egregious occurrences of negative externalities driven by nonconforming land use patterns are held in check by informal social mechanisms, formal usage-based zoning regulations, and legal institutions that award damages to parties that can demonstrate direct harm caused by others. For the most part, these simple approaches effectively reduce market failures driven by place-based, localized negative externalities. One convenient aspect of externalities related to nonconforming uses is that they are generally contained within a small geographic area, such that a single jurisdiction governs all involved properties. As such, a desire to enhance welfare and maintain property values in the community provides local governments with incentives that are socially efficient.

Usage-based zoning is not the only way to handle these situations, however, and in extreme cases, it may not even be the most efficient. Houston is often noted as an intriguing counterexample to the efficient zoning argument, because it contains no formal zoning regulations yet displays land use patterns that resemble otherwise similar zoned cities (Siegan, 1970). One goal of usage-based zoning is to prevent projects that will harm the immediately surrounding areas. This approach may be efficient or inefficient, however, depending on the value of the new project. The opportunity cost of prohibiting a given construction project (that is, the difference between the value of that project and that of the next-most valued use for the property) may exceed any external harm to existing nearby properties. For this special case, restrictive zoning that prohibits the project actually reduces social welfare. Suppose a developer wishes to build an apartment complex in a location currently zoned single-family residential, but where she is confident that the current net present value of the multifamily project far exceeds that of alternative uses. Nearby property owners fearing a reduction in the value of their homes would resist a rezoning request, which would therefore likely be denied. The harm to nearby property owners might be dominated in magnitude by the opportunity cost of the apartment complex, however, such that its prohibition is inefficient.

In special cases like this one, in which a rezoning or variance is required to move forward with the project, a monetary payment (for example, an impact fee), direct dedication, or a fee-in-lieu payment could enable the welfare-enhancing development to occur. Assuming an impact fee for acquiring the modified zoning was set at a correctly determined price, this approach could offer enhanced efficiency properties over rejecting the project. Note that efficiency concerns are met so long as the developer's costs increase by the full amount of the negative externalities generated by the construction. Equity-related concerns could also be satisfied if revenues from this practice were used in ways that directly compensated the parties harmed by the new construction.

In theory, a new category of impact fee could be set equal to the precise impact of the development on nearby property values and could be levied along with other traditional categories of fees. The local government could spend revenues from this fee in ways that mitigated any negative spillovers to bordering properties or to directly compensate the harmed parties. The use of development impact fees for this purpose seems at best impractical, however, and at worst counterproductive. One of the most important aspects of impact fees is that they are predetermined rather than subject to case-by-case negotiation. This reduction in risk and uncertainty has been applauded for creating predictable rules for the development game. Because the nature of these externalities is inherently driven by the unique combination of bordering activities, it is difficult to imagine a local government estimating predetermined impact fees for the set of all conceivable development proposals. Also, if impact fee levies were subject to case-by-case negotiation, they would bring little to no improvement over the longer standing practice of requiring in-kind exactions or cash proffers. We recommend that communities impose no impact fees from this newly proposed category on projects consistent with prezoned land use designations, but that they require projects needing a major rezoning or variance to pay a new impact fee equal to the size of the negative externalities allowed under the rezoning or variance. We admit, however, the application of the rational nexus test to fees of this nature is complicated.[2] The test requires that a reasonable benefit accrue to the payer of the impact fee. In this case, efficient use of the revenues would require spending them in ways that do not benefit the developer, per se. As such, the approval of the variance or rezoning which allowed for the project to move forward would need to be recognized by courts as the benefit felt by the developer.

Open-Space Amenities

"And preserving our open spaces, or having them there for recreational purposes, is one of the things that contributes to the high level of quality of life that we offer in Pennsylvania."

—Ed Rendell, Governor of Pennsylvania, 2002

Another common market failure associated with the development of urban land flows from the failure to adequately preserve open-space amenities. Easy access to nearby open space carries significant benefits for households. The standard urban land use model suggests that the conversion of rural farmland to urban use depends on the land's private productivity in each activity—but not on any benefits accrued by residents who live near the undeveloped land. Ignoring the positive value of open-space amenities, the private market converts land from agricultural to urban use too quickly and to uses that are suboptimal. The question of whether interventions meant to correct for this form of market failure will produce better outcomes is controversial, however. The debate

[2] Because a more detailed description of the rational nexus test and its nuanced applications lies beyond the scope of the present discussion, we direct interested readers to Nelson, Nicholas, and Juergensmeyer (2008).

centers on two related questions that explore the nature of open-space amenities: (1) What open space does and does not produce positive externalities, and (2) does the nature of the positive externality from open space vary across the urban environment?

Irwin (2002) found that the positive effects of open space on property values accrue only when long-term use restrictions are placed on land parcels, and she found that positive capitalization effects are not present when nearby open space is zoned as ready for development. Three factors drive this result. First, long-term dedication ensures that any positive external effects will continue in a dynamic sense, compounding the value of any current benefits. Second, dedication frequently involves modifying the property in specific ways that create the positive externality. For example, most households would prefer to live within a few blocks of a well-maintained public park as opposed to a large agricultural plot. Although both are open space, the farm does not provide the same services to the household that the park does. Third, uncertainty over potential externalities related to nonconforming uses is present when the open space is zoned for easy development but is removed after it is dedicated. Regarding the nature of spillovers across different portions of the urban environment, Anderson and West (2006) showed that proximity to open space is greatly valued by residents who live within core interior urban areas but that these positive effects dissipate significantly as the household moves toward the urban fringe. In a collective sense, these findings suggest that the most important market failure related to open space may not be the pace of development at the fringe, but rather a lack of sufficient interior locations dedicated as useable open space for the long term.

Local governments traditionally have tried to preserve open space in one of two ways. The first approach is directly acquiring public lands in the form of parks, dedicated forests, wildlife preserves, and community land trusts, whereas the second involves adopting exclusionary growth-control policies such as greenbelts, urban growth and service boundaries, density-based zoning, targeted or cluster development programs, permit caps, and even growth moratoria. The first approach addresses the actual nature of the externality problem by removing uncertainty over the current and future use of the open space while ensuring the land will be used in a way that community residents value. On the other hand, the exclusionary growth restriction approach falls short in many ways. First, it does not directly lead to undeveloped land being converted to parks or set aside as dedicated preserves. It does quite the opposite, in fact; these policies have been found to inflate the price of undeveloped land and of residential and commercial structures in within-boundary developable areas while lowering the market price of outside-boundary undeveloped locations (Dawkins and Nelson, 2002). For example, when an adopted greenbelt or urban-service boundary increases the price of undeveloped land within the boundary, it actually increases the opportunity cost of long-term dedication for these sites, making interior open-space preservation less likely. Of course, land outside the boundary may be cheaper, but the literature suggests that dedicated open space in more remote locations generates much lesser positive spillovers on residents.

Although they are certainly not universal, impact fees for parks and recreation are commonly implemented by local governments (Bauman and Ethier, 1987). In Florida, for example, which has used development impact fee programs for more than 35 years, most counties and nearly all the urban counties collect park impact fees (Duncan Associates, 2010). It is unfortunate that, whereas commercial development removes valuable open space, most communities levy parks and recreation impact fees only on residential developers. Although inefficient, this approach does provide the advantage of simplicity. To successfully levy recreational impact fees on commercial developers or expand programs to include preservation of other valuable open space that is not to be turned into parks open to the public, cities must be equipped with evidence from research that more clearly identifies the significance of these benefits to the parties paying the fees.[3] Doing so would enable the expanded programs to pass the rational nexus test and retain their treatment under the law as fees for services provided rather than as taxes. In considering the approach wherein local governments acquire and maintain permanent recreational open space, we believe that development impact fees enhance and pair with this practice. On the other hand, impact fees do not pair well with growth containment barriers, because the value of undeveloped parcels inside and outside the boundary have already been artificially inflated and reduced, respectively.

We propose a new category of open-space impact fees, equal in size to the magnitude of the spillovers associated with the removal of open space.[4] At least four different approaches to setting these fees are possible, each with advantages and disadvantages.

1. A flat fee per project permitted or developed.
2. A flat fee per acre of land developed.
3. A fee calculated as a proportion of the undeveloped parcels' assessed value.
4. A fee based on the interior square footage of the new construction.

The first and second approaches carry the advantage of simplicity but have significant drawbacks that leave them inefficient and inequitable. The first forces smaller homes and buildings to subsidize larger developments, a troublesome result. Also, when the fee is not affected by the characteristics of the development, a division is placed between the size of the open-space externality and the cost of the fee to the developer. The second approach causes low-density developments to subsidize high-density developments and inefficiently treats centrally and remotely located land the same, although research show they carry different open-space values (Anderson and West, 2006). The third approach overcomes this drawback, because centrally located parcels carry greater assessed values. This approach, however, steps on the heels of local property tax programs and would likely be ruled an unconstitutional ad valorem tax. In comparing the second and third approaches, Anderson (2004) concluded that an impact fee set as a percentage of the parcel's predevelopment value is more efficient than a lump sum fee per acre. Of course, the superiority of the percentage-of-value approach rests on the accuracy of property tax assessments for undeveloped land parcels. Empirical evidence suggests that systematic inaccuracies in assessments do occur, even for improved parcels, which provide sales transactions far more frequently than undeveloped land parcels (Goolsby, 1997; Ihlanfeldt and Jackson, 1982; Kowalski and Colwell, 1986). Very few studies have considered the accuracy of property tax assessments for undeveloped land, and the

[3] Although the practice is still novel, some impact fee analysts have developed methods that allow for this connection, and they have started applying them in Florida. Describing these nuanced methods lies beyond the scope of this article.

[4] We thank an anonymous reviewer for noting that, to levy open-space fees on both residential and commercial properties, park impact fees would need to be apportioned into the fees. This practice already has precedent in many current programs in the United States.

investigations that have generally found it to be less accurate than assessments for other property strata (Burge and Ihlanfeldt, 2005). The fourth approach returns to legally defensible grounds, and it does carry the desirable attribute that larger properties pay more, but the disadvantage is that it severs the direct link between fee size and land conversion. For example, consider the case of a used car dealership. Suppose only a small building is placed in the middle of a paved lot of several acres. The development would pay much less under the fourth approach than it would under the second or third approaches.

In light of these nuanced and often conflicting tradeoffs, we suggest a balanced approach that would implement a per-acre development fee but vary the size of this fee across intuitively distinct geographic zones within the community (or larger metropolitan region).[5] We presume that local governments possess information that speaks to where dedicated open space is the most and least valuable, and they could set rates accordingly. To pass the rational nexus test, revenues should be used to secure undeveloped land and to provide for its long-term preservation as open space.

Congestion Externalities

"A commuter tie-up consists of you—and the people who, for some reason, won't use public transit."

—*Robert Breault, opera tenor, 2009*

When urban scholars consider the various tradeoffs related to organizing economic activity more or less densely, the phenomena of congestion externalities and crowding of impure local public goods are first-order concerns. Although we choose to limit our discussion to traffic congestion, the sustainability of urban environments can also be threatened by overcrowded public schools, slower response times for police and fire services, and other situations in which congested local public services provide households with reduced utility. One way for growing communities to avoid compromised service levels is to expand the stock of infrastructure, creating a direct connection between congestion externalities and compromised local public infrastructure quality. We recognize this strong interdependency but contend that each topic is worth discussing individually. Traffic congestion is also closely connected to air pollution, a topic we will also discuss.

Arnott and Small (1994) and Downs (2004) are among the contributions that refined an understanding of inefficiencies related to traffic congestion in urban areas. Households make decisions concerning where to live and work, conditional on the transportation costs they face internally but failing to account for the external costs they impose on others by consuming congestible roads. In equilibrium, monetary commuting costs, time commuting costs, energy consumption, pollution, and traffic accidents and fatalities are all greater than they would be if individual decisionmakers paid the full costs of commuting.

Economists traditionally favor tolls as the best way to correct for traffic congestion externalities. It seems intuitive that tolls should be set at their highest levels during peak driving hours and at their lowest levels when traffic is uncongested. Several studies (for example, Decorla-Souza and Kane,

[5] Another way to view our recommendation is that it bears some similarity to a fee program that comprises different tiers so that, for instance, undeveloped land parcels with positive spillover value to different capture areas (neighborhood, community, and region) would have unique impact fees assessed on each level.

1992; Shmanske, 1993; and Small and Yan, 1997) took up the challenge of estimating the optimal size of congestion tolls. An interesting aspect of this literature is that, as tracking and emissions-measurement technologies continue to improve, ideas that were once discussed as only theoretical possibilities are becoming feasible at more reasonable costs. Less efficient interventions that are far easier to implement and administer include offering incentives for driving during offpeak hours, creating carpooling lanes, requiring rush-hour and downtown drivers to purchase licenses, and subsidizing the production and use of mass transit systems.

Transportation impact fees have frequently been used to address the impact of development on urban transportation systems and traffic congestion levels—typically with a focus on ensuring that additional traffic does not flow into areas without concurrent improvements in capacity and coverage. It is perhaps ironic that the advantages and disadvantages of transportation impact fees compared with the alternative approaches to correcting for this market failure both stem from the same distinctive characteristic—the one-time payment of the impact fee relative to the ongoing nature of the other approaches. One clear advantage of a transportation impact fee over an optimal toll program would be ease of implementation and operation. Although advancing technologies are making toll programs more feasible, the costs associated with administering optimal tolls are still high compared with those of impact fee programs. The disadvantage of using transportation impact fees instead of tolls is that individual commuting decisions would not be further impacted daily. Local governments could use transportation impact fees to correct for the average external congestion costs created by a new development, given its characteristics, but not to further influence households' commuting decisions at the margin.

At a given time, the level of traffic congestion in a region is a function of three factors.

1. The spatial distribution of improved structures (for example, homes, apartments, workplaces, and retail stores) in the community.

2. The placement and quality of existing transportation infrastructure (for example, highways, interstates, local roads, and mass transit systems).

3. Individual commuting decisions that are made conditional on the first two factors.

To be effective, transportation impact fees should account for how proposed projects influence the first factor and add to the expected level of congestion in an aggregate sense. An efficient fee would be the amount of money the community needs to improve and expand existing transportation systems, such that the development can be incorporated into the spatial distribution of structures without increasing congestion. Revenues from these fees should be used in ways that improve transportation infrastructure (the second factor) in the most effective ways. Although roads are clearly a top priority, a potentially effective use for these fees in heavily populated urban areas is to improve and expand the reach of existing busing routes and mass-transit systems.[6] Note that the presence of transportation impact fees in no way decreases the effectiveness of policies aimed primarily at influencing the third factor. In tandem, development impact fees and optimal toll programs

[6] For this insightful suggestion and several others that improved this article, we thank Timothy Chapin.

represent an efficient two-part pricing scheme that accounts for the average external cost associated with construction projects and for the marginal costs of daily decisions made by commuters.

A key question is whether adopted transportation impact fees have actually followed the intuition of this approach. The answer is most frequently, and unfortunately, *no*. Transportation impact fees are often uniform across space, and they primarily add capacity to outer portions of the metropolitan area as opposed to expanding the capacity of freeways and arterioles (Blanco et al., 2011). Transportation impact fee programs could be more effective if they were modified to (1) expand major freeways and arteries rather than focusing primarily on roads near the development, (2) levy fees that were higher at the urban fringe and lower at interior locations, (3) fall under the administration of regional transportation planning agencies rather than small local governments, and (4) be less in cases in which individual projects internalized negative effects by formally diverting automobile trips into biking, walking, or mass transit.[7]

Compromised Local Public Infrastructure

"We are still driving on Eisenhower's roads and sending our kids to Roosevelt's schools."

—Blaine Leonard, President of the American Society of Civil Engineers, 2010

As cities across the United States and abroad work to climb their way out of the recent national economic recession, the connection among infrastructure quality, local fiscal health, and urban sustainability has never been clearer. Effectively maintaining adequate systems for roads, schools, water and sewer, police, fire, and recreation without amassing burdensome local public debt is perhaps the best way for cites to enhance their long-term prospects for success and prosperity. The provision of high-quality local public infrastructure can be seen as a way for cities to invest in the stock of physical and human capital they need to compete in the future. Conversely, a failure to maintain the quality of infrastructure systems as population grows rapidly harms both current and future community residents, and it is a dynamic negative externality problem. For simplicity, we focus on the existing quality of infrastructure, holding levels of local bonded debt constant. One could easily take the opposite approach, however, assuming communities hold the quality of infrastructure constant in the face of growth but that bond debt increases. In reality, neither extreme is likely to occur, and growth simultaneously places pressures on both infrastructure quality and outstanding debt.

In the United States, local public infrastructure is financed primarily through property tax revenues, leading to the obvious point that although growth results in new infrastructure needs, it also adds to the property tax base and increases revenues over time. To determine whether a fiscal externality exists, the relevant question is, "Are the additional revenues over time enough to cover the full costs?" Scholars and practitioners have long used fiscal impact analysis as a tool to answer this question, finding that, for most new construction projects in already densely populated areas, the answer is *no*. Altshuler and Gómez-Ibáñez (1993) documented how by far most fiscal impact analyses find most projects do not pay their own way, instead causing existing residents to bear a greater tax

[7] Again, we thank a helpful anonymous reviewer for suggesting the fourth potential modification.

burden as the community covers higher maintenance costs associated with higher levels of usage. Here, the appropriate policy response and the observed policy responses of local governments overlap to an extent, because development impact fees for water and sewer systems, roads, schools, parks, police, and fire have become popular in rapidly growing regions during the past few decades.[8]

When considering the effects of development impact fees, Brueckner (1997) noted the empirical regularity that the per capita costs of building and maintaining most types of local public infrastructure are U-shaped with respect to community population. In rural communities where economies of scale in service provision have not been fully exhausted, development brings positive fiscal externalities in the long run that may partially offset or even dominate any negative externalities in the short run. Burge (2010) noted that a comprehensive approach would consider the overall long-run fiscal impact of the development on the community and account for feedback effects on other revenues and the future demand for infrastructure spending. Because our discussion primarily concerns sustainable growth in already densely populated urban areas, we focus on situations in which any economies of scale in production have already been exhausted, such that the development externality in question is negative. Even after eliminating rural communities from the discussion, however, a distinction still exists between cities and their suburban counterparts. Cities typically have a great deal of existing physical infrastructure, such that their main challenge is effectively maintaining its quality. On the other hand, suburban areas more frequently need to build capacity and likely have newer systems that require less maintenance cost.

From a conceptual perspective, impact fee programs can be used to handle either situation effectively. For growing suburban municipalities, they can be used to expand local public infrastructure systems through a two-part pricing scheme, wherein impact fee revenue covers the upfront costs of adding capacity and recurrent taxes and fees finance the ongoing costs of operation and maintenance. Under this approach, sustainable development occurs when construction projects contribute the full upfront costs associated with their presence in the community, such that the project does not create the pressure to raise other taxes (for example, property taxes) to maintain the quality of local public services. For already infrastructure-rich central cities, however, this conceptual approach makes less sense. For central cities, it makes sense to allow for impact fee revenues to be spent for capital preservation; for example, major maintenance projects such as road resurfacing, school renovations, and equipment upgrades for existing parks and wastewater plants. If impact fee programs are implemented by jurisdictions large enough to cover the central city and its suburbs (for example, counties or regions), programs should be built in flexible ways that allow for revenues to be spent in either manner.

Arguing that impact fee programs *could* help communities effectively maintain the quality of their public infrastructure systems is very different than claiming they *have been used* toward this end. One problematic aspect of how development impact fee programs have been implemented in practice is that they tend to follow an average cost-based approach rather than a marginal cost-based approach (Nelson et al., 2008). Consider two development projects with identical physical

[8] Monetary impact fee programs in the United States date back to the late 1970s. Less formal practices, such as securing in-kind contributions or negotiating ad hoc exactions, have a much longer history.

characteristics that differ only in terms of their proposed locations—one at an interior location near the urban core and the other at a remote location near the urban fringe. The former imposes much less marginal cost on the community, because existing infrastructure systems are already in place to accommodate the new construction. The latter property should face a greater impact fee to account for the external costs it imposes on the system.

It is unfortunate that most impact fee programs levy similar or even identical rates on both types of projects and do not allow for communities to use revenues for large maintenance expenditures, leading to an inefficiently high level of growth in remote areas. For example, in Florida, most counties with impact fee programs levy uniform fees across their entire jurisdiction. Others, including Bay, Clay, Indian River, and Osceola Counties, have geographically defined zones with little variation (in each case, the least expensive zone pays 75 to 90 percent of the most expensive). In fact, only 2 of the more than 40 Florida counties that have adopted programs, Brevard and Broward Counties, have created substantial variation in rates across geographically based zones.[9] Over time, this practice can create a mismatch between where new construction occurs and where existing infrastructure systems can most effectively accommodate growth. On the other hand, one desirable aspect of impact fee programs that the literature often ignores is that impact fees are generally waived when teardown-and-rebuild construction occurs. The practice of providing an impact fee credit based on the property previously occupying the parcel should make gentrification and infill redevelopment projects more attractive than other development locations. An important topic for future research is to investigate the extent to which teardown-and-rebuild construction activity is greater in jurisdictions that impose impact fees but waive them for these projects.

Degraded Local Environmental Quality

"We can no longer afford to consider air and water common property, free to be abused by anyone without regard to the consequences. Instead, we should begin now to treat them as scarce resources."

—President Richard Nixon, State of the Union Address, 1970

Declining environmental quality has become a defining trademark of the past century. Compared with previous generations, we breathe dirtier air, drink dirtier water, deal with more instances of contaminated land, and are more frequently exposed to toxins and carcinogens. Most environmental scholars believe that future generations may fare even worse if dramatic steps are not taken. One similarity between environmental degradation and the previously discussed threats to urban sustainability is that each can be viewed as a market failure driven by externalities. Pollution is a *tragedy of the commons* phenomenon, wherein private decisions fail to account for the social value of clean air, water, soil, and so on (Kahn, 2006). One difference between pollution and the other externalities, however, is that pollution's reach, in both geographic and temporal terms, extends much further. For example, the combustion of fossil fuels to produce energy emits both sulfur dioxide and carbon dioxide. Whereas high concentrations of sulfur dioxide contribute to local pollution problems, carbon dioxide, a significant greenhouse gas, creates a negative externality that

[9] A handful of counties apply impact fees only to projects in the unincorporated portions of the county. In most of these cases, however, municipalities within the county have their own programs with similar or identical rates. Also, school impact fees must be levied uniformly across the entire county, because counties define school districts.

extends globally (Yang, 2006). We acknowledge the potentially extremely far-reaching geographic and temporal reach of pollution externalities while still focusing on how pollution threatens the sustainability of local urban environments. We do so not to downplay the issue of global climate change, but rather to highlight the many ways that local environmental degradation lessens quality of life in the short run, as well. In addition, we focus on optimal policy choices for local governments, and we point out that higher order governments would be the more efficient level at which to address how construction affects the level of global pollutants.[10] As such, we turn to a discussion of how growth can affect the quality of the local environment.

Urban communities across the world struggle to deal with environmental problems, including air pollution and smog, contaminated water sources, localized flooding, brownfields, toxic and nontoxic waste management, and the loss of natural habitats including wetlands. Each of these problems reduces the quality of life for current and future residents. Individual construction projects generally influence these problems through three main channels.

1. The location of the construction relative to the existing developed urban landscape.
2. How the construction affects the immediately surrounding physical environment.
3. The specific physical characteristics of the building.

Regarding the first channel, considerable debate centers on the effect of urban sprawl on environmental quality. The costs associated with sprawling or low-density development have been examined for decades. A well-known study by the Real Estate Research Corporation (1974) presented detailed cost calculations generated by different density configurations. Using newer data and methodological innovations, this approach has since been reexamined and extended (Burchell et al., 2002, 1998; Burchell and Mukherji, 2003). The findings of these studies lend support to the conventional wisdom that sprawl results in significant environmental degradation.

Other studies, however, have taken issue with these findings. Anas and Lindsey (2011) and Gordon and Richardson (2000, 1995) argued that previous studies did not sufficiently account for the fact that, as population has suburbanized, so have employment opportunities. Their results suggest that the concomitant suburbanization of jobs has kept commutes and traffic congestion stable over time. This conclusion was also supported by Holcombe and Williams (2010), who found that sprawl is unrelated not only to commuting time, but also to automobile ownership, per capita miles driven, automobile accident rates, air pollution, and highway expenditures. Kahn (2000) provided some contradictory evidence, finding that the typical suburban household drives 31 percent more miles than the typical central-city household. His findings, however, agreed with those of Holcombe and Williams, who showed that local air quality is not degraded by urban sprawl. A key idea from these prosprawl studies is that some local environmental problems are actually magnified when

[10] Jepson (2011) considered whether locally imposed impact fees could be used as an effective tool to regulate carbon dioxide emissions. We argue that, besides the legal and political challenges he identified, the most serious problem is that because carbon dioxide pollution is not contained spatially, any reduction in local emissions provides a minimal benefit to the residents of the community relative to the overall benefits to society. Also, note that any variation in local impact fee levies on carbon dioxide emissions would violate efficiency, because the magnitude of the externality is not a function of where the carbon dioxide is produced.

economic activity becomes too concentrated. Regardless of which side of the urban sprawl debate is correct, the central issues framing this debate (for example, open space, traffic congestion, higher costs of servicing remote locations, and increased energy consumption leading to global warming) either were discussed previously or have been noted as falling outside the scope of our article. As such, we focus on the second and third channels.

New construction can harm the surrounding local environment in several ways. One is that the effectiveness of water and wastewater drainage systems may become compromised as undeveloped land is converted to improved and paved uses. Besides increasing the risk of localized flooding, the loss of drainable soil causes water to travel over impervious surfaces, picking up pollutants including gasoline, oil, heavy metals, fertilizers, pesticides, and discarded medicines.[11] These pollutants increase the monetary costs of cleaning water for municipal systems and leave more contaminants in untreated discharge that is funneled into nearby streams, rivers, aquifers, and lakes. Unmanaged runoff can also exacerbate the intensity of soil erosion problems. Communities are fortunate that, when lands that directly contribute to the effectiveness of existing drainage and runoff systems are to be converted to improved uses, local regulations often require offset contributions such as retention ponds or infiltration basins. Command-and-control prohibitive regulation is also common, as proposals deemed to have particularly adverse environmental impacts can be prohibited entirely (Hahn and Stavins, 1991).

Another negative externality associated with growth is the destruction or fragmentation of natural wildlife habitats. Although deforestation and desertification have received the most attention, for understandable reasons, the case of lost wetlands provides another interesting example. A *wetland* is a piece of land where the soil is saturated with water, either permanently or seasonally. Wetlands provide a transition between dry land and water bodies, and have been noted as uniquely valuable habitats that serve as an interface between terrestrial and aquatic ecosystems (Barbier, 1993). Although the destruction of wetlands is regulated by federal guidelines, efforts to preserve wetlands commonly involve joint efforts among federal, state, and local governments. One of the most common approaches is to form local wetland mitigation banking programs. In these programs, developers who destroy or degrade wetlands in one location are required to restore, create, or provide enhanced permanent protection for wetlands in other locations.[12] Banking programs have fierce opponents and ardent supporters. Nicholas and Juergensmeyer (2003) proposed that linkage programs such as wetlands mitigation banks be paired with environmental impact fees (commonly called *environmental mitigation fees*) to create efficient incentives for private developers.

We agree with their conclusion and recommend that impact or mitigation fees be set at the cost of preserving the local environmental quality in the long run. Revenues should then be used to secure and preserve the integrity of local habitats and to maintain the quality of local environmental resources (for example, clean water, clean air, and uncontaminated land). Although some communities have implemented environmental mitigation fee programs, such programs are currently sparse

[11] Increased levels of toxins and pollutants in the water supply have been linked to myriad adverse outcomes, including, but not limited to, higher incidences of allergies, chronic illnesses, infertility, and cancer.

[12] See Nicholas and Juergensmeyer (2003) for a more detailed discussion of wetland mitigation banking programs.

and rest on insecure legal footing. Because it can be difficult to establish a clear and proportionate link among individual construction projects, the subsequent environmental damage, and the use of the collected funds to prevent or offset the environmental damage, the primary legal challenge for mitigation fees to date had been passing the rational nexus test.[13]

Turning to the third channel, the physical characteristics of the building relate to the topic of green construction. Green buildings are designed to minimize energy use, save water, and use recycled materials when possible. The most common method of evaluating the environmental friendliness of individual construction projects in the United States is the Leadership in Energy and Environmental Design (LEED) point-based rating system maintained by the U.S. Green Building Council (USGBC).[14] Although many characteristics of green buildings (for example, lower utility and electric bills, and better interior air quality) are valued by the eventual consumers of the facility, potentially reflected in the higher expected selling price, those reducing external harm are not. This discrepancy leads to a situation wherein developers and contractors find it difficult to profitably develop LEED-certified buildings (Kingsley, 2008).[15]

Common local reactions so far have been to offer incentives or subsidies to private decisionmakers, mostly in the form of expedited review or density bonuses.[16] Some programs even include direct payments to private developers who build LEED-certified structures. Rebate programs for homeowners who make energy-saving appliance purchases are also somewhat common (King and King, 2005). One reason direct subsidy payments are rare is that they are costly for already fiscally strained local governments. Moreover, using subsidies to correct for negative externalities is counterintuitive; that practice should be reserved for encouraging positive externalities.

To curb these negative externalities, the correction should come from Pigouvian taxes. Using subsidies, the implicit assumption is that normal construction harms the local environment (that is, construction that creates less harm is rewarded). Using Pigouvian taxes, the assumption is that development should preserve the local environment (that is, projects not meeting that standard pay a penalty). Correctly determined environmental impact fees would not only lead to less pollution,

[13] The three requirements for passing the rational nexus test are (1) establishing a clear connection between new growth and the need for new expenditures, (2) ensuring that fees are proportional to the need for increased spending, and (3) ensuring that the payer of the fee benefits directly from the new spending. These requirements have been problematic for mitigation programs in Florida because wetland banks are rarely close to the developments paying the fees. We argue that the rational nexus test would be easy to satisfy if impact fee revenues were spent in ways that enhance or preserve the local ecosystem, but impact fees may fail the test if they are not.

[14] Gaining LEED certification from the USGBC requires extensive documentation and payment of fees. Certification is based on a 100-point scale and has four distinct levels: certified (40 to 49), silver (50 to 59), gold (60 to 79), and platinum (80 or more). Builders receive points for myriad characteristics, including building near public transportation, limiting stormwater runoff, decreasing expected energy consumption by building above code, using recycled materials, and many other items. This information and more about green building are available at http://www.usgbc.org.

[15] Many private developers are not convinced that building green is profitable. The term *greenwashing* describes attempts by green building advocates to sell the profitability of green buildings.

[16] Another approach would be simply to require that all new construction meet LEED certification standards. Although many state and local governments have requirements that all new public buildings obtain LEED certification, we have not come across local programs that require all private developments to meet this standard. Strict requirements of this kind would discourage some otherwise efficient construction.

they would also generate revenues for local governments.[17] In practice, environmental impact fee rates could be tied to LEED certification levels, with noncertified buildings paying the highest fees and buildings certified at higher levels paying reduced or no fees. A major challenge associated with using impact fees to offset local environmental damage stems from the difficulties associated with accurately measuring the extent of damages and distributing the responsibility across potential sources. Of course, this difficulty plagues any approach to correcting for environmental externalities.

A Market-Oriented Approach to Sustainable Development

We began this article by noting that urban sprawl, sustainable growth, intergenerational equity, and climate change have all received unprecedented levels of attention during the past few decades. In response, city and regional governments have frequently pursued sustainable development as a centerpiece of their planning efforts (Berke and Conroy, 2000; Portney, 2009). During the same period, development impact fees have grown from a stage of infancy to the point at which recent estimates suggest that 1,000 jurisdictions in the United States have programs. We do not view the concurrency of these explosions as coincidental. Somewhat surprisingly, however, the potentially powerful link between the two topics has received very little attention. This article takes a step toward eliminating that divide.

In reviewing the five main types of externalities generated by new construction, we argued that impact fees could play a role in correcting these market failures. Throughout, we have highlighted the many advantages of impact fee programs. Besides serving as a flexible Pigouvian tax that preserves the allocative efficiency of the pricing mechanism, effectively administered programs can reduce uncertainty over the permit approval process, create a direct link between the actions triggering the impact fee and how the revenues will be spent, and align the timing of increased supply and demand for local services. As such, it is not surprising that local governments already frequently use impact fee programs to help provide roads, water and sewer services, schools, parks, police and fire facilities, libraries, and other municipal services. Impact fee programs are by no means a panacea, however. We now summarize the six most serious problems plaguing development impact fee programs as they have commonly been implemented, in each case suggesting how improvements could be made.

1. Whereas communities have demonstrated considerable interest in adopting impact fees that address fiscal externalities, they have shown far less interest in using them to protect the quality of the environment. The two most common types of impact fee programs to date have been for roads and utility services (Burge, 2010). Although revenues from these programs could conceivably be spent to reduce congestion and pollution, no evidence suggests that this spending has occurred. Recent evidence suggests that road impact fees primarily expand the transportation network in periphery areas rather than improving regional freeways and thoroughfares or public transportation (Blanco et al., 2011). In a similar way, water and sewer revenues are primarily used to expand the capacity and reach of the system, rather than to mitigate the system's impact on the local environment. Slightly less prevalent, but often greater in magnitude, are school

[17] Because local governments could then, in turn, lower the rates of other distortionary taxes, this approach relates to the double-dividend hypothesis that Goulder (1995) and Oates (1995), among others, discussed.

impact fees.[18] Although certainly beneficial, these fees again address only an internal fiscal externality. In fact, park and recreation impact fees programs are the only commonly used programs intended to preserve any desirable trait of the local environment. Environmental mitigation fees and charges for non-LEED-certified structures should be used if communities want to address the full range of threats to urban sustainability. This problem relates closely to our second identified problem.

2. Whereas communities have demonstrated considerable interest in adopting impact fees that address externalities contained within their borders, they have shown far less interest in using them to address interjurisdictional spillovers. A single construction project can generate many externalities, each with a different geographic reach. Consider a development that destroys a large tract of wetlands. Ecosystems and natural habitats are large, are interdependent, and do not respect jurisdictional borders. Whereas they take massive amounts of time for nature to build, their value can be compromised relatively quickly. Although local governments may reasonably be expected to address external spillovers contained within their borders, they do not have properly aligned incentives to charge developers for harm done outside of their jurisdiction. This fact marks an important related point—impact fee programs in the United States have most frequently been adopted at the municipal level. Florida and Maryland are the only states that have programs coordinated primarily at the county level (Burge, 2010). Although we believe counties are preferable to municipalities, we would still not expect an increased commitment to county and regional impact fee programs (or better coordination among municipal programs within regions) to have a sizeable effect on the level of global pollutants over time. National and international bodies should levy carbon taxes or create tradable emission programs to pair with locally imposed environmental mitigation fees that address local environmental quality.

3. Most impact fee programs are too rigid. They follow an average-cost pricing approach rather than a marginal-cost pricing approach. They do not reflect the size of the physical structure, the amount of land converted, or the location of the project. A simple example illustrates this problem. To build a 3,000-square-foot home on a 2-acre lot in Dade County, Florida, a developer would currently pay about $10,000 in total impact fees across all categories. In the same community, a developer would pay approximately $9,100 to build a 1,800-square-foot home on a quarter-acre lot. In many communities, no discount for a smaller property would be present at all. Note also that the geographic placement of the two homes would not influence these charges. Setting equity-based concerns aside for the moment, rigidity in levels across different projects may be efficient for categories like school or library impact fees, for which the costs imposed on the existing system, are mostly invariant. Programs for roads, utilities, parks, and any form of environmental protection, however, should respect how the magnitude of the externality relates to the construction's size, land usage, and location. The correct approach would use nuanced impact fee schedules that accounted for the systematic differences in the true social marginal cost of development across these dimensions.

[18] For example, school impact fees in Montgomery County, Maryland, are nearly $22,000 for a 2,000-square-foot single-family home—roughly twice the combined amount of all other impact fees levied on a development.

4. Revenues are spent in ways that do not address the nature of the growth externality, which is not a problem for some common categories of impact fees. Finding an appropriate link between revenues and expenditures for education, park, police, fire, emergency medical service, and public building impact fees is straightforward. On the other hand, the connection for transportation impact fees can be problematic. An efficient transportation impact fee needs at least three components. The first would address traffic flows and accessibility near the development. The second would address the broader effect on the regional network. These components should be used to expand the capacity of the regional highway system. The third would address effects on regional public transit systems. Transportation impact fee revenues are used almost entirely to address the first concern at the detriment of the other two. A similar weakness of most utility impact fee programs is that, although they address the need for expanding the reach of the system, they do not ensure that the system can expand without compromising local environmental quality and the long-run sustainability of water resources. Establishing an appropriate connection between impact fee revenues and expenditures is particularly important for environmental externalities. For example, the Florida wetlands mitigation banking program bears a similarity to impact fees, in the sense that developers who destroy wetlands can pay into a fund that is then used to purchase rural farmland and convert it into wetlands. Critics of this program argue it does not retain the immediate local benefits of the wetlands and that it creates something less valuable than the original natural habitat.

5. Impact fees are not typically collected on all properties creating the externality. The best example of this problem comes from a consideration of open-space amenities. Impact fees for parks represent the only currently used program connected to this problem. Although both residential and commercial developments eliminate valuable open space, only developers of residential property pay park impact fees. Of course, the real problem is that park impact fees have never actually been intended to correct for open-space externalities. Rather, they are simply a means to help finance a specific local public good. As such, another way of thinking about this particular shortcoming is that many impact fee programs take a narrow view of how development affects the community.

6. Impact fee programs are subject to political pressures that have nothing to do with long-run efficient development patterns. In considering the transition from the early impact fee programs of the 1980s to the more recent setting, Burge and Ihlanfeldt (2007) documented how most impact fee programs in Florida started small and expanded incrementally over time. They also showed that current impact fee levies still do not approach most estimates of the full external burden of growth. As such, they argued that impact fees are driven as much by politics and legal uncertainty as by the underlying external costs of development. In addition, empirical results have verified that impact fee adoptions are influenced by the policy implementation decisions of neighboring localities (Jeong, 2006). In perhaps the best example that politics can drive impact fee outcomes, we note that, in response to the recent prolonged recession, many communities have reduced or even rescinded their impact fee levies (Duncan Associates, 2010). These *rollbacks* have been particularly common in California and Florida, where programs are widespread and high profile. Although predictable, this response is not grounded in sound reasoning. No reason

exists to believe that the business cycle controls the magnitude of development-related externalities. In addition, rollbacks compromise equity. Otherwise similar developments are treated differently based only on whether they occurred before, during, or after the rollback.

Conclusions

Development impact fees have rapidly grown in popularity during the past two decades. With few exceptions, implemented programs have been used to cover the costs of providing public infrastructure needed for new development. In so doing, they address the fiscal externalities of growth. The effect of growth, however, goes well beyond budgetary considerations. In particular, development can result in environmental externalities borne by current and future residents. By our definition, these projects represent unsustainable development. Economic theory demonstrates that, under many conditions, the optimal policy response to negative externalities is to impose a tax directly on the offensive activity. In this article, we have argued that development impact fees can be tailored to accomplish this goal in most instances.

The legal distinction between taxes and fees must be kept in mind, however. Impact fee programs most frequently finance capital expansions necessitated by new development and must satisfy the rational nexus test. This test requires that a clear connection exists between new growth and the required spending, that fees are proportional to the costs of providing the enhanced services, and that the payer of the fee benefits directly from the spending. If programs are to be expanded to internalize other types of externalities associated with new development, the rational nexus test may become more difficult to satisfy. Hence, one drawback of the approach we have advocated is the significant attention to design that would need to accompany any program that stood a chance of satisfying the rational nexus test. An alternative approach would be for courts to revisit the rational nexus test in efforts to create a revised version with lower standards, recognizing that the environmental impact of new construction has a larger and potentially less well-defined footprint than its fiscal impact. For example, negative externalities such as smog and traffic congestion operate at the regional level rather than at the jurisdictional level.

A final challenge is that successfully balancing goals related to both equity- and efficiency-based concerns requires more precise measurement of the various negative externalities associated with new construction, which is more easily said than done. Our recommendation for future research, therefore, is careful quantification of the effects, both positive and negative, that specific types of development projects have on both current and future generations.

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Partisanship and Local Climate Policy

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Abstract

This article examines the relationship between partisanship and cities' approaches to climate policy. Do partisan patterns at the local level match patterns at the national level? Whose partisanship matters: that of elected officials, citizens, or other actors? Previous research indicates that constraints created by the federal system dampen the effects of partisanship on many local policies. Given the absence of strong federal policy direction in the environmental policy arena, this article's hypothesis is that these dampening effects will be minimal and clear partisan differences are expected to emerge at the local level. Employing data from a recent survey of local government officials, the analysis provides evidence that the specific constituencies targeted by a given policy affect whose partisanship matters. These effects remain robust after accounting for the broader partisan environment. These findings have important implications for our growing understanding of the determinants of local climate policy and the influence of partisanship in local politics.

Introduction

Climate scientists have reached virtual consensus that human activity has fundamentally changed the earth's climate and that human action is needed to slow, reverse, and adapt to those changes (for example, NRC, 2011); yet the politics of climate change in the United States remain far from consensual. Sharp partisan cleavages persist in the national debate about climate policy (Shipan and Lowery, 2001), with Democrats advocating proactive approaches to reduce greenhouse gases and mandate the use of renewable energy, and Republicans pushing for more limited approaches or challenging the scientific evidence. Recently, we have seen Democrats and Republicans in Congress squaring off over such issues as regulating greenhouse gas emissions, strengthening automotive emissions standards, and limiting the Environmental Protection Agency's authority (Pew Center on Global Climate Change, 2011).

This article considers the contours of climate politics and policy at the local level. In the absence of strong and effective federal policy leadership, cities and other local governments find themselves on the front lines of public climate policy efforts.[1] Lutsey and Sperling (2008) find dozens of states and hundreds of cities participating in voluntary efforts aimed at mitigating climate change. They estimate that full implementation of these combined efforts "could stabilize U.S. [greenhouse gas] emissions at 2010 levels by the year 2020" (Lutsey and Sperling, 2008: 673). Diverse organizations such as California's Institute for Local Government,[2] the U.S. Department of Transportation,[3] and ICLEI—Local Governments for Sustainability[4] sponsor programs at the state, national, and international levels, respectively, to provide local governments with resources to institute effective local climate-change programs.

Despite city governments' important role in creating and implementing U.S. climate policy, we know little about the ways that cities decide whether and how to deal with climate change and what political factors shape their policies. Most local climate policies are strictly voluntary—local governments are free to adopt them or not—and many can be characterized as public goods: they impose direct, concentrated costs on the producing jurisdiction and provide diffuse benefits to people in other jurisdictions. These two features mean that local decisionmakers must overcome significant barriers when they choose to adopt climate policies. Recent research has focused on a variety of determinants, including population characteristics, institutional features, and governance arrangements (see Portney and Berry, 2010, for an excellent summary of recent research that investigates the determinants of the related but arguably broader concept of sustainability).

This article examines the relationship between partisanship and cities' approaches to climate policy. Do partisan patterns at the local level match patterns at the national level? In other words, do Democratic cities pursue proactive climate policies and Republican cities pursue indirect and weaker policies or none at all?

Understanding how partisanship shapes cities' approaches to climate policy is important for several reasons. First, it informs our general understanding of the determinants of local policy, adding to the growing body of literature that seeks to understand what national political processes also apply at the local level and what processes are unique to local politics. Second, it provides insight into the distinctive politics of climate policy, which will likely become more salient as the effects of climate change manifest. Third, it provides guidance for policy entrepreneurs and advocates to more effectively direct their energy and resources toward favorable opportunities for policy leadership, experimentation and change.

This article investigates the relationship between partisanship and local climate policy by combining recently collected survey data about local government participation in a variety of climate-change programs with information on partisanship at various geographic scales. The current

[1] A substantial body of scholarship considers states' roles in climate policy (for example, Rabe, 2004). For the purposes of this article, we consider city policies as distinct from those of their state governments.

[2] http://www.ca-ilg.org/.

[3] http://climate.dot.gov/state-local/index.html.

[4] http://www.iclei.org/our-activities/programs-initiatives.html.

article's focus is on climate-change policies intended to reduce carbon emissions and greenhouse gases and to increase reliance on renewable energy; future research will consider other aspects of climate-change policy as well.[5]

Partisanship and Local Policy Outcomes

Political science research has clearly demonstrated that partisanship is a key determinant of political behavior and policy outcomes at the national level. Among the mass public, partisanship hugely dominates voting decisions (Green, Palmquist, and Schickler, 2002), policy positions (Carmines and Stimson, 1989), core values (Goren, 2005), and political evaluations (Popkin, 1991). Among political elites, party organizations are key sources of information and resources (Aldrich, 1995), and party effects are strong and consistent determinants of roll-call voting (Snyder and Groseclose, 2000). Many of the congressional roll call votes on major legislation in recent years, including the stimulus plan (Calmes, 2009), healthcare reform (Hitt and Adamy, 2010), and the debt ceiling (Pear, 2012), have split along party lines.

Given the dominance of partisanship in the national-level political process, it is natural to ask whether the same holds true at the local level. Does partisanship play a similar role in local-level political processes? Does it play a key role in structuring the political behavior of the mass citizenry and political elites? After all, many of the same people vote in national and local elections, and the same party organizations and labels provide resources and cues to candidates and voters.

Despite these similarities, several factors prompt skepticism of partisanship's role in local political processes. Many local elections are officially nonpartisan (that is, party labels are not listed on the ballots), although even in those elections, partisan cues are often available (Gerber and Hopkins, 2011). Voters in local elections may consider numerous other factors besides partisanship, such as incumbency or nonpolicy attributes (Shaffner, Streb, and Wright, 2001). Local government decision-makers may be more constrained than national decisionmakers in their ability to institute partisan policies because of market (Ferreira and Gyourko, 2009; Tiebout, 1956) and political (Gerber and Hopkins, 2011) factors. Finally, policies pursued by local governments may not align with the same partisan cleavages as most national issues, and different cleavages may exist and be more important.

Partisanship and Environmental Policy Preferences

As interest in climate policy has increased in recent years, numerous scholars have begun to study the contours of public opinion toward climate and the environment. Precious few studies focus on partisanship and other political factors explicitly, however. Those studies that do include measures of individual partisanship in their surveys and models indicate clear partisan differences in attitudes

[5] One area of growing local involvement is in efforts to adapt to the consequences of climate change. Adaptation policies include, for example, emergency preparedness planning, increasing drainage and sewage capacity, strengthening coastal and waterfront infrastructure, changing landscaping practices, public education efforts, and so on. These policies are in contrast to most current efforts, including those that are the focus of this article, which focus on mitigating the causes of climate change rather than adapting to its consequences.

toward the environment in general (for example, Egan and Mullin, 2012; Krosnick and MacInnis, 2011) and in preferences toward climate policies at the national and local levels in particular (Curry, Ansolabehere, and Herzog, 2007; Leiserowitz et al., 2011). These differences are often striking: for example, in a national survey, only half as many Republicans strongly supported local regulations requiring residential energy efficiency as Democrats (17 to 35 percent); 70 percent of Democrats and only 48 percent of Republicans felt it was extremely or very important for their communities to protect local water supplies from the effects of global warming (Leiserowitz et al., 2011).

Hypotheses

These results clearly indicate that strong partisan differences in environmental and climate policy preferences exist among the general public. We might therefore expect to see clear partisan differences in the climate policies pursued at the local level, with Democratic cities more likely to adopt proactive climate policies and Republican cities less likely to adopt such policies. These differences, however, may not be so simple. As discussed previously, city actors may be constrained in their ability to pursue policies that coincide with their partisan policy preferences. In addition, citizen and elite partisanship may differ. A citizenry dominated by one party may elect a city council with a different partisan majority, or they may elect a mayor with a different partisan affiliation.[6] When this disconnect occurs, it is not clear whose partisanship will have a greater effect.

This analysis focuses on who is the primary target of a particular climate policy. Some climate policies provide direct benefits to residents—for example, recycling programs, refunds or rebates for purchases of certain environmentally friendly products, and programs that publically recognize individual efforts. Others are more focused on the internal operations of government. These operations include planning initiatives, green municipal purchasing programs, environmentally friendly workplace practices, and so on. These internally focused programs clearly provide benefits to residents and others who care about the environment; however, their primary targets, in terms of influencing behavior, are the governments (and government employees) themselves. In the former case, where programs directly target residents, we expect the partisanship and policy preferences of residents and citizens to be the more important determinants of a city's policy choices. In the latter case, where programs target government practices, we expect government officials' partisanship and policy preferences to be the more important determinants.[7] These expectations are captured in the following hypotheses.

- **H_1.** For policies that provide direct benefits, programs, or services to residents and local businesses, citizen partisanship will affect whether a city adopts the policy. Cities with a higher percentage of Democratic residents will be more likely to adopt, and cities with a lower percentage of Democratic residents will be less likely to adopt, such policies.

[6] In the Michigan data that I analyze in this article, this partisan mismatch occurs in 38 percent of the 1,000 cities and townships in the sample.

[7] Daley, Sharp, and Bae (2012) and Feiock and Bae (2011) similarly distinguish between internal and external policies and between inhouse and community-focused policies.

- **H_2.** For policies that provide indirect benefits, programs, or services to residents, elected officials' partisanship will affect whether a city adopts the policy. Cities with Democratic elected officials will be more likely to pursue, and cities with Republican elected officials will be less likely to pursue, such policies.

- **H_0.** No differences will exist in the policies pursued by cities with Democratic and Republican elected officials and with Democratic and Republican citizens.

In addition, partisan actors outside a jurisdiction's boundaries may influence a city's climate policies. These actors may include, for example, citizens or elites in neighboring jurisdictions, or party officials at the county or state levels. Outside partisan actors could affect local policy choices in several ways. Partisan actors outside a local government's boundaries may directly affect policy choices by providing resources, information, or policy leadership to local government officials. For example, like-minded county government officials may directly assist local governments in adopting programs or joining ongoing county efforts. In other words, they may encourage cooperation between jurisdictions in working toward common environmental and climate-related goals. Partisan actors outside a local government's boundaries may also indirectly affect local policy choices. For example, county government officials may initiate climate policies at the county level, effectively satisfying some of the local need and demand for climate policies and allowing for local government officials to devote resources to other activities. In effect, outside actors may enable or encourage free riding off existing climate policies in other jurisdictions. The regional partisan political environment may also predispose residents in a given jurisdiction to be more or less receptive to climate policies within their city or township, or they may provide political cover for policymakers to pursue policies that are unpopular with their own constituents.

As these examples suggest, outside partisan actors may affect a jurisdiction's decisions about adopting either internal or external policies, and their effects may be in either the same or the opposite direction of internal party actors. This expectation implies the following alternative hypotheses.

- **H_{3a}.** Partisan actors in surrounding communities will reinforce the effects of local partisanship on internal and external policies. That is, the likelihood of adopting local climate policies will be greater for Democratic cities with Democratic neighbors than for Democratic cities with Republic neighbors. The likelihood of adopting local climate policies will be less for Republican cities with Republican neighbors than for Republican cities with Democratic neighbors.

- **H_{3b}.** Partisan actors in surrounding communities will offset the effects of local partisanship on internal and external policies. That is, the likelihood of adopting local climate policies will be less for Democratic cities with Democratic neighbors than for Democratic cities with Republic neighbors. The likelihood of adopting local climate policies will be greater for Republican cities with Republican neighbors than for Republican cities with Democratic neighbors.

- **H_0.** No differences will exist in the policies pursued by cities with Democratic and Republican elected officials and with Democratic and Republican citizens.

Data

Testing these hypotheses requires data about the climate policies being pursued by cities and other local governments and about the partisanship of citizens, elected officials, and neighboring jurisdictions. This article uses a unique dataset that contains these elements.

The core of the dataset is a recent survey of Michigan local government officials: The Michigan Public Policy Survey (MPPS).[8] MPPS is a semiannual survey of local government officials from each of the 1,859 general-purpose local governments in Michigan, including cities, villages, townships, and counties.[9] E-mail invitations are sent to the top appointed official and the top elected official in each jurisdiction; both groups of officials are invited to complete the approximately 30-minute survey on line or to request a hard copy. The Fall 2010 MPPS (CLOSUP, 2010) contained a number of questions about local climate change-mitigation policies and about the respondent's partisan identification and personal beliefs about a number of climate-related issues. Of the 1,859 local governments included in the sampling frame, 1,459 completed surveys were received from 1,189 unique jurisdictions. Because one of the key hypotheses concerns the effect of elected officials' partisanship, the sample is limited to the 1,000 responses from city or township elected officials.[10, 11]

The Fall 2010 MPPS asked the following battery of questions about local climate-change policies in the respondent's jurisdiction.

> Q25. Some local governments are adopting policies and practices to meet their jurisdictions' energy demands while reducing the costs and environmental impacts of energy use. In your opinion, in the next 12 months, how likely or unlikely is it that your jurisdiction will adopt the following types of policies and practices?
>
> - Improving energy efficiency in your government facilities (such as lighting, insulation, or HVAC upgrades, anti-idling policies for municipal fleets, and so on).
> - Changing your jurisdiction's work practices (such as water conservation, thermostat regulation, and so on).

[8] The University of Michigan's Center for Local, State, and Urban Policy and a number of other sponsors conduct the MPPS (http://www.closup.umich.edu/mpps.php). Any opinions, findings, and conclusions or recommendations expressed in this article are those of the author and do not necessarily reflect the views of the funding organizations.

[9] Cities, villages, and townships are all considered incorporated places in Michigan.

[10] The analysis is also limited to cities and townships, excluding responses from village and county officials. In Michigan, village boundaries overlap township boundaries, and so vote returns, the basis of our key citizen partisanship variable, are not reported at the village level. Counties are excluded because they have less fiscal autonomy from the state than do other local governments and the county-level respondents who completed our survey were all appointed officials.

[11] The subset of 1,000 cities and townships from which we have responses from elected officials differs from the full sample of Michigan cities and townships in several ways. The average total population in the subsample is 5,922; in the full sample, the average total population is 6,897. In the subsample, cities are underrepresented (8 versus 18 percent in the full sample) and townships are overrepresented (93 versus 82 percent in the full sample). On other observable characteristics, such as racial and ethnic composition, median household income, educational attainment, and partisan composition, the sample and subsample are indistinguishable. Notably, the mean Democratic vote percentage in 2008 was 48.7 percent for all cities and townships and 48.8 percent for the MPPS subsample.

- Programs targeted at residents (such as recycling programs, promoting home weatherization, and so on).
- Programs targeted at local businesses (such as rebates to businesses that cut consumption, commercial recycling, formal recognition of green practices, and so on).
- Developing or purchasing alternative energy sources (such as employing solar panels or wind turbines). (CLOSUP, 2010: 4).

The response options were Already Adopted, Very Likely to Adopt, Somewhat Likely, Neither Likely Nor Unlikely, Somewhat Unlikely, Very Unlikely to Adopt, and Don't Know. Exhibit 1 reports the raw responses to this question.

It is interesting to note several patterns in the raw data. First, some of these programs are much more popular than others. More than 20 percent of respondents report that their cities or townships have already adopted the first three policies (energy efficiency in public facilities, municipal workplace practices, and programs targeting residents), and one-fourth report being very or somewhat likely to adopt them in the near future. By contrast, only a very few respondents have programs targeting businesses and alternative energy purchasing programs in their jurisdictions. Second, a wide range of responses exists regarding the likelihood of adopting each of the policies in the future. This wide variation suggests a high degree of heterogeneity across jurisdictions in terms of their preferences for various climate policies. Our empirical analyses test whether some of this variation can be attributed to the jurisdiction's partisan context.

To test hypotheses H_1 and H_2, policies are clustered according to their primary direct beneficiaries. The first, second, and fifth options all represent policies that are aimed at internal governmental and organizational behaviors; these policies are clustered into one group of *internal* policies. The third and fourth options represent policies that provide benefits or services directly to local residents and businesses; these policies are clustered into a second group of *external* policies. The hypotheses are that residents' partisanship will affect the probability of a city adopting external policies and that elected officials' partisanship will affect the probability of a city adopting internal policies.

In addition to these two sets of policies, the dataset is supplemented with information about each city's participation in two national programs: The United States Conference of Mayors' Climate Protection Agreement and the Sierra Club's Cool Cities Program. Both programs ask signatories to

Exhibit 1

Local Climate Policies, Michigan Cities and Townships (percent)

	Energy Efficiency in Facilities	Changing Workplace Practices	Programs Targeting Residents	Programs Targeting Businesses	Purchasing Alternative Energy
Already Adopted	20.9	20.8	22.9	2.4	3.7
Very Likely to Adopt	9.3	8.1	7.1	4.8	3.6
Somewhat Likely	19.2	14.3	17.4	11.4	11.9
Neither Likely Nor Unlikely	11.7	17.7	15.0	20.9	20.7
Somewhat Unlikely	6.9	7.8	6.7	12.8	15.1
Very Unlikely to Adopt	15.6	14.8	14.3	25.9	24.9
Don't Know	16.4	16.5	16.6	21.8	20.1
N	1,000	1,000	1,000	1,000	1,000

Source: CLOSUP (2010)

take concrete steps to reduce carbon emissions and implement clean energy solutions; both have more than 1,000 participating cities and other local governments. In Michigan, 31 local governments are currently participants in the Climate Protection Agreement and 28 are participants in the Cool Cities Program. These programs share many similarities with the internal policies included in the MPPS survey; that is, they involve activities such as implementing green planning processes and adopting smart energy solutions at the municipal level. As such, the hypothesis is that elected officials' partisanship will affect the probability of a city's participating in these programs.

Results

Exhibit 2 reports the results of a preliminary analysis of the relationship between local partisanship and local climate policies. Each column reports the results of a separate regression-type estimation. The dependent variable in each case is a binary variable coded 1 if the city or township has at least one of the policies (for external and internal policies) or is a participant in the program (for the Climate Protection Agreement and the Cool Cities Program) and coded 0 otherwise. Given the binary dependent variables, logistic regression is employed.[12]

The key independent variables in each logit analysis are three measures of local partisanship: the percentage of voters from that jurisdiction who voted for Barack Obama in the 2008 Presidential election (Dem percent),[13] the respondent's party identification (PID),[14] and a dummy variable indicating whether the jurisdiction's partisan majority and the respondent's party identification are the same (Party match).[15] Dem percent measures citizens' partisanship, whereas PID measures elected officials' partisanship. Party match captures situations where these two measures of partisanship are consistent. The remaining independent variables are intended as controls; they include a dummy variable indicating whether the local government is a city (City), the natural log of median household income (lnIncome), the percentage of adults with a bachelor degree (Bachelor percent), the percentage of the population older than 65 years (Over 65 percent), and the natural log of total population (lnPop). Data on jurisdiction type come from the Michigan Secretary of State (2008); income, education, age, and population data are all from the U.S. Census Bureau's 2005–2009 American Community Survey 5-year Estimates.[16]

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[12] I ran additional analyses in which the dependent variable is the number of external and internal policies (rather than a simple binary variable) and the empirical model is a Poisson regression. In both cases, the main partisanship results are essentially the same, although more than 100 cases are lost in the additional analyses because of missing data.

[13] Several minor-party candidates were on the ballot (Michigan Secretary of State, 2008).

[14] Data for this variable come from the Fall 2010 MPPS. PID is measured on a standard 7-point scale with 7 = Strong Democrat.

[15] Party match is scored 1 if Dem percent > 0.55 and PID = 6 or 7. Party match is also scored 1 if Dem percent < 0.45 and PID = 1 or 2. It is scored 0 otherwise. Additional analyses (available from the author) find that the results reported in exhibit 2 are robust to small changes in the cutoff values for this variable.

[16] The Fall 2010 MPPS also included questions measuring the respondent's attitudes on a number of climate-related issues, such as whether promoting sustainability is an important element of local leadership; the severity of global warming as a public-policy problem; and the responsibilities of local, state, and federal governments in reducing global warming. In supplemental analyses, responses to these questions were included as additional regressors in the logit analyses. None were statistically significant, and given the potential that these attitudes and the respondent's partisanship are jointly determined they are excluded from the final model specifications.

Exhibit 2

Partisanship and Local Climate Policy, Michigan Cities and Townships (logistic regression coefficients)

	External	Internal	Climate Protection Agreement	Cool Cities Program
Dem percent	2.83**	– 0.33	– 6.25	– 10.76**
	(1.22)	(1.12)	(4.48)	(5.29)
PID	0.035	0.093**	0.94**	1.045**
	(0.050)	(0.046)	(0.33)	(0.40)
Party match	0.42**	0.37**	– 1.50	– 3.53**
	(0.19)	(0.18)	(1.19)	(1.68)
City	0.71**	0.48	3.25**	3.85**
	(0.32)	(0.31)	(1.16)	(1.51)
lnIncome	1.54**	0.24	1.28	– 0.92
	(0.56)	(0.51)	(2.25)	(2.74)
Bachelor percent	0.59	4.72**	5.95	16.61
	(2.24)	(2.072)	(8.91)	(10.87)
Over 65 percent	8.32***	– 1.38	– 1.52	– 22.12
	(2.34)	(2.23)	(12.14)	(16.83)
lnPop	0.26**	0.24**	2.14***	1.93***
	(0.10)	(0.091)	(0.53)	(0.56)
Constant	– 24.57***	– 5.99	– 40.30**	– 11.76
	(6.028)	(5.40)	(0.55)	(30.50)
R^2	0.12	0.08	0.60	0.59
N	754	754	754	754

***p < 0.05. ***p < 0.01.*

Source: CLOSUP (2010)

The first column of exhibit 2 reports the results of a logistic regression in which the dependent variable is whether or not the jurisdiction has adopted any of the external policies included in the MPPS. As hypothesized, Dem percent is positive and significant; jurisdictions that have a more Democratic citizenry are more likely to adopt climate policies targeted at residents or local businesses compared with jurisdictions that have a more Republican citizenry. Party match is positive and significant as well, indicating that when citizens' partisanship and elected officials' partisanship align, the probability of adopting external policies is even greater. The independent effect of elected officials' party identification (PID) is insignificant, as hypothesized. In addition, several of the controls are significant, including City, lnIncome, and Over 65 percent.

The second column of exhibit 2 reports the results of a logistic regression in which the dependent variable is whether or not the jurisdiction has any of the MPPS's internal policies in place. Here we see the opposite pattern in the partisanship variables: the elected official's party identification is positive and significant (jurisdictions whose elected officials identify as stronger Democrats are more likely to have internal climate policies) and the citizenry's partisanship is insignificant. When citizens and elected officials share the same partisanship (that is, Party match = 1), the probability of adopting internal policies is greater. Larger jurisdictions and cities or townships with a more educated citizenry are more likely to adopt internal climate policies as well.

The third and fourth columns of exhibit 2 report two more logistic regressions, with participation in the Climate Protection Agreement and the Cool Cities Program as the binary dependent variables, respectively. As with the internal policies, PID is positive and significant, with Democratic elected officials more likely to participate in these programs. Unlike with the internal policies, however, Dem percent is negative and, in the case of the Climate Protection Agreement, significant: cities with higher percentages of Democratic voters are less likely to participate in these programs. Party match also plays a different role here: it is negative in both regressions (and significant in the Cool Cities Program model), indicating that when citizens' and local officials' partisanship diverges, participation in both of these programs is more likely. Cities (as compared with townships) and larger jurisdictions (as compared with smaller ones) are more likely to participate.

The partisan effects reported in exhibit 2 suggest the effects of citizens' partisanship and elected officials' partisanship have both separate and interactive effects on a jurisdiction's climate policies. Indeed, an interesting and important question is what occurs when elected leaders of a city or township have partisan affiliations that directly conflict with the affiliation of their constituents. Exhibit 3 further investigates these multiple partisanship effects by reporting the percentage of jurisdictions in the survey that have external and internal policies, depending on whether they have a strong Democratic electorate and a strong Democratic elected official (N = 78 in our survey subsample); a strong Republican electorate and a strong Republican elected official (N = 159); a strong Democratic electorate and a strong Republican elected official (N = 12); and strong Republican electorate and a strong Democratic elected official (N = 22).[17]

The left two columns of exhibit 3 report the percentage of jurisdictions that have adopted external policies. We see that when the electorate votes solidly Republican (in the top row), moving from a strong Republican elected official to a strong Democratic elected official barely changes the percentage of jurisdictions that adopt the policies (from 21 to 23 percent). By contrast, when the electorate votes solidly Democratic, moving from a strong Republican elected official to a strong Democratic elected official is associated with more than doubling the percentage of jurisdictions that adopt the external policies. In other words, the effect of variation in the elected official's partisanship is only great when the electorate is strongly Democratic.

Exhibit 3

Michigan Cities and Townships Adopting External and Internal Policies, by Citizens' and Elected Officials' Partisanship (percent of survey sample)

	External		Internal	
	PID = 1 or 2 (Republican)	PID = 6 or 7 (Democrat)	PID = 1 or 2 (Republican)	PID = 6 or 7 (Democrat)
Dem percent < 0.45	21	23	29	32
Dem percent > 0.55	22	56	37	56

Sources: CLOSUP (2010); Michigan Secretary of State (2008)

[17] Exhibit 3 reports these results only for external and internal policies, because the percentages of cities and townships participating in the Climate Protection Agreement and the Cool Cities Program are prohibitively small.

The right two columns of exhibit 3 report comparable percentages for internal policies. Here we see that jurisdictions with Democratic electorates are more likely to adopt internal policies than are jurisdictions with Republican electorates, regardless of the partisan identification of the elected official. This difference is substantially greater, however, when the elected official is a Democrat. Thus, the effect of variation in the electorate's partisanship matters most when the elected official is a strong Democrat.

Exhibit 4 investigates hypotheses H_{3a} and H_{3b}. It reports selected results from a series of logistic regressions that begin with the analyses reported in exhibit 2 and add several elements to account for the partisanship of actors in surrounding jurisdictions. The exhibit reports the significance level of various measures of partisanship (note that each set of results is from a multivariate logistic regression that also includes the controls reported in exhibit 2). The first panel of exhibit 4 exactly replicates the exhibit 2 analyses that include only Dem percent, PID, Party match, and controls. Model 2 includes a measure that captures whether the jurisdiction is part of a partisan cluster, or *hot spot*, specifically the jurisdiction's estimated Z-score for the Getis-Ord Gi* statistic for Dem percent (Dem hot spot).[18] As exhibit 5 illustrates, Dem percent shows a high degree of clustering, with

Exhibit 4

Partisanship, Context, and Local Climate Policies (significance of logistic regression coefficients on partisanship variables)

	External	Internal
Model 1		
Dem percent	+**	–
PID	+	+**
Party match	+**	+**
Model 2 (with Dem hot spot)		
Dem percent	+	–*
PID	+	+*
Party match	+**	+**
Dem hot spot	+**	+**
Model 3 (with Dem percent N)		
Dem percent	+**	–
PID	+	+**
Party match	+**	+**
Dem percent N	–*	+
Model 4 (with Dem percent Co)		
Dem percent	+	–
PID	+	+*
Party match	+**	+**
Dem percent Co	–	+

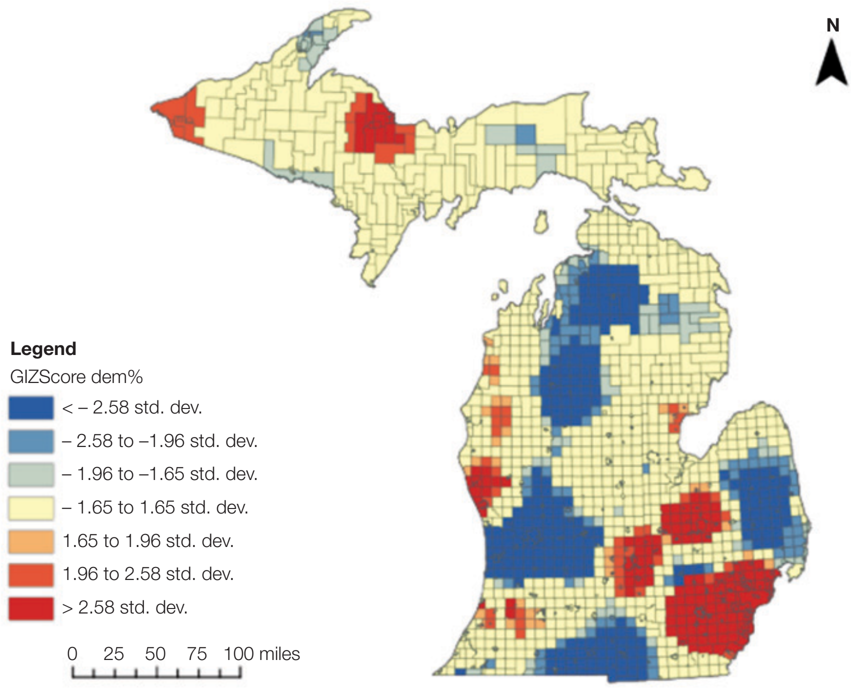
*$p < 0.10$. **$p < 0.05$.

Sources: CLOSUP (2010); Michigan Secretary of State (2008); U.S. Census Bureau (2009)

[18] Gi* uses GIS to compute the average value for one spatial unit (jurisdiction) and its immediate neighbors on the variable of interest (in this case, Dem percent), and compares that local average with the global average. If the cluster's average value is statistically different from the global average, the unit is considered to be part of a hot spot (for high values) or a cold spot (for low values). See Ord and Getis (1995).

Exhibit 5

Democratic Share of the Two-Party Vote for President, 2008 (Getis-Ord Gi*)



std. dev. = standard deviations.

Notes: Jurisdictions indicated in red have values of Gi significantly greater (Z > 1.96) than the state average. Jurisdictions indicated in blue have values of Gi* significantly less (Z < –1.96) than the state average.*

Democratic hot spots and cold spots throughout the state. Model 3 adds a measure of partisanship in the jurisdiction's immediate neighbors (Dem percent N).[19] Finally, model 4 adds a measure of county partisanship, which is the countywide percentage of the 2008 Presidential vote that went to Obama (Dem percent Co).

The results in exhibit 4 indicate that the partisanship effects observed in exhibit 2 are quite robust. The effect of the electorate's partisanship remains positive in all the external policy model specifications (although its significance is less than $p < 0.10$ in two cases). The effect of elected officials' party identification remains positive and significant in all the specifications for internal policies. The effect of Party match remains of the same sign and significance level as in the baseline models. In other words, even after we account for the effect of local partisan environment, partisan clustering, and county partisanship, the elected officials' party identification remains a strong and significant determinant of whether a city chooses to adopt internal climate policies. The electorate's

[19] This measure is constructed by creating a spatial weights matrix in ArcGIS 9.3 to identify each jurisdiction's immediate neighbors (sharing edges and corners), and then taking the mean of Dem percent for those neighbors.

partisanship remains a positive determinant of whether a city chooses to adopt external climate policies, although the precision with which these effects are estimated drops. The reinforcing effects of consistent partisanship on external and internal policies remain as well.

The exhibit 4 results also indicate that the broader partisan context has a direct effect on adoption of climate policies, above and beyond a jurisdiction's internal partisan dynamics. Inclusion in a partisan cluster (as indicated by the Dem hot spot variable in model 2) has a strong, positive, and significant effect on the probability that a jurisdiction adopts external and internal policies. In other words, cities that are part of a Democratic partisan cluster are significantly more likely to adopt local climate policies (and cities that are part of a Democratic cold spot are significantly less likely to adopt local climate policies) than one would expect considering only the partisanship of citizens and elected officials within their jurisdictional boundaries. In fact, the results in model 2 indicate that the effects of the broader partisan context may be more important than the partisan pressures that come from within the jurisdiction; the effects of Dem percent and PID become weaker and less significant when Dem hot spot is included in the model.

By contrast, the effects of Dem percent N and Dem percent Co are much less evident. In model 3, Dem percent N has a weakly negative effect on external policies, suggesting a slight offsetting effect, whereas it has a weakly positive (reinforcing) effect on internal policies. Similarly, Dem percent Co has a weakly negative effect on external policies and a weakly positive effect on internal policies, although in this case, neither effect is statistically significant. A possible explanation for the difference between the various partisan context factors is that the regional partisan cluster, captured by the Dem hot spot analysis, is, in fact, the spatial scale at which external partisan pressures have the greatest effect on the internal policy dynamics of a local government.[20] Future analyses will further explore the notion of how the effects of partisan context vary with spatial scale.

So far, the analysis has been limited to understanding the factors that lead cities and townships to adopt various local climate policies or to participate in two national climate action programs. The data collected in the MPPS are much richer, however; they also contain information about respondents' perceptions of their jurisdictions' intent to adopt additional policies. The final analyses consider these responses in more detail. Exhibit 6 reports the correlations between intentions to adopt each of the five MPPS policies. This analysis is limited to jurisdictions that have not already adopted each of the policies. We see that, although all the correlations are greater than 0.5, the correlations that are between the most similar policies (for example, facilities and workplace practices, residential programs and business programs, and business programs and alternative energy) reveal the largest correlations (0.73, 0.71, and 0.74, respectively). In other words, in the minds of the MPPS respondents, cities and townships with the greatest intention to adopt one of these policies also have the greatest intention to adopt the other most similar policies.

Exhibit 7 reports a series of ordinary least squares (OLS) regressions that are designed to identify the factors that are related to a jurisdiction's intention to adopt a particular local climate policy,

[20] Another possibility is that the Getis-Ord routine in ArcGIS creates a less noisy measure of spatial context than the spatial weights matrix approach. The Gi* tool effectively imputes values for missing units and jurisdictions, whereas the spatial weights matrix approach treats missing values as missing. As such, the Dem hot spot measure of spatial context may have artificially low levels of measurement error.

Exhibit 6

Correlations Between Reported Likelihood of Adopting Local Climate Policies (correlations)

	Facilities	Workplace Practices	Residential Programs	Business Programs	Alternative Energy
Facilities	1.00				
Workplace practices	0.73	1.00			
Residential programs	0.51	0.58	1.00		
Business programs	0.56	0.58	0.71	1.00	
Alternative energy	0.55	0.56	0.58	0.74	1.00

Source: CLOSUP (2010)

Exhibit 7

Determinants of Intentions To Adopt Local Climate Policies, Michigan Cities and Townships (ordinary least squares regression coefficients)

	Facilities	Workplace Practices	Residential Programs	Business Programs	Alternative Energy
Dem percent	– 0.26	– 0.45	– 0.087	– 1.22	– 0.80
	(1.00)	(0.93)	(1.046)	(0.81)	(0.76)
PID	0.030	0.044	0.062*	0.082***	0.052**
	(0.032)	(0.029)	(0.031)	(0.027)	(0.026)
Party match	0.036	– 0.040	– 0.19	– 0.012	0.052
	(0.13)	(0.12)	(0.13)	(0.10)	(0.10)
Z(Gi*)	– 0.014	– 0.010	– 0.021	– 0.024	– 0.026
	(0.022)	(0.021)	(0.024)	(0.018)	(0.018)
City	0.75***	0.30	0.65**	0.58**	0.025
	(0.26)	(0.24)	(0.27)	(0.21)	(0.20)
lnIncome	– 0.74*	– 1.11***	– 0.46	– 0.70**	– 0.46
	(0.39)	(0.36)	(0.40)	(0.31)	(0.31)
Bachelor percent	3.44**	2.81**	1.42	1.66	0.23
	(1.44)	(1.37)	(1.45)	(1.19)	(1.20)
Over 65 percent	2.27	0.84	0.15	0.041	2.00
	(1.52)	(1.43)	(1.59)	(1.29)	(1.22)
lnPop	0.33***	0.41***	0.29***	0.30***	0.33***
	(0.069)	(0.064)	(0.069)	(0.054)	(0.053)
Num programs	0.40***	0.33***	0.11	0.20***	0.12**
	(0.098)	(0.10)	(0.093)	(0.049)	(0.047)
Constant	7.57*	11.23***	5.29	7.48**	4.57
	(4.29)	(3.90)	(4.36)	(3.41)	(3.42)
R^2	0.14	0.14	0.08	0.12	0.07
N	518	527	496	635	644

Z(Gi) = estimated Z-score for the Getis-Ord Gi* statistic.*

$*p < 0.10$. $**p < 0.05$. $***p < 0.01$.

Sources: CLOSUP (2010); Michigan Secretary of State (2008); U.S. Census Bureau (2009) and specifically whether these factors are the same as those factors related to a jurisdiction ultimately adopting those policies. Each column reports the results of a separate OLS regression in which the dependent variable is a jurisdiction's perceived likelihood of adopting a given policy, scored from 1 (very unlikely) to 5 (very likely). These analyses, like the analyses in exhibit 6, are limited to jurisdictions that have not already adopted a given policy.

We see from exhibit 7 that, in fact, the factors that explain intentions are quite different than the factors that explain ultimate policy adoptions. The partisanship variables that were significant and robust in the previous analyses are nearly always insignificant. The two structural variables (city and population) are positive and typically significant, suggesting that cities and large jurisdictions report a greater likelihood of adopting each of the policies than townships and smaller jurisdictions. Cities and townships with more educated and older populations also report a greater likelihood of adoption, whereas cities and townships with higher median household incomes are less likely to adopt local climate policies. Finally, the number of existing programs is a strong and positive indicator of whether a jurisdiction is likely to pursue additional policies. Together, these results suggest that jurisdictions do not view local climate policies in isolation, but rather pursue multiple policies that address similar needs and goals. Cities, larger jurisdictions, those local governments with more educated and older citizens, and those cities and townships with fewer resources are all more likely to pursue local climate policies, although whether they are actually adopted has more to do with the local partisan political climate.

Implications

To summarize, analysis of the Fall 2010 MPPS data suggests that partisanship affects local climate policy in ways that are consistent with this article's characterization of a given policy's direct targets or beneficiaries: when a policy targets residents or businesses, the partisanship of the jurisdiction's electorate significantly influences the probability of that jurisdiction adopting such a policy. When a policy seeks to influence the behavior of government employees or decisionmakers, it is the partisanship of the jurisdiction's elected officials that matters. Further, local policy decisions are made within a broader partisan political environment, and the effects of regional partisanship affect local climate policy decisions as well.

These findings have important implications for our understanding of the influence of partisanship on local policy processes and outcomes. Recent studies of the effect of partisanship at the local level tend to focus on fiscal policy outcomes and the effect of the mayor's partisanship on those outcomes. Given that most fiscal policies (1) result from a political interaction between the mayor and the city council (who might have different partisan affiliations); (2) are constrained by mandates, contracts, and ongoing obligations; and (3) provide direct benefits and services to residents and businesses (rather than target the behavior of government actors), it is not surprising that they find limited (Gerber and Hopkins, 2011) or null (Ferreira and Gyourko, 2009) results. This article focuses on policies that differ in all three respects: they often result from unilateral executive action; they are less constrained by other levels of government; and they vary in terms of whose behavior they target. By more directly linking characteristics of a policy with relevant measures of partisanship, this article provides evidence of the conditional effects of local partisanship.

These findings are also important for how we think about climate policy, specifically voluntary policies that aim to mitigate climate change by reducing carbon emissions and energy consumption. The analysis encourages us to consider the complex interplay between local partisanship and the broader partisan environment. Local forces clearly matter, especially on policies that involve targeting the behavior of municipal government employees and participation in the programs of national organizations such as the United States Conference of Mayors and the Sierra Club. These forces include partisanship and features of the local government such as population size and capacity (that is, whether they are full-service cities as opposed to townships). At the same time, evidence shows that partisan actors outside a jurisdiction may also influence a jurisdiction's climate policy decisions. These outside actors may be especially important in helping local government officials overcome the potentially formidable barriers inherent in voluntary climate change-mitigation policies, such as the policies included in the current analyses.

Future research will expand the set of climate policies to include policies focused on adaptation to the consequences of climate change. In contrast to the mitigation policies analyzed in this article, adaptation policies lend more naturally to intergovernmental collaborative approaches, because the effects they seek to combat—storms, droughts, flooding, rising or falling water levels, heat events—tend to occur at a regional scale. A preliminary hypothesis is that these features of adaptation policies will result in a more important role for actors outside a given jurisdiction and will demonstrate greater spatial interdependencies.

Finally, these results have implications for how policy advocates target their resources. Many of the policies studied here—especially internal mitigation policies and participation in national organizations' programs—appear to be driven less by local (or regional) citizen demand than by the personal decisions of local government officials, whose own partisanship and preferences may be at odds with the preferences of the citizens they represent. These officials, who are in most cases big-city mayors, play leadership roles as policy entrepreneurs, setting the local agenda and creating a green culture within the organizations of their city governments. These findings suggest that advocates may be well served to pursue a top-down strategy, targeting elected officials, rather than a bottom-up public education strategy. Future research will more closely consider the role of local elected officials as climate policy entrepreneurs.

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The Motivations Behind Municipal Climate Engagement: An Empirical Assessment of How Local Objectives Shape the Production of a Public Good

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Abstract

Cities engage in greenhouse gas mitigation efforts because of some combination of desires to achieve local co-benefits, respond to the preferences and pressures of influential political actors, and contribute to the public good by minimizing climate change. The relative importance of each motivation is hypothesized to affect the composition and comprehensiveness of subsequent climate initiatives. In some cities, initiatives appear to be ad hoc collections of tangentially related actions, whereas in others they are the result of a strategic planning process. This article uses survey-based data collected from U.S. cities that are explicitly involved in climate change-mitigation efforts and empirically examines two related questions: (1) What are the primary objectives and considerations that motivated these cities to engage in climate-change mitigation? (2) How do these considerations shape the relevant planning activities they undertake? Cities consistently point to cost savings as the primary rationale behind their initial decision to engage. When controlling for other relevant characteristics, however, a stronger direct concern about global climate change, as opposed to achieving financial savings or other co-benefits, is shown to be associated with the implementation of a more comprehensive climate-planning process.

Introduction

Voluntary local climate mitigation efforts have been viewed as a *paradox of collective action*. Since Mancur Olson's seminal 1965 work, the idea that, in the absence of coercion, independent entities will regularly fail to take actions that generate public benefits has retained a theoretically dominant position in studies of public policy and public choice (Olson, 1965). Although Ostrom (1990) famously identified conditions that facilitate the voluntary emergence of socially beneficial behaviors—that is, limited numbers of actors with repeated interactions and high levels of trust—these conditions do not readily characterize the problem of global climate change. Greenhouse gas (GHG) emissions disperse globally. Thus, regardless of the location or leadership of abatement efforts, those efforts yield nonexcludable global benefits in the form of climate-change mitigation. From the perspective offered by the theory of collective action, climate protection can be obtained only through national or international policy that compels subnational entities to comply with mitigation requirements. Along these lines, local governments are not expected to take initiative on climate protection, much less become some of its leaders, but they have done so in considerable numbers.

In an attempt to explain this phenomenon, researchers have pointed to the locally accruing *co-benefits* of climate protection—such as cost savings, improved local air quality, and decreased congestion—and have suggested that perhaps local climate involvement is not a collective-action paradox but is instead, at least partially, driven by the possibility of local gains. More specifically, Kousky and Schneider (2003) hypothesized four possible explanations for why free riding has not prevented cities' involvement in climate protection. First, municipalities may be altruistic and reduce GHG emissions to contribute to the public good even if is not "economically rational." Second, mitigation activities may not be perceived to entail additional costs. Third, those activities may lead to economic or tangible benefits that can be captured by the local community. Fourth, they may result in political gains for local leaders. Although Kousky and Schneider's study of 23 cities pointed to economic benefits as the single most important explanation for climate action, the relative importance of these motivations varies by location. Moreover, their relative importance likely influences the nature and comprehensiveness of the climate actions implemented. In some cities, climate initiatives are ad hoc collections of tangentially related actions, whereas in others they are the result of a strategic and comprehensive planning process.

This study examines local motivations in a more rigorous manner than has been done in the past. It collects original data from climate-committed cities and empirically addresses two related questions: (1) What motivated these cities to engage in climate-change mitigation? (2) How do those motivations shape the climate initiatives developed? This article tests the hypothesis that, even when controlling for relevant city characteristics such as local government capacity and demographics, a strong public goods motivation will to lead to more comprehensive climate planning.

Framing Local Climate Protection

A clear understanding of local climate protection and the activities that comprise it is needed before launching into an examination of its motivations. This understanding, in turn, requires a discussion of issue framing. The way an issue is framed, or most commonly characterized, guides the prevailing perception about whether it actually is a problem, what should be done to address it, and who has the responsibility for taking action (Rabe, 2004; Rochefort and Cobb, 1993). Because it involves a global public good, climate change is traditionally framed as a national or international issue requiring large-scale centralized responses (Brunner, 1991). At least partially because of stagnation in the traditional approach, however, the framing of climate change has shifted such that subnational governments are increasingly viewed as important climate actors. An emerging threefold framework characterizes the relationship between cities and climate change. In it, cities are seen as significant contributors to the problem of climate change, they are expected to suffer disproportionately from it, and—because of their authority over many urban land use, transportation, and energy decisions—they are considered strategically positioned to bring about reductions in GHG emissions (Bai, 2007; Bulkeley and Betsill, 2003; Kates and Wilbanks, 2003; Krause, 2011b; World Bank, 2010). Under this framework, the causes and consequences and the power to do something about both are squarely within the reach of local governments.

Wildavsky (1979: 42) observed an important psychological link between policy problems and solutions, noting, “a problem is only a problem if something can be done about it.” Lindseth (2004) further noted that public action is contingent on the political discourse presenting a problem in a manner that makes it solvable. These observations are applicable to climate-change reframing and the increasing localization of related policy. Although few observers would suggest that climate change can be “solved” by local action alone, proponents assert that municipal efforts can meaningfully contribute to overall mitigation. Proponents further suggest that climate protection initiatives also help mitigate other local challenges—which are almost inherently more “solvable” than climate change—making relevant action win-win (ICLEI, 2009; World Bank, 2010).

The presence of multiple motivations for pursing GHG-relevant action can make it difficult to determine whether particular local actions constitute climate protection, per se. Along these lines, Aall, Groven, and Lindseth (2007) discussed two understandings of local climate protection: explicit and implicit. Explicit climate protection is specifically aimed at reducing GHG emissions, whereas its implicit form has a broader scope and encompasses actions with related but distinct objectives, such as those included in energy, land use, and transport planning. The explicit-implicit distinction can be described simply as the differences between actions taken *to* reduce climate change versus those taken *that* reduce it. Intent is the fundamental difference. Whereas actions explicitly taken to reduce GHG emissions clearly constitute climate protection, the proper categorization of implicit actions that have a side effect of reducing emissions is less obvious. When intent is removed from the equation, it can be difficult to establish what counts as local climate protection. For example, consider a city government that has no stated climate protection agenda but that purchases hybrid vehicles for its fleet. This act will reduce net emissions, but should it be considered part of a local climate protection effort? Moreover, should all other actions that lack a climate label but reduce GHG emissions be treated similarly? The answers to these questions are important for studies trying to measure local climate protection.

The existing literature alternates between the implicit and explicit understandings of climate protection according to the nature of the question being asked. In his work characterizing the internal dynamics that lead to the emergence of state-level climate policy in the United States, Rabe (2004) described the different ways that states label climate-relevant policies to match the prevailing political sentiment. Regardless of their label, he treated all the GHG-reducing policies he reviewed as fundamentally climate policies. A series of papers by Krause (2011a, b, c), which examined the factors that influence local governments that implement many GHG-reducing actions, likewise did not require the term "climate protection" to be invoked for inclusion. Several other papers focused on cities' stated commitment to climate protection (Zahran et al., 2008) or on the planning activities undertaken by climate-committed cities (Aall, Groven, and Lindseth, 2007; Sharp, Daley, and Lynch, 2011; Wheeler, 2008). This article examines how cities' motivations to engage in climate mitigation influence the comprehensiveness of their related planning efforts. It therefore uses the explicit understanding of climate protection, and all cities in the analysis are *climate committed*.

Within the subset of climate-committed cities, the relative importance placed on achieving emission reductions compared with that of other co-benefits varies, such that each city may either (1) engage in policy reframing, whereby already existing activities are presented as part of a new climate initiative; (2) structure climate protection initiatives to maximize desired co-benefits; or (3) use co-benefits to help legitimize the development of a comprehensive climate protection regime. Although both climate protection and co-benefits appear in all three characterizations, the first two characterizations prioritize co-benefits and enable their pursuit to shape climate protection efforts. Climate protection is a secondary rationale for taking particular actions. The third characterization suggests that the objective of GHG reduction determines relevant actions, and co-benefits are treated as advantageous side effects.

Climate initiatives vary by city and range from ad hoc collections of related actions to the implementation of strategic and comprehensive plans. It is unclear whether, or the degree to which, holding climate protection as a primary as opposed to secondary motivation affects this structure. Existing views on this issue are mostly anecdotal or based on conjecture, and they are often contradictory. On the one hand, a co-benefits emphasis can tie climate protection to the goals of a variety of existing city departments, enabling policy integration and permanence. On the other hand, a co-benefits focus does not prioritize climate change and may relegate it to a place of secondary importance behind other interests and priorities (Bulkeley and Betsill, 2003; Lindseth, 2004). Skeptics of the *co-benefits-first* strategy have suggested that without being treated as an overarching objective, the emissions reductions that local climate protection initiatives can achieve are minimal (Lindseth, 2004). This article hypothesizes that motivations matter and that, when controlling for relevant external factors, they affect the composition and comprehensiveness of the subsequent climate initiatives.

Sample and Data

Although cities can engage in actions that reduce GHG emissions without ever referencing climate protection as an objective, this study focuses on those that have explicitly adopted climate protection as a goal. Specifically, it considers the 425 cities in the United States with populations greater than 50,000 that have indicated involvement in climate protection, typically through their signing of the United States Conference of Mayors' Climate Protection Agreement or their participation in ICLEI—Local Governments for Sustainability.[1]

[1] Per the 2005 U.S. census estimates, 665 U.S. cities have populations greater than 50,000. The 240 of these cities that have no climate policy are excluded from the sample.

Data about local climate planning actions and motivations were collected in September and October 2011. A survey was sent to the individual in each city responsible for climate, sustainability, or environmental initiatives, as identified through a web-based search or phone calls to city hall. The questionnaire was initially administered via the Internet, and hard copies were then mailed to nonrespondents. Usable surveys were returned from 255 cities in 42 states, a 60-percent response rate. Exhibit 1 shows that the responding cities mirror the larger sample on several important measures; none of the differences are statistically significant at $\alpha = .1$. Thus, the likelihood of self-selection-induced bias in the analysis is slight. Of the responding cities, 10 stated that, despite their nominal membership in a climate protection organization, they were never involved in *any* climate-protection or GHG-reduction efforts (emphasis included in survey question). The subsequent empirical analysis is conducted on the remaining 245 cities.

Exhibit 1

Characteristics of Responding and Nonresponding Cities

	Full Sample (N = 425)	Responding Cities (N = 255)	Nonresponding Cities (N = 170)
Mean population	202,508	213,853	185,590
Percent of cities by population			
50,000–100,000	53.4	50.6	57.3
100,001–200,000	26.6	26.3	26.9
200,001–500,000	12.9	16.5	7.6
> 500,000	7.1	6.7	8.2
Median household income ($)	54,225	54,673	53,558
Educational attainment (percent with bachelor degree)	31.4	32.0	30.4
Percent voting Democrat in 2008 presidential election	58.9	58.8	59.1

Cities' Motivations To Pursue Climate Protection

The factors that motivate local governments to voluntarily pursue climate protection have been addressed previously in the literature, primarily through the use of publically available city-level data and regression analysis to determine which characteristics lead to a greater likelihood of climate protection commitment (Krause, 2011a; Sharp, Daley, and Lynch, 2011; Zahran et al., 2008). Alternatively, several studies qualitatively examined the motivations of a few climate-committed cities. Although better able to examine the dynamic underlying adoption decisions, their findings are not generalizable (Betsill, 2001; Bulkeley and Betsill, 2003; Granberg and Elander, 2007). This article takes a third approach and, via survey data, examines the specific considerations that motivated many cities to engage in climate protection.

The questionnaire administered to local government officials as part of this research asks two related questions about the rationale behind their city's original decision to engage in climate protection. The first provides a list of 11 potential considerations (see the first column of exhibit 2) and asks respondents to characterize each as either extremely, somewhat, or not important factors in this decision. All the considerations listed, with the exception of "assisting in the global effort to minimize worldwide climate change," either yield or could be perceived as yielding some form of locally accruing co-benefits, whether tangible, economic, or political in nature. A followup question asks respondents to identify the single most important factor behind their decision to pursue climate protection. Exhibit 2 shows the relative frequency with which the 245 responding cities identified each motivation.

The responses in exhibit 2 appear to support the general idea that, for most cities, climate protection is the co-benefit rather than the primary objective of activities that fall under the local climate protection umbrella. Indeed, by a large margin, city governments point to the desire to reduce energy-related expenses as their primary motivation to engage in climate-related initiatives. A full 85 percent of responding cities describe it as an extremely important consideration and nearly 33 percent identify it as their single most important motivation. Accommodating the preferences and priorities of local government officials is the second most common reason that cities site for engaging in this issue. A variety of reasons might explain why an official places climate protection near the top of his or her personal agenda. Regardless of individual motivations, however, the fact that 43 percent of cities described their decisions to engage in climate protection as being extremely influenced by local officials adds support to the observed importance of policy and political entrepreneurs in subnational climate policy (Krause, 2011c; Rabe, 2004, 2007; Selin and VanDeveer, 2007).

Adherence to regulations or legislation passed by the state government emerges as the third single most important consideration motivating local climate action. Cities in California are driving this result, however, and they cause it to overstate the importance that state-level legislation has on

Exhibit 2

The Relative Importance of Select Motivations in Cities' Decisions To Pursue Climate Protection

Motivation	Percent of Cities That Identified Each as:			
	Single Most Important	Extremely Important	Somewhat Important	Not Important
Achieving energy and cost savings for the city government	31.3	85.2	14.4	0.4
The preferences and priorities of particular city official(s)	19.7	43.0	45.0	12.0
State government requirements or legislation	14.2	24.7	26.3	49.0
Assisting in the global effort to minimize worldwide climate change	9.9	29.4	54.1	16.5
Developing a reputation as a "green city" to attract economic investment	8.2	53.3	39.3	7.4
Interest group or citizen demands	7.3	28.0	52.7	19.3
Improving local air quality	3.9	38.3	46.3	15.4
Increasing ability to attract grants and external funding	1.7	47.3	44.0	8.7
The influence of neighboring or "peer" cities	1.3	9.1	52.7	38.2
Reducing local traffic congestion	0.1	22.7	52.5	24.8
Reducing community's risk of weather-related disasters (flooding, drought, storms, and so on)	0.0	22.0	46.3	31.8
Other	1.7	NA	NA	NA

NA = not applicable.

local decisions for the nation as a whole. Of the cities in the sample, 63 (approximately 25 percent) are in California. Of those, 27 cities (43 percent) point to state legislation as the single most important driver of their climate protection activities. Only 6 cities outside California describe state legislation as their single most important consideration. Indeed, as the breakdown in the last column of exhibit 1 shows, 49 percent of cities say state-level policy was not important to their decision. This finding suggests that, although state climate policy can influence local objectives, municipal actions need to be targeted directly. Many states outside California have engaged in some type of climate policy, including the development of climate action plans and membership in regional GHG-reduction initiatives, but their influence fails to trickle down to local actions. A few additional considerations in exhibit 1 have their overall importance misrepresented by the single most important measure. For example, although no cities identify ameliorating risk from weather-related disasters as their single most important reason for getting involved in climate-change mitigation, 22 percent of cities nonetheless describe it as an extremely important motivation.

In a noteworthy finding, only 10 percent of cities say that assisting in global climate protection is the primary reason that they engage in GHG-mitigation efforts. Indeed, 70 percent describe it as a somewhat or not important consideration. Thus, contributing to the public good of reduced global climate change appears to be at best a secondary motivation for many cities. This finding supports some previous observations made in the literature (Bulkeley and Betsill, 2003) and suggests that the common frame, which presents local climate initiatives as a paradox of collective action, may misrepresent the actual dynamic. In most cases, municipal involvement in climate protection appears not to violate the theory of collective action after all but instead is a locally beneficial rational choice.

When considering these descriptive statistics, keep in mind two qualifications. First, the questions are to varying degrees retrospective, asking respondents to recall the dynamic that led to the original decision to engage in climate protection. Second, one representative from each city is providing the response on behalf of the entire city, and that individual's perception and subjectivity are therefore influential. Because the surveys were sent directly to the individual in each city responsible for sustainability-related issues, who theoretically has the greatest level of relevant knowledge, these limitations should be minimized, however.

To further assess the factors that influence local governments' engagement in climate protection initiatives, I apply a factor analysis to the 10 motivation variables that offer the possibility of generating local co-benefits (that is, all those listed in exhibit 2 except "assisting in the global effort to mitigate worldwide climate change," which yields only public goods). Factor analysis examines the interrelationships among the observed variables and identifies the linear combinations that contain the most information. It assesses whether their common features can be expressed by fewer underlying variables and therefore whether the original variables can be reduced into fewer meaningfully related groups (Stewart, 1981). Factor analysis is employed here to transform the 10 motivation variables into orthogonal factors by assigning factor loadings, which are the correlation coefficients between each variable and factor.[2] Factor loadings greater than 0.6 are considered high and represent

[2] The motivation variables in the factor analysis are coded such that 0 indicates that a variable was not important to the city's decision to engage in climate protection, 1 indicates that it was somewhat important, and 2 indicates that it was extremely important.

the main considerations within a decision (Hair et al., 1998). Typically, factors with eigenvalues greater than 1 are retained, as the Kaiser criterion suggests. The retained factors are then subject to intuitive or theoretical interpretation.

Four main factors appear to underlie the 10 co-benefit-generating motivation variables (see exhibit 3). The four retained factors each account for between 14.8 and 18.9 percent of the observed variance, resulting in a cumulative 66.3 percent of total variance explained. The dominant factor loadings, which are used to determine variables' placement within factors, are indicated with asterisks. The interpretation of factors is a necessarily subjective exercise; the variables load in an apparently meaningful manner, however. Factor 1 consists of variables related to the achievement of complementary local goals, namely, adhering to state legislation, improving air quality, and decreasing traffic congestion. Factor 2 includes variables related to economic and cost considerations: achieving energy and cost savings, improving access to external funding, and increasing the city's green reputation and related investment opportunities. The variable representing concern about vulnerability to weather-related disasters is dominant in Factor 3. Factor 4 contains variables associated with political influence, namely the influence of peer cities, public pressure, and the priorities of local officials. These factors loosely match the reasons hypothesized by Kousky and Schneider (2003) for why free riding has not prevented cities from engaging in climate protection.

The creation of a simple index illustrates the relative importance of these factors in cities' original decisions to engage in climate-change mitigation. Cities described each motivation as extremely, somewhat, or not important, and these responses were assigned a value of 2, 1, and 0, respectively. The values were then added together and divided by the maximum possible score for that factor. The resulting value, listed in the fourth column of exhibit 4, is a standardized measure of the

Exhibit 3

Factor Loadings for the Considerations Behind Local Governments' Decisions To Engage in Climate Protection

	Factor 1: Complementary Goals	Factor 2: Financial Concerns	Factor 3: Vulnerability Concerns	Factor 4: Political Influence
Reducing community's risk of weather-related disasters (flooding, drought, storms, and so on)	– 0.076	0.049	0.843*	0.095
Achieving energy and cost savings for the city government	– 0.186	0.735*	0.263	– 0.001
Increasing ability to attract grants and external funding	0.158	0.819*	– 0.017	– 0.042
Developing a reputation as a "green city" to attract economic investment	– 0.004	0.709*	0.067	0.381
Interest group or citizen demands	– 0.152	– 0.054	0.365	0.681*
The preferences and priorities of city official(s)	– 0.014	0.141	0.008	0.810*
The influence of neighboring or "peer" cities	0.419	0.049	– 0.008	0.609*
State government requirements or legislation	0.821*	– 0.136	– 0.149	– 0.050
Improving local air quality	0.546*	0.270	0.518	0.130
Reducing local traffic congestion	0.609*	0.262	0.494	0.026

** Dominant factor loadings.*

average importance of the overall factor. Exhibit 4 also contains a similarly developed index, which was not included in the factor analysis, representing the perceived importance of contributing to the reduction of worldwide climate change. This index represents an altruistic, public-goods-driven motivation. Factor 2, financial concerns, emerges as the most important consideration behind cities' decisions to become involved in climate-protection initiatives. The other indices—complementary goals, vulnerability concerns, political influence, and altruistic concern about global climate change—show levels of importance that hover around 0.50. Although still influential, they are secondary considerations for most cities.

Exhibit 4

Relative Importance of Factors to Cities' Climate Decisions

	Cumulative Average	Maximum Potential	Standardized Factor Importance
Factor 1: Complementary goals	2.97	6	0.49
Factor 2: Financial concerns	4.70	6	0.78
Factor 3: Vulnerability concerns	0.88	2	0.44
Factor 4: Political influence	3.12	6	0.52
Altruistic concern about global climate change	1.11	2	0.56

The Effect of Motivation on Climate Action

The type, quality, and comprehensiveness of initiatives vary among cities that have made explicit climate commitments. A small but growing number of studies have tried to explain this variation by empirically examining the factors that influence cities' implementation of specific GHG mitigation measures. Feiock and Bae (2011) considered factors leading to the development of local GHG inventories. Sharp, Daley, and Lynch (2011) examined the drivers and barriers to the implementation of ICLEI milestones,[3] and Krause (2011c) constructed an index of GHG-reducing actions and assessed the factors that influence cities to implement more of the identified activities. These studies tested several models of local decisionmaking, which include independent variables variously representing interest-group influence, the structure of political institutions, governmental capacity, and physical vulnerability.

This analysis uses a base model similar to those developed in previous papers, but includes an additional set of key independent variables; namely, the considerations that cities describe as important motivations behind their original decisions to pursue climate protection. I hypothesize that, when controlling for all the policy supply and demand factors typically contained in models of local decisionmaking, the underlying objective(s) for climate action—whether they be monetary savings, compliance with state legislation, contributing to global GHG mitigation, and so on—will remain influential. Moreover, I expect that the nature of the dominant motivations will shape climate planning in a systematic manner.

[3] ICLEI milestones are (1) complete a GHG emissions inventory, (2) adopt a GHG reduction target, (3) develop a climate action plan to reach that target, (4) implement the plan, and (5) monitor results (ICLEI, 2009).

Exhibit 5 contains a description of the control variables included in this model. Like many previous studies, this study includes a series of local demographic statistics to act as proxies for interest-group activity and civic pressure. Here, the variables income, education, political leaning, and manufacturing fill this role. Cities' populations and general revenues indicate the overall level of resources available to the local government. Although political institutions are often considered mediating variables, best captured by interaction terms (Clingermayer and Feiock, 2001), recent studies observed governmental form as having a direct effect on the implementation of climate-relevant activities (Feiock, Francis, and Kassekert, 2010). A dichotomous variable indicating whether cities have a mayor-council or alternative form of government is thus used to control for the influence of local political institutions. Finally, cities' location near a coast serves as a control for the effect of perceived vulnerability to weather-related risks.[4]

Exhibit 5

Control Variables

Description	Source
Income	Median household income, 2006–2008, in $1,000s. Source: U.S. Census Bureau 2000, SF-3
Education	Percentage of population older than age 25 with a bachelor degree or higher. Source: U.S. Census Bureau, 2006–2008 American Community Survey 3-year data
Political leaning	Percentage of county votes supporting the Democratic candidate in the 2008 presidential election. Source: *Congressional Quarterly*, Voting and Elections Collection
Manufacturing	Percentage of city's jobs in the manufacturing sector of the economy. Source: *County and City Data Book 2007*
Population	Logged population of each city in 2005. Source: *County and City Data Book 2007*
General revenue	Per capita general revenue for each city, 2001–2002, in $100s. Sources: *County and City Data Book 2007*; U.S. Department of Housing and Urban Development
Form of city government	Dichotomous variable indicating whether a city has a mayor-council (1) or different (0) form of government. Source: International City/County Management Association, *Municipal Year Book 2000*
Coastal community	Dichotomous variable indicating whether a municipality is (1) or is not (0) in a coastal county. Source: National Oceanic and Atmospheric Administration

This analysis aims to determine how the specific objectives that motivate cities to engage in climate protection influence the comprehensiveness of their subsequent climate initiatives. Thus, in addition to the previously described control variables, the indices presented in exhibit 4—most of which are based on a factor analysis of the responses to the survey's motivation questions—are included as the primary variables of interest.

The dependent variables in this model measure different dimensions of cities' climate initiatives. Namely, they consist of three dichotomous variables indicating whether cities have—

- Engaged in city-government-focused climate planning by developing both a GHG emissions inventory and a climate action plan addressing emissions from city government operations.

[4] Although climate change-related vulnerabilities may come in numerous forms, including increased drought, heat, and floods, the connection between climate change and sea level rise is particularly salient. Location near a coast is therefore used as a proxy for perceived local vulnerability.

- Engaged in communitywide climate planning by developing both a GHG emissions inventory and a climate action plan addressing communitywide emissions.
- Committed resources to climate protection in the form of both designated money in the city budget and the assignment of climate management responsibilities to specific individuals.

Exhibit 6 lists these dependent variables in order of increasing commitment and effort put toward climate protection on the part of the local governments. The development of an inventory and

Exhibit 6

Results of Logit Regressions Indicating How Internal Motivations and External Controls Influence Local Climate Engagement

	City Government Climate Planning		Communitywide Climate Planning		Resource Commitment	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Motivation factors						
Complementary goals	– 0.238 (0.534)	0.900 (0.669)	– 0.144 (0.515)	0.391 (0.605)	– 0.555 (0.600)	0.142 (0.691)
Financial concerns	– 0.474 (0.674)	– 0.751 (0.733)	– 1.332** (0.650)	– 1.504** (0.710)	– 0.376 (0.743)	– 0.855 (0.832)
Vulnerability concerns	– 0.378 (0.468)	– 0.531 (0.506)	0.571 (0.440)	0.409 (0.469)	– 0.093 (0.488)	– 0.296 (0.530)
Political influence	1.414** (0.655)	0.802 (0.735)	1.569*** (0.625)	1.192* (0.680)	1.283** (0.698)	1.342* (0.774)
Altruistic concern about global climate change	0.919* (0.520)	0.198 (0.594)	1.023** (0.493)	0.485 (0.536)	2.628*** (0.597)	2.209*** (0.634)
External control variables						
Income	—	– 0.037*** (0.014)	—	– 0.024** (0.012)	—	– 0.029** (0.014)
Education	—	0.058*** (0.020)	—	0.040*** (0.016)	—	0.014 (0.016)
Political leaning	—	0.042*** (0.016)	—	0.025* (0.015)	—	– 0.003 (0.018)
Manufacturing	—	0.014 (0.032)	—	– 0.034 (0.031)	—	– 0.050 (0.043)
Population	—	0.000 (0.001)	—	0.001 (0.001)	—	0.001 (0.001)
General revenue	—	0.127** (0.061)	—	0.054 (0.049)	—	0.124** (0.050)
Form of city government	—	– 0.812** (0.367)	—	– 0.621* (0.349)	—	– 0.644* (0.402)
Coastal community	—	– 0.417 (0.397)	—	0.062 (0.373)	—	– 0.383 (0.419)
Constant	0.256 (0.561)	– 1.911* (1.076)	– 0.499 (0.546)	– 1.663* (1.006)	– 2.632*** (0.699)	– 1.265 (1.205)
	N = 245 LRχ^2 = 11.49 Probχ^2 = 0.04	N = 245 LRχ^2 = 43.95 Probχ^2 = 0.00	N = 245 LRχ^2 = 26.38 Probχ^2 = 0.00	N = 245 LRχ^2 = 48.55 Probχ^2 = 0.00	N = 245 LRχ^2 = 39.04 Probχ^2 = 0.00	N = 245 LRχ^2 = 59.61 Probχ^2 = 0.00

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$.

Notes: Standard errors in parentheses. Model 1 = independent variables only. Model 2 = independent and control variables.

climate action plan for city government operations is less demanding than the development of similar plans for the community as a whole. The provision of designated resources, in the form of staffing and money, shifts the climate effort from planning to action. These dependent variables are also associated with decreasing frequency of implementation. Whereas 169 of the city governments in the sample have developed a GHG inventory and action plan for their own operations, 124 have done so for communitywide emissions, and only 70 have committed human and financial resources to the effort.

Logit regressions determine the factors that influence the achievement of the three dependent variables (see exhibit 6). The first model corresponding to each dependent variable contains only the motivation factors as independent variables: complementary goals, financial concerns, vulnerability concerns, political influence, and altruistic concern about global climate change. The second model associated with each dependent variable also includes cities' demographic, economic, and geographic characteristics, which serve as control variables. Because the coefficients from logit regressions are not directly interpretable, exhibit 7 presents their substantive effect in terms of odds ratios. This method describes the change in the dependent variable (Y) for a 1-standard-deviation change in the independent variable (X_i,) holding all other variables constant. For dichotomous independent variables, a 1-unit change is used.

Exhibit 6 makes it evident that all the models, but particularly the initial ones containing only the motivation factors, become more significant as the dependent variables reflect increasing amounts of commitment. The LRχ^2 for the motivation-only models increases from 11.49 for the least demanding dependent variable, city government climate planning, to 39.04 for the most demanding dependent variable, resource commitment. For the full models, the LRχ^2 increases from 43.95 to 59.61.

Exhibit 7

Substantive Effect of Internal Motivations and External Controls on the Odds of Local Climate Engagement

	City Government Climate Planning	Communitywide Climate Planning	Resource Commitment
Motivation factors			
Complementary goals	1.282	1.114	1.040
Financial concerns	0.846	0.715**	0.826
Vulnerability concerns	0.824	1.161	0.898
Political influence	1.216	1.337	1.387*
Altruistic concern about global climate change	1.069	1.177	2.105***
External control variables			
Income	0.526***	0.658**	0.601**
Education	2.199***	1.729***	1.213
Political leaning	1.668***	1.355*	0.964
Manufacturing	1.073	0.844	0.779
Population	1.109	1.615	1.510
General revenue	1.595**	1.219	1.581**
Form of city government (0 to 1)	0.451**	0.538*	0.525*
Coastal community (0 to 1)	0.493	1.064	0.682

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Notes: Odds ratios. Results reflect a 1-standard-deviation increase in the independent variable, except where indicated by (0 to 1), which reflects a one-unit change.

Several external control variables are statistically significant. Their observed effects are relatively consistent across the models and reflect the findings of previous studies. Specifically, holding all else equal, cities with greater average household incomes and mayor-council forms of government are likely to have taken fewer climate actions. Those with higher education rates, greater political support for Democrats, and higher levels of per capita general revenue typically exhibit a greater likelihood of climate engagement.

With the control variables in place, none of the internal motivation factors significantly influences the likelihood of city-government-focused climate planning. Several remain significant for the dependent variables of communitywide planning and resource commitment, however. A 1-standard-deviation increase in the stated importance of financial concerns as a motivation for involvement decreases the likelihood of communitywide climate planning by 0.751. Holding all other variables constant, a 1-standard-deviation increase in the importance of political influence in a city's initial decision to become engaged in climate protection increases its odds of having conducted communitywide planning and committed resources by 1.337 and 1.387, respectively. Finally, holding all else equal, for a 1-standard-deviation increase in cities' altruistic concern about global climate change, the odds of having completed communitywide climate planning is 1.177 times greater and the odds of having committed resources are 2.105 times greater.

Discussion

This study examines U.S. cities that are explicitly engaged in climate change-mitigation initiatives. It considers, among these already committed cities, whether the motivations behind their decisions influence the comprehensiveness of the relevant planning actions they have taken as followthrough. Asked more specifically: After cities have decided to get involved in climate protection, does it make any practical difference whether they were motivated by direct concerns about climate change or the pursuit of different types of local co-benefits? The results of this study suggest that the answer is yes.

The 11 motivations identified as being behind cities' decisions to engage in climate protection reduce to five underlying factors: achieving complementary goals, financial concerns, concerns about local vulnerability, political influence, and the desire to help mitigate worldwide climate change. The first four factors are based on the potential of accruing local co-benefits, whereas the fifth expresses an altruistic desire to contribute to the production of a public good. Of these factors, financial concerns—that is, achieving cost savings and attracting external funding and investment—were most frequently cited by cities when explaining the rationale behind their decisions to become involved in this issue.

After controlling for external characteristics that have previously been shown to influence local political decisionmaking—including interest-group pressure, governmental capacity, institutional form, and vulnerability to climate-induced threats—cities' internal motivations retain significance in shaping the type and comprehensiveness of followthrough action. Perhaps most notable are the effects that the objectives of achieving local financial benefit and mitigating global climate change have on cities' implementation of the more demanding climate actions: planning for communitywide GHG reduction and dedicating human and financial resources.

Although locally accruing co-benefits, such as cost savings, make participation in climate initiatives attractive for cities, they may be detrimental to the comprehensiveness of the followthrough activities undertaken. Specifically, the results from this analysis indicate that, holding all else equal, cities whose rationale for involvement in climate protection rests more strongly on achieving financial benefits in the form of cost savings and investment are less likely to have undertaken emissions-reduction planning for the community as a whole. This finding is logical because, unlike efforts that focus on reducing energy consumption in government operations, those that target the entire community are unlikely to yield cost savings for the city government and often require additional expenditures. Because the vast majority of urban emissions come from residential or commercial activities and not city government operations, however, a focus on achieving financial savings may inhibit some of the most significant emissions reductions. Indeed, Ramaswami et al. (2012) quantified the effect of several local abatement actions and found that that many of those most commonly implemented yield negligible reductions in overall emissions. Local governments whose motivations for engaging in climate-change mitigation are strongly linked to the objective of minimizing its global effects are significantly more likely to have undertaken the more demanding initiatives of community-focused planning and resource dedication. The presence of political support—from local leaders, interest groups, or peer cities—also influences the completion of these actions.

In sum, the presence of co-benefits contributes to cities' initial decisions to engage in climate protection, but has a lesser effect on encouraging their substantive followthrough, which is particularly true for financial co-benefits. The altruistic motivation of helping to minimize the global problem of climate change, on the other hand, shows its greatest effect not with regard to cities' initial decisions to engage with the issue but in influencing their implementation of community-focused planning and resource allocation.

Conclusion

Previous quantitative studies examining the factors that influence local governments to adopt or implement climate-protection initiatives have focused on the effect of community and city government characteristics. This focus has resulted in a fairly thorough assessment of the performance of several theories of local political decisionmaking in the context of climate protection. The analysis presented in this article controls for community and city government characteristics and targets attention directly on motivations; that is, the specific considerations within each city that led it to adopt an explicit climate protection objective. The stated motivations of climate-committed cities are interesting in and of themselves, with financial considerations (particularly cost savings) dominating the rationale. The desire to help mitigate worldwide climate change appears to be a secondary consideration for most cities' involvement, suggesting that voluntary local climate action may not be a paradox of collective action at all, but rather a rational choice made in the pursuit of co-benefits. The results of this analysis further suggest, however, that after cities are committed a strong public goods motivation does the most to increase the comprehensiveness of the overall climate-planning effort.

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Understanding City Engagement in Community-Focused Sustainability Initiatives

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Abstract

Many local governments are promoting sustainability initiatives, ranging from progressive urban design and development to climate protection. Past research suggests that governments are often motivated to act because of the possible co-benefits, such as cost savings, associated with sustainability. Many sustainability programs target inhouse city operations, however, thus ensuring that co-benefits accrue to local government while not imposing regulations on businesses or residents. Co-benefits might be less likely to drive decisionmaking when sustainability initiatives are directed to the larger community. In this article, we examine why some cities actively pursue the more difficult prospect of communitywide sustainability policy. We merge secondary data with original data from a survey of local governments to explore three broad theoretical influences on decisionmaking: (1) interest group pressure, (2) problem severity or need, and (3) network strength. Our results suggest that, regardless of the institutional structure within a city, participation in some interlocal networks promotes communitywide sustainability initiatives.

Introduction

Local governments are increasingly investing in programs and initiatives to promote sustainability. Sustainability policy casts a broad net and can include a variety of initiatives ranging from climate protection and energy efficiency to comprehensive land use planning. Efforts to advance sustainability at the local level have garnered considerable scholarly attention. As early as 1987, the Brundtland Commission's report, *Our Common Future*, identified city governments as critical stakeholders in advancing sustainable development (WCED, 1987). Since then, scholars and practitioners have developed a vibrant research agenda exploring the meaning of sustainability (Hempel, 2009; Portney, 2009, 2003), evaluating its effects (Budd et al., 2008; Fitzgerald, 2010; Rabe, 2008; Upadhyay and Brinkman, 2010), and identifying the determinants of policies designed to promote local sustainability (Brody et al., 2008; Bulkeley and Betsill, 2005; Krause, 2011; Lubell, Feiock, and Handy, 2009; Pierce, Budd, and Lovrich, 2011; Portney, 2009; Portney and Berry, 2010; Sharp, Daley, and Lynch, 2011; Zahran et al., 2008a, 2008b).

As scholarship in this area grows, two challenges remain. The first is the theoretical and conceptual challenge implicit in advancing a more nuanced understanding of the relationship between economic development and environmental policy. All too often, these concepts have been treated as competitive endeavors (see Hempel, 2009, and Portney 2003, 2009, for a broader discussion of this point), limiting our ability to understand the win-win scenario that advances both environmental policy and economic development. This suggests a need to explore how different cities capitalize on contemporary postindustrial global economic forces. The second challenge is the need to build on the numerous findings of *co-benefits* as motivators of city action on climate change and other sustainability initiatives. Many scholars have found that energy cost savings to city governments and similar co-benefits motivate policy adoption in this area (Betsill and Bulkeley, 2004; Bulkeley and Betsill, 2003; Kousky and Schneider, 2003; Portney, 2009). Although co-benefits are likely to loom large in decisionmaking aimed at city operations, it is less clear if this explanation holds when city governments develop communitywide sustainability policy that exceeds inhouse city activities. Benefits from communitywide policies are likely to drift across political boundaries, adding hurdles to pursuing broad-based sustainability initiatives (Rabe, 2004, 2008). Ultimately, communitywide sustainability initiatives are more complex than their inhouse counterparts, and we know less about why cities embark on these broader, more challenging sustainability paths. Indeed, recent research identified systematic differences between the determinants of greenhouse gas (GHG) reduction policy aimed at inhouse city operations and those initiatives targeting the broader community (Feiock and Bae, 2011).

In this article, we explore the determinants of communitywide sustainability policy in more detail. Sustainability is a tremendously broad concept that can have multiple, and sometimes divergent, definitions (Zeemering, 2009). We consider sustainability policy to include any program or initiative that intends to lessen a city's environmental impacts over time. Our analysis stems from our previous work exploring cities' participation in and progress through the climate protection program promulgated by ICLEI—Local Governments for Sustainability (Sharp, Daley, and Lynch, 2011). Our previous research suggests that that financially strapped cities are more likely to participate in ICLEI's climate protection program, advancing the notion that co-benefits are an important factor promoting policy adoption. These same cities experience implementation difficulties, however; they are systematically less likely to achieve programmatic milestones. This result compelled us to question the relationship between co-benefits as a determinant of decisionmaking and the scale or breadth of a policy initiative. Whereas increasing scholarship has aimed at understanding why some cities pursue sustainability initiatives and others do not, far less attention has focused on how broadly these initiatives are deployed, presumably because of data constraints. The data used for our previous analysis did not distinguish if cities' climate protection initiatives were simply inhouse programs targeting local government operations, and thus more likely to be motivated by co-benefits, or if these programs were more ambitious communitywide initiatives engaging a broader cross-section of stakeholders in policy implementation.

This article is a conceptual replication of the model used in our previous research that focused exclusively on urban climate-change policy (Sharp, Daley, and Lynch, 2011). We adapt that model in several important ways, however. First, we rely on different data sources. If our replication suggests similar patterns guiding decisionmaking despite relying on different data sources to operationalize our concepts of interest, we can be more confident about the nature of these relationships (King, Keohane, and Verba, 1994). We merge secondary data with data from an original survey supported by the IBM Center for the Business of Government (the IBM survey) and collected at Florida State University under the direction of Richard Feiock. This merging enables us to expand our focus beyond climate-change policy and rely on primary data from large cities to create a measure that represents an array of sustainability initiatives, an approach also used by other scholars interested in sustainability (Lubell, Feiock, and Handy 2009; Pierce, Budd, and Lovrich, 2011; Portney, 2003). The second adaptation is that the structure of the survey data enables us to distinguish between sustainability initiatives directed at inhouse government operations and communitywide sustainability programs. Initial research in this area suggested that, with respect to climate-change decisionmaking, programmatic scale matters; different factors shape the uptake of inhouse programs compared with that of communitywide programs (Feiock and Bae, 2011).

Comprehensive sustainability programs have the potential to yield greater effects if successfully implemented, but they are, by definition, more complex and politically complicated. We adapt the model from our previous research to examine why some large cities are embracing communitywide sustainability programs and others are not. Our analysis considers the role of political institutions; a range of organized interests; policy need or problem severity, with a particular emphasis on distinguishing how a city's economy relies on more environmentally intensive activities compared with creative-class enterprises; and, finally, intergovernmental cooperation and network participation. Among other things, our results cast some doubt on co-benefits as a factor promoting communitywide sustainability initiatives. Our analysis instead suggests that, regardless of a city's institutional structure, broad-based organized interests within a community and participation in certain interlocal policy networks propel communitywide sustainability policy. The next section of the article outlines our theoretical and conceptual approach in more detail. In the subsequent sections, we provide our research methods and describe our results and discussion. We conclude the article by discussing our results in light of the broader literature on sustainability and suggesting fertile areas of research to build on and expand these results.

Cities, Sustainability, and Environmental Decisionmaking

Sustainability is a concept often examined at the international and national levels (Aldy and Stavins, 2010, 2007; Barbier, 2010; Mazmanian and Kraft, 2009; Rabe, 2010), despite the longstanding recognition of cities' importance in advancing sustainability (WCED, 1987). Portney (2003) persuasively argued that, in the American context, cities hold tremendous promise for advancing sustainability. Indeed, he contended that several forces combine to highlight cities' prominence in this area. For several decades, the fragmentation and divided authority in American federalism has occurred against a near-constant drumbeat of advancing state and local rights. The result, on the federal level, has been an institutional environment unable to generate—and at times openly hostile to—new environmental legislation. Instead, much of the recent political debate in environmental decisionmaking has centered on returning authority to lower levels of government. The promise of such decentralization lies in scale: problems are more likely to be accurately identified, solutions are crafted at the local level by individuals who understand the political and social culture, and feedback and adaptive management can be more immediate. If something becomes better or worse, local governments can respond more quickly and strategically compared with their federal counterparts. Portney (2003) contended that these factors, and the sheer number of people living in urban environments, combine to make cities a serious and potentially effective level of government to advance sustainability. What factors, however, predict city governments' propensity to develop communitywide sustainability initiatives? We draw from previous research on urban sustainability to examine this question. In our estimation, four broad theoretical explanations have been advanced in the literature: political institutions; organized interests; policy need or problem severity; and network participation, sometimes described within the context of multilevel governance.

Political Institutions

Past research indicated that a city's local political institutions shape policy outcomes (Lubell, Feiock, and Ramirez de la Cruz, 2009; Ramirez de la Cruz, 2009). The configuration of executive-branch institutions is an important variable that mediates how other factors influence policymaking (Clingermayer and Feiock, 2001; Feiock and Cable, 1992; Sharp, 2002; Sharp, Daley, and Lynch, 2011). For example, the influence of supportive and oppositional groups should be more keenly felt in cities that have mayor-council governments. This form of government is a more politicized setting than a council-manager form of government; therefore, organized interests capitalize on this institutional setting to sway decisionmaking. We expect that organized interests for or against sustainability initiatives will be more evident in cities with mayor-council governments. By contrast, council-manager governments are far more insulated from the vagaries of special interests and more likely to advance notions of economic efficiency in decisionmaking (McCabe et al., 2008).

Organized Interests

Theoretically, we expect that the presence of organized interests will influence the uptake of comprehensive sustainability initiatives. Groups that favor the pursuit of sustainability encourage the uptake of broad-based sustainability programs, and groups that oppose such initiatives dampen the pursuit of formal sustainability policy. As noted in the preceding section, however, we expect these relationships to be mediated by the institutional arrangements within cities that either promote or inhibit access to decisionmakers. Previous research noted that *civic capacity* influences decisionmaking in this area. Environmental groups and civic capacity, which is often represented by aggregate measures like income and education, are generally associated with the uptake of sustainability programs (Portney, 2009; Zahran et al., 2008b). In addition, researchers have contended that scholarship in this area needs to move beyond simply identifying environmental groups and diffuse forms of civic capacity as a force for policy uptake; it needs to take more seriously the notion of measuring general participation in a city as providing either a constraint or opportunity for sustainability initiatives (Hawkins and Wang, 2012; Portney and Berry, 2010). These researchers argued that an array of participatory forums, such as homeowners' associations and neighborhood groups, are an important and meaningful gauge of community-level civic capacity.

Categories of organized interests must include oppositional forces. For example, past research suggested that developers are likely to oppose comprehensive sustainability policy (Lubell, Feiock, and Handy, 2009; Ramirez de la Cruz, 2009). Our past research measured oppositional interests as the presence of a carbon-intensive industry, manufacturing. Although not an ideal operationalization, our results suggested that, for mayor-council cities, oppositional interest groups could constrain policy implementation (Sharp, Daley, and Lynch, 2011). Other research found a similar pattern: Krause (2011) noted that, the greater the value added from manufacturing to the local economy, the less likely a city is to sign the United States Conference of Mayors' (USCM's) Climate Protection Agreement (CPA).

Policy Need or Problem Severity

As we noted in our previous analysis focused on climate-protection policies, the literature offers limited theoretical clarity regarding the way in which policy need or problem severity influences decisionmaking (Sharp, Daley, and Lynch, 2011). The general expectation is that, all things being equal, problem severity motivates decisionmaking. In other words, local governments are more likely to act when problems are getting worse. The literature includes no agreed-on or even widely used measures of problem severity, however. For example, research focused more on sustainability policy directed toward land use decisionmaking or development has tended to conceptualize low-density or sprawling communities as problematic and, therefore, as propelling cities' action to advance sustainability (Lubell, Feiock, and Ramirez de la Cruz, 2009; Ramirez de la Cruz, 2009). Others have argued that high-density urban environments can, depending on the way the city operates, have a significant environmental effect or ecological footprint (Bulkeley and Betsill, 2003; Rees, 1997). This line of thinking suggests that, if public decisionmakers are responding to problem conditions, as population density increases a city's ecological footprint, the local government will be more likely to develop comprehensive sustainability initiatives.

In our previous research, we relied on the presence of manufacturing facilities relative to creative-class industries within a city to represent two divergent hypotheses. First, manufacturing strength could be a proxy for oppositional interest groups. Although this proxy is not ideal, limited measures are available for representing business interests when using secondary data. Second, we also conceptualized this variable as an indication of policy need or problem severity. Cities with more manufacturing facilities than creative-class establishments are areas where the economy is heavily reliant on industries that pollute. Thus, this variable is also an avenue to measure the severity of pollution in an area relative to areas that rely more on other economic opportunities. Because in this article we can rely on survey information for more detailed measures of business interest, as we will detail in the following section, we rely on manufacturing presence only as an indicator of the need for sustainability initiatives. In keeping with the previous problem severity hypothesis, we expect that cities where the economic sector is more reliant on manufacturing will be more likely to pursue comprehensive sustainability policy.

Our final hypothesis with respect to policy need or problem severity is related to co-benefits and fiscal stress. Past research suggested that co-benefits, such as cost savings, serve as important motivators for cities to engage in sustainability policy (Bulkeley and Betsill, 2003; Kousky and Schneider, 2003; Portney, 2009). Therefore, the ability of co-benefits to motivate policy action is directly related to a city's fiscal stress. Put another way, if co-benefits compel decisionmaking, this is most likely to be evident in cities with limited fiscal resources. Our past research partially supported this notion: financially strapped cities are more likely to join ICLEI's climate protection program. These same cities, however, experience implementation delays (Sharp, Daley, and Lynch, 2011). Our past work could not distinguish if climate-protection initiatives were in house or communitywide. Although the literature advances co-benefits as important, we suspect that its relevance is conditional on policy scale. Financially strapped cities may be more likely to adopt sustainability programs that improve fiscal health. These are likely to be in-house sustainability programs. By contrast, we expect that communitywide sustainability programs require fiscal resources; therefore, we expect that cities with better fiscal health are more likely to pursue multiple and comprehensive sustainability programs. This line of reasoning—that policy activity requires resources—has been widely acknowledged in the state policy adoption literature (Berry and Berry, 2007).

Network Participation

This last category of hypotheses explores the relationship between network participation and communitywide sustainability policy. In our previous research, our dependent variable measured participation in and progress through an interlocal network, ICLEI (Sharp, Daley, and Lynch, 2011). Other scholars have also pointed to the importance of local government participation in networks (Krause, 2011). Moreover, much of the global governance literature on urban sustainability has examined city action through a lens of multilevel governance or intergovernmental relations. This work advanced the notion that local governments do not act in a vacuum (Betsill and Rabe, 2009; Bulkeley and Betsill, 2005) and that the network or intergovernmental context is important to consider—a familiar argument in the public administration literature (Agranoff, 2007; Rabe, 2008). We expect that participation in proenvironmental interlocal networks will promote urban sustainability initiatives. More specifically, the longer cities are engaged with these networks, the more likely they are to tackle communitywide sustainability programs. We expect, however, that political institutions will mediate some networks. For example, networks tailored specifically to mayors should be more effective in mayor-council cities. Interlocal networks that are more ecumenical with respect to their target audience should be associated with positive policy action regardless of the form of local government.

Research Methods

We merge original survey data with existing secondary data to examine the ways in which political institutions, organized interests, policy need or problem severity, and network participation influence the uptake of communitywide sustainability policy. The original survey is based on a random sample of cities with populations greater than 50,000 and asked a wealth of questions about energy-efficiency and sustainability programs. For this article, we restrict our analysis to cities with more than 75,000 residents to more closely replicate our previous research and maintain a focus on larger cities, where comprehensive sustainability policy is likely to be politically complicated and difficult to develop. The mixed-method survey (web-based with mail followup) was completed in the fall of 2010. City managers and administrative officers were the initial contacts. The overall survey response rate was 57.0 percent; the response rate among the larger cities—75,000 or more residents—was slightly higher, 58.7 percent. We augment survey data with secondary data from a variety of sources to replicate our previous analysis.

We draw our dependent variable, an additive index score of several items related to communitywide sustainability initiatives, from a battery of items included in the survey. The variable includes whether a city government has developed communitywide policy to advance initiatives such as green buildings, alternative transportation systems, energy efficiency, GHG inventory, renewable energy, smart grid technology, and integrative land use planning. The appendix details the exact language of the survey questions used to construct the index. All told, 15 items are in our additive index, each coded 1 if a city has communitywide initiatives for the particular survey question and 0 otherwise. These communitywide initiatives would limit a city's environmental effect over time primarily by reducing energy consumption. Our survey items scale well together; reliability analysis indicates a Chronbach's alpha of .859. Exhibit 1 compares the percentages of cities in our analysis that have inhouse and communitywide sustainability initiatives. Not surprisingly, inhouse initiatives are more common, particularly those initiatives whereby energy-saving co-benefits could accrue to local governments.

Exhibit 2 outlines the independent variables used in this analysis. Our measure of political institutions is drawn from the International City/County Management Association's 2004 survey of economic development. We use this survey to distinguish between mayor-council cities and council-manager cities. For cities not included in that dataset, we examined city websites to classify the form of government.

Exhibit 1

Percent of Large Cities With Inhouse and Communitywide Sustainability Initiatives

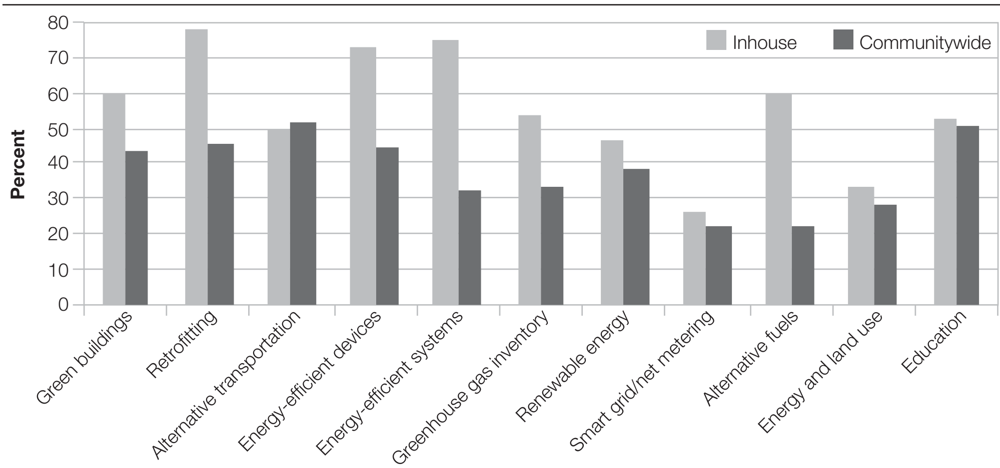

Exhibit 2

Variable Description

Theoretical Explanation	Variable	Description
Political institutions	Form of government	Dichotomous variable coded 1 if the city has a mayor-council form of government and 2 if the city has a council-manager form of government (ICMA and city websites).
Organized interests	Support for energy conservation or climate protection from—	Averaged scorings of perceived opposition or support (strongly oppose = 1; strongly support = 5) of—
	a. Business interest groups	Chamber of Commerce, real estate developers, and large business corporations (IBM survey).
	b. Environmental interest groups	Environmental groups (IBM survey).
	c. General interest groups	General public, homeowners' associations, neighborhood organizations (IBM survey).
Policy need or problem severity	Population density	Total 2000 city population (in thousands) divided by land area in square miles (Census Bureau).
	Manufacturing/ creative-class industry	Number of manufacturing establishments in 2002 divided by number of scientific, professional, or technical establishments (Census Bureau).
	Fiscal stress	Total own-source revenue per capita divided by median household income (Census Bureau).
Network participation	Length of CPA membership	Length of time since a city adopted the United States Conference of Mayors' Climate Protection Agreement (0 = never adopted; 1 = since 2008–10; 2 = since 2006–07; 3 = since 2001–05; 4 = since before 2001) (IBM survey).
	Length of ICLEI membership	Length of time since a city joined ICLEI—Local Governments for Sustainability (same scoring as previous item) (IBM survey).
	Index of interlocal cooperation on energy efficiency or climate protection	Count of following four collaborative actions engaged in— Collaborative partnership with other local entities. Informal agreement with one or more local governments on energy issues. Formal agreement with one or more local governments on energy issues. Policy or comprehensive plan changes based on regional planning efforts (IBM survey).
	California	Coded 1 if city in California, else 0.
Control variable	Population	Population in 2006 (Census Bureau).

ICMA = International City/County Management Association.

In our previous analysis of urban climate protection programs, like many other researchers, we relied on broad measures of civic capacity (education levels and counts of environmental nonprofits). The IBM survey provides a richer, albeit subjective, set of measures of stakeholder opposition and support. The survey asks a question regarding the level of support for sustainability decisionmaking by several different types of groups. The scale on this question ranges from strongly oppose (coded 1) to strongly support (coded 5), which enables us to create more finely tuned measures of organized interest support or opposition. We create three distinct variables to represent organized interests. First, we average the perceived level of support from business interests, including the chamber of commerce, real estate developers, and large business corporations. Our second measure is perceived support from environmental groups. Finally, following Portney's (2003) thinking, we include a third variable measuring broad-based community organizations to provide an indication of general civic capacity. This measure averages the support for sustainability initiatives from the general public, homeowners' associations, and neighborhood organizations.

We use several measures to capture policy need or problem severity. First, using Census Bureau data from 2000, we add a measure of population density. This measure not only serves to replicate our previous research, it is also consistent with the contention that high-density development tends to be energy intensive or unsustainable and exacerbate GHG emissions (Bulkeley and Betsill, 2003). Our second measure is the number of manufacturing facilities relative to the number of creative-class establishments within a city in 2002. In this case, we use census information on the number of scientific, professional, or technical establishments within a city as an indication of creative-class economic activity. Our final measure of problem severity is fiscal stress. The literature offers no consensus regarding a standard measure of fiscal stress for local governments. We opt to use the same measure we included in our previous analysis, dividing each city's total own-source revenue per capita by median household income. We draw the information used to create this variable from the Census Bureau.

We rely on several measures to understand the influence of interlocal network participation. The survey included a question asking respondents to categorize how long they have been members of two major sustainability networks: the CPA and ICLEI's Cities for Climate Protection. This question enabled us to construct two variables, one for each interlocal network, coded so that a higher number means longer membership. In addition to measuring participation in these two prominent sustainability networks, we also capitalized on the structure of the survey to note the breadth of intergovernmental relationships and collaborative behavior. We included a variable that is a count of positive responses on survey items asking about collaborative partnerships, informal and formal agreements on energy issues, and responsiveness to comprehensive regional planning efforts. This composite indicator enables us to test whether more extensive involvement in webs of interlocal cooperation influences sustainability policy uptake. Our final variable in this category is a dichotomous measure noting if a city is in California. Because California is such a consistent innovator in environmental policy, particularly with respect to sustainability and climate protection (Betsill and Rabe, 2009), we expect that California cities are more likely to rely on comprehensive sustainability policies.

We include population as a control variable in our analysis. Originally, we believed that restricting our analysis to cities of 75,000 or more residents would preclude the need to add this control variable. In examining our data more carefully, however, we noted substantial variation in city size between mayor-council cities and council-manager cities. On average, in 2006, mayor-council cities had much greater populations (409,789) than council-manager cities (178,724). Exhibit 3 provides descriptive statistics by form of government and for the entire sample for all the independent variables used in this analysis.

Exhibit 3

Descriptive Statistics by Form of Government

	Mayor-Council Cities				Council-Manager Cities				Total			
	Mean	St. Dev.	Min.	Max.	Mean	St. Dev.	Min.	Max.	Mean	St. Dev.	Min.	Max.
Sustainability initiatives	5.687	4.367	0.000	15.000	4.981	3.711	0.000	15.000	5.254	3.980	0.000	15.000
Length of CPA membership	1.200	1.314	0.000	4.000	0.722	1.136	0.000	3.000	0.893	1.221	0.000	4.000
Length of ICLEI membership	0.771	1.206	0.000	4.000	0.543	1.075	0.000	4.000	0.623	1.125	0.000	4.000
Fiscal stress	0.043	0.025	– 0.001	0.131	0.032	0.024	0.007	0.145	0.036	0.025	– 0.001	0.145
Population density	4.624	4.115	0.440	26.400	3.478	2.531	0.480	15.760	3.886	3.223	0.440	26.400
General interest-group support	3.884	0.626	2.333	5.000	3.836	0.583	2.000	5.000	3.853	0.597	2.000	5.000
Business interest-group support	3.621	0.659	1.667	5.000	3.575	0.629	2.000	5.000	3.592	0.638	1.667	5.000
Environmental interest-group support	4.130	1.110	1.000	5.000	4.283	1.055	1.000	5.000	4.228	1.075	1.000	5.000
Manufacturing/creative-class industry	0.404	0.275	0.069	1.480	0.440	0.502	0.083	3.429	0.427	0.434	0.069	3.429
Interlocal cooperation	1.042	1.212	0.000	4.000	1.225	1.233	0.000	4.000	1.160	1.226	0.000	4.000
California	0.056	0.232	0.000	1.000	0.279	0.450	0.000	1.000	0.200	0.401	0.000	1.000
Total population	409,789	1,066,857	75,978	8,274,527	178,724	179,134	75,515	1,328,984	260,752	658,250	75,515	8,274,527

CPA = United States Conference of Mayors' Climate Protection Agreement. St. Dev. = standard deviation.

Results and Discussion

To maintain consistency with our previous analysis, and for added parsimony, we model mayor-council and council-manager cities separately. Exhibit 4 presents the results from our regression analysis. Our dependent variable is an additive index of the number of communitywide sustainability initiatives within a city. Because our dependent variable is essentially a count of sustainability initiatives, we analyzed our data using negative binomial regression analysis and compared these results with results generated using ordinary least squares (OLS) regression. No significant differences emerged between the two modeling approaches. Therefore, we report OLS regression results for ease of interpretation.

Our results contain some interesting patterns. We expected political institutions to mediate the influence of organized interests, which is not, in fact, the case. Two of the three variables we include to measure organized interests fail to reach conventional levels of significance regardless of a city's form of government. Neither business nor environmental interest-group support is consistently related to comprehensive sustainability policy. General interest-group support—measured as perceived levels of support from homeowners' associations, neighborhood groups, and the general public—matters for both mayor-council and council-manager cities. This finding is surprising considering the political nature of an elected executive branch in mayor-council cities. That said, this result is consistent with Portney and Berry's (2010) findings about the importance of such broad-based civic organizations. Although their relevance in council-manager settings is surprising when such groups are viewed as political interests, it is less surprising when such entities are viewed as the backbone for civic capacity. This result suggests that, regardless of institutional structure, comprehensive action on sustainability policy is more likely when decisionmakers perceive support among residential stakeholders and the general public.

Exhibit 4

Ordinary Least Squares Regression Results: Determinants of Communitywide Sustainability Initiatives

	Mayor-Council Cities		Council-Manager Cities	
	Coeff.	**SE**	**Coeff.**	**SE**
Business interest-group support	– 0.818	1.048	0.134	0.570
Environmental interest-group support	0.189	0.446	0.119	0.313
General interest-group support	1.751	0.986*	1.509	0.634**
Population density	0.016	0.165	0.164	0.152
Manufacturing/creative-class industry	3.759	2.172*	– 1.151	0.615*
Fiscal stress	26.384	22.055	11.135	14.956
Length of CPA membership	0.068	0.466	0.005	0.304
Length of ICLEI membership	1.211	0.537**	0.904	0.320***
Interlocal cooperation	1.596	0.500***	0.454	0.292
California	– 1.990	2.281	1.738	0.857**
Total population	9.08E-07	0	2.21E-06	0
(Constant)	– 4.897	3.858	– 4.441	2.614*
Adjusted R^2		0.341		0.407
F		3.73***		6.56***
N		58		89

Coeff. = coefficient. CPA = United States Conference of Mayors' Climate Protection Agreement. SE = standard error.
**p ≤ 0.10. **p ≤ 0.05. ***p ≤ 0.01.*

Our problem-severity measures do not behave as we predicted. No evidence suggests that density is relevant for understanding variation in cities' broader, community-targeted sustainability policy. The role that manufacturing presence plays relative to that of creative-class industries is contingent on the form of government. When we focus on council-manager cities, we find that cities whose economies are more reliant on manufacturing than on creative-class establishments appear to be constrained from pursuing the community-focused sustainability policies of interest; to state it another way, cities where creative-class industry is a relatively prominent component of the economy are more likely to do more sustainability policy. We find the reverse relationship for mayor-council cities. By contrast, mayor-council cities that are heavily reliant on the manufacturing industry are attempting more in the way of sustainability policies than are mayor-council cities that are less reliant on manufacturing. The results for mayor-council cities are thus consistent with one key version of the problem-severity explanation. A more manufacturing-dominated economy can be taken to mean a city with a heavy carbon footprint and other environmental problems that make it relatively problematic on sustainability grounds. The strong positive coefficient for our manufacturing/creative-class industry indicator in mayor-council cities suggests that, in that governance context, cities with manufacturing-heavy economies are reaching for sustainability policies as solutions to the problems wrought by their manufacturing dependence.

The contrasting result for council-manager cities is initially more suggestive of the organized interests interpretation that we took up when we encountered similar findings in our analysis of ICLEI implementation. That is, the negative coefficient could mean simply that a greater prevalence of manufacturing establishments in the economy signifies the greater strength of manufacturing interests that constrain sustainability activity that they find threatening. Abandoning a problem-severity perspective is not necessary, however, to interpret the contrasting results in council-manager cities. Instead, the problem-severity thesis can be framed in a second way. The negative coefficients that we observe suggest that the council-manager cities most aggressively pursuing sustainability policies are those whose economies feature a heavier presence of postindustrial, creative-class enterprises. Unlike mayors of large cities still dominated by manufacturing, who may be pushing for sustainability policy to transform their economies, the need for sustainability policy in council-manager cities may be defined as the importance of pursuing activity that is consistent with the needs of creative-class establishments that have already emerged as relatively important elements of the local economy. Perhaps cities with a vibrant creative class have their own version of the need for sustainability policy. More detailed research is needed to understand how this need might be communicated to decisionmakers.

Our final variable in this family of measures of policy need or problem severity is fiscal stress. Although previous research has suggested that cities pursue sustainability policy to capture co-benefits, we suspect that this relationship is conditional on the scale of a policy. We expect cities with more fiscal resources to be more likely to develop communitywide—and costly—sustainability policy. Instead, we find that fiscal stress is not a relevant predictor of sustainability policy activity in either mayor-council or council-manager cities.

When we look beyond the city's borders to the extralocal entities that might shape sustainability efforts, we find one important commonality and a pair of contrasts between mayor-council and council-manager cities. We hypothesized that the duration of participation in prosustainability networks would be positive and significant, and that when these networks target both types of city governments, their effect would not be mediated by form of government. Indeed, our results suggest that the longer cities have been involved with ICLEI, an organization that appeals to all forms of city government, the more communitywide sustainability policies they have. Our previous research suggested ICLEI's positive role in policy implementation for GHG reduction, and the results here confirm this positive role is also true when we are looking at the much broader and more demanding outcome represented by this article's index of involvement in community-targeted sustainability programs.

By contrast, we expect that the CPA will be a relevant predictor of outcomes for mayor-council cities but not for council-manager cities (because council-manager cities, even hybrid ones with some sort of mayor, presumably do not identify with the USCM like mayor-council cities do). Involvement with the CPA makes no difference for either type of city, however. More research is needed to unpack the differences between these two interlocal networks, but it may be that ICLEI's experience in this arena—it has been active in this field since the early 1990s—combined with the tangible support it provides local governments in the form of technical planning tools advantages its ability to influence cities to act comprehensively to advance sustainability.

In addition to the influence stemming from the length of their involvement in ICLEI, governments' involvement in cooperative relationships with other local governments in the metropolitan area or region is a significant facilitator of sustainability policy activity for mayor-council cities. This predictor is not relevant for council-manager cities. This result is curious, and one that we did not anticipate. It may be that mayors, especially mayors in larger cities, have become adept at building coalitions needed to govern in a fragmented policy world. Elected officials may be more savvy about and successful with reaching out to local and regional partners, forging relationships, and building support than city managers who may not have similar public relations skills. Indeed, this result is consistent with Feiock, Steinacker, and Park's (2009) research noting that mayor-council cities are more likely to pursue interlocal agreements to advance economic development. It may also be that comprehensive sustainability policy provides more political capitol to ambitious mayors considering careers as elected officials beyond a city's boundaries. Therefore, elected officials with broader ambitions may be more willing to collaborate with officials beyond their boundaries to create ambitious sustainability policy. Previous work on interlocal cooperation is decidedly mixed, however. For example, our result stands in stark contrast with Feiock's (2007) thesis that both the emergence and the durability of cooperative intergovernmental agreements should be linked to the presence of council-manager government. More detailed research is needed to better understand the role of contrasting types of chief executives in regional networks that are tied to sustainability policy initiatives.

On the other hand, California's leading role in environmental policy is important only for council-manager cities. Council-manager cities in that state have much more sustainability policy activity than council-manager cities in other states, but the state context has no apparent effect on the sustainability policy activities of mayor-council cities. This finding is the opposite of what we found in our previous analysis of progress in implementing ICLEI's milestones, wherein California city status was an important facilitator for mayor-council but not council-manager cities. This result may simply be an artifact of the distribution of mayor-council and council-manager cities in this sample compared with that of our previous sample. Our findings about the importance of the state of California, at least in its council-manager cities, diverge from Krause's (2011) finding on the insignificance of state-level factors in accounting for cities' involvement in the CPA. Her research considered the contextual importance of all 50 states, however, examining state characteristics such as whether a state action plan for GHG reductions and reduction targets existed before 2005. When we considered individual state-by-state differences in the perceived degree of state support for energy conservation and climate protection via the relevant item on the IBM survey, the coefficient for that item was insignificant (results not shown). Only being in California, which has been touted as such an extraordinary policy leader in this topical area (Betsill and Rabe, 2009), as opposed to being in any other state, is important, and then only for council-manager cities.

Conclusion

This article contributes in two ways to the growing body of literature examining urban sustainability. First, we systematically examine the determinants of communitywide sustainability policy. Relying on original survey data, we are able to distinguish more narrow initiatives that target inhouse government activity from more ambitious communitywide policy. We focus on the latter to understand what factors compel cities to engage in more complex and politically difficult sustainability initiatives. Second, we approach this endeavor as a conceptual replication of our past research, but adapt this replication to capitalize on new data.

Our results paint an interesting picture and overlap somewhat with our previous research, particularly with respect to the importance of certain types of network participation. In our past research, we found that, regardless of form of government, cities that had been ICLEI members longer were also more likely to have made progress in implementing GHG reductions. In our current analysis, we find that ICLEI membership is consistently associated with more ambitious sustainability programs in both mayor-council and council-manager cities. This finding is consistent with past research suggesting that networks and multilevel governance participation are important (Betsill and Rabe, 2009; Bulkeley and Betsill, 2005). Interlocal cooperation also matters, however, only for mayor-council cities. More research is needed to unpack the dynamics of cooperation on sustainability across cities.

This analysis departs from our past research with respect to the role of organized interests and that of policy need or problem severity. General civic capacity, measured as perceived support from homeowners' associations, neighborhood groups, and the general public, is critical for both mayor-council and council-manager cities. We expected institutional structure to mediate organized interests, which is not evident. This result, however, is consistent with Portney and Berry's (2010) contention that broad-based civic capacity is needed to propel sustainability initiatives. In other words, those interested in advancing urban sustainability should not neglect citizen support. Communitywide sustainability initiatives are more likely to be pursued in cities where decisionmakers perceived such widespread citizen support. Curiously, and in contrast to our past research, environmental and business interests are not significant factors for or against communitywide sustainability policy. This divergent result highlights the tenuous nature of measuring organized interests; the local level exhibits considerable diversity, and it is challenging to identify appropriate groups that can be measured across numerous cities.

Our policy need or problem severity variables behave differently based on form of government. Mayor-council cities with a heavy manufacturing base are more likely to engage in comprehensive sustainability policy. The opposite is true for council-manager cities, however: a stronger creative-class economic presence promotes communitywide sustainability initiatives. In some respects, this result contributes to an already murky theoretical approach. The literature exhibits limited consistency on how best to measure problem conditions and align these measures with clear theoretical expectations. More research is needed to understand how best to operationalize problem conditions. For example, we speculate that council-manager cities that have transformed their economy may have a different version of need in terms of sustainability policy. Future research could focus on fine-tuning these measurements. Finally, our research provides some additional insight into the notion of fiscal co-benefits as motivators for sustainability policy. Whereas past research highlighted co-benefits as important, our research suggests that they may be a more relevant explanation for understanding inhouse sustainability policy. Future research in this area could examine the relationship and potential timing between in-house and communitywide sustainability policies. It may be that inhouse initiatives are gateway policies that create an opportunity to forge a broader communitywide sustainability path.

Appendix: Composition of the Dependent Variable

The dependent variable is an additive index drawn from a series of survey questions. The web-based survey (Implementation of Energy Efficiency and Sustainability Programs) was administered in the fall of 2010 by Richard Feiock and supported by the IBM Center for the Business of Government.

1. Which of the following energy/climate related issues does your jurisdiction officially address (for example, through regulation or policies as it relates to … the community at large? (select all that apply)
    a. Green Buildings
    b. Retrofitting existing buildings for energy efficiency
    c. Alternative Transportation Systems
    d. Energy Efficient Devices (appliances, lighting, etc)
    e. Energy Efficient Buildings (building controls, etc)
    f. Inventory of Greenhouse Gas Emissions
    g. Renewable Energy
    h. Smart Grid/Net Metering
    i. Alternative Fuels
    j. Incorporating Energy in Land Use Decisions
    k. Provide information about efficiency to residents
2. Has a greenhouse gas reduction goal been formally adopted by the city?
3. Does your jurisdiction offer loans to upgrade or retrofit buildings
4. Does your jurisdiction offer grants to upgrade or retrofit buildings?

5. Does your jurisdiction offer rebates to upgrade or retrofit buildings?
6. Has your city adopted planning goals relating to climate protection or energy efficiency in either its general plan or a separate document?

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Contrasting Capacities From City to International Levels of Government in Addressing Climate and Energy Issues

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Abstract

How does extent of involvement at various levels (from city to international) relate to individual and organizational capacities and to the use of collaborative and analytical techniques of policy analysis? This article pursues this question through an analysis of data from a questionnaire administered in 2011 to actors involved in climate and energy issues in Colorado. The results indicate that involvement in city-level climate and energy activities includes a combination of local government officials and actors from a range of nongovernment and state and federal government organizations. Whereas individual capacity is unrelated to involvement, organizational capacity is associated with involvement at the national and international levels. In addition, involvement at the city, state, and international levels is associated with the use of collaborative techniques (such as facilitation). By contrast, involvement at the national and international levels is associated with the use of analytical techniques (such as modeling and economic analysis). The article complements the existing literature on climate and energy issues by highlighting how the use of different tools and techniques of policy analysis depends on the extent of involvement by different levels of government.

Introduction

Addressing climate change at the city level is often viewed as a significant opportunity to mitigate the effects of climate change. The reason is simple: one-half of the planet's population lives in urban areas with far-reaching carbon footprints, and higher levels of government have shown more inaction than action (Hillman and Ramaswami, 2010; OECD, 1995). Thus, scholars and practitioners have voiced a need for city-level action on climate issues. Ramaswami et al. (2008), for example, described how climate-change policies at the city level can engage vast segments of the planet's population and mitigate effects in large spatial areas. Betsill (2001) argued that policies at the city level are crucial for countries to meet their commitments within national and international climate agreements. Dietz, Ostrom, and Stern (2003) reported on the importance of locally designed institutions (that is, rules) for adaption to and mitigation of climate change. Lutsey and Sperling (2008) detailed several advantages to decentralized action on climate change, including better opportunities for policy experimentation, an ability to tailor policies to fit the preferences of constituents, an ability to test the political responses to innovative policies, and local expertise and experience in implementing and administering programs.

Many of the existing empirical studies of local action on climate change focused on the activities of city leaders (Rutland and Ayett, 2008). Recent research efforts, for example, have involved survey data from hundreds of city managers and mayors. These large-sample surveys provided a broad representation of local governments and helped to explain patterns of sustainability activities from recycling programs and bike paths to green-collar workforce training and renewable energy incentives (Daley, Sharp, and Bae, 2012; Hawkins and Wang, 2012; Svara, Watt, and Jang, 2012). They also advanced understanding of why a local government would engage in sustainability efforts when the benefits are distant and uncertain and the costs are immediate and localized. One of the limitations, however, of such large-sample survey designs is the lack of description and explanation within any particular city or state. One of the contributions of this article is to complement existing large-sample survey studies with an in depth analysis within one state, focusing on the capacities of and the tools and techniques used by actors in dealing with climate and energy issues.

Addressing climate change at the city level often confronts several barriers and challenges (for example, Rutland and Ayett, 2008). One barrier is the difficulty of reconciling the interests of various local stakeholders with those of businesses, which often oppose environmental programs and policies. The development of local environmental actions also faces challenges from the limited resources of local governments, limited or insufficient jurisdictions to address issues, and conflicts with other, higher priority programs and policies at the local level. Betsill (2001) identified three barriers that can prevent policy action at the city level: (1) uncertainty related to the institutional home for climate policymaking; (2) lack of capacity to develop climate policies and programs and to oversee, monitor, and analyze carbon emissions; and (3) deficient commitment to investing financial resources to address climate change.

Overcoming these barriers and challenges requires not only the right institutional arrangements to foster trust and cooperation but also policy action across all levels of government, backed by a policy analytical capacity (PAC) to inform such actions. *PAC* relates to information acquisition and use in the policy process (Howlett, 2009). To study PAC at any level of government is to assume that, even with cooperation and trust among actors facing an ongoing societal dilemma, learning and sustainable decisionmaking will falter unless individuals and organizations are able to acquire and use relevant policy analysis tools and techniques to make the best decisions in responding to uncertain situations. This article explores how the extent of involvement at various levels (from city to international) relates to individual and organizational capacities and to the use of collaborative and analytical techniques of policy analysis.

The context for this study is climate and energy issues in Colorado, which possesses a balance of traditional energy resources and has experienced a recent rise in renewable energy. The threats to the state from climate change include shorter and warmer winters, a thinner snowpack, earlier melting of the snowpack with increased spring runoff, increased periods of drought, more wildfires, and substantial losses of alpine forests to pine beetle infestations. Like many areas of the world and the United States, Colorado launched an initiative to address climate change, which resulted in the creation of the Colorado Climate Action Plan, in November 2007, which called for a 20-percent reduction of state greenhouse gas (GHG) emissions by 2020 (Ritter, 2007). Although the specifics of Colorado are different from those of other states, the forecast adverse effects of climate change and tepid response make Colorado typical among states.

This article proceeds with a description of the policy analysis and PAC literatures. It then describes the context of climate and energy policies in Colorado and the methods of data collection and measurement. The results indicate that involvement in city-level climate and energy activities encompasses local government officials and actors from a range of organizational affiliations. Although individual capacity is unrelated to the extent of involvement at each level, involvement at the national and international levels is associated with great organizational capacity. Finally, actors involved at the city, state, and international levels are more likely to use collaborative techniques, whereas actors involved at the international and national levels are more likely to use analytical techniques.

Description of Policy Analysis and Policy Analytical Capacity

Local action on climate change often develops through activism and leadership at the city level, from small- and medium-sized towns to New York City (Hawkins, 2011; Rutland and Ayett, 2008). Actors involved in local climate-change policy operate within networks to distribute information, gain support, generate policy ideas, and advocate for action (or stasis) on climate change to authorities (Ingold, 2011; Selin and VanDeveer, 2007). Although the literature on climate activities often deals with the factors associated with the adoption of sustainability efforts and of climate policies and politics (Daley, Sharp, and Bae, 2012; Hawkins and Wang, 2012; Svara, Watt, and Jang, 2012), an examination of the capacities of and techniques used by policy actors to analyze and evaluate climate and energy policy alternatives is mostly absent.

The lack of capacity and techniques for learning and adaptive decisionmaking can be problematic for developing, adopting, and implementing effective policies. Partially in response to the policy successes of operations research during World War II and to the policy failures of the Great Society programs in the 1960s, a voluminous literature has focused on improving the art and craft of providing policy advice and on the development of various technical approaches for generating and using information for better policy processes (Weimer and Vining, 2010). In describing such approaches, for example, Lindblom (1959) compared the *root method*, whereby individuals start the process of analyzing policies from the ground up, with the *branch method*, whereby individuals continually build on current situations in a step-by-step, incremental process. Lindblom argued that although the root method is ideal in an abstract sense, individuals more often pragmatically use the branch method, resulting in a more incremental and less systematic and methodical form of decisionmaking. Nonetheless, Lindblom's root method is typical of the rational decisionmaking and technocratic or analytical approaches to policy analysis that dominated discussions about the appropriate tools and techniques for providing policy advice for much of the 1960s and 1970s (for example, Dror, 1967; Stokey and Zeckhauser, 1978).

Dissatisfaction with rational, analytical approaches became a salient topic among researchers from the late 1970s onward (Lindblom and Cohen, 1979; Weiss, 1977). Brewer and deLeon (1984), for example, described how the effectiveness of policy analysis tools is constrained by the skill, experience, and judgments of the individuals, the time and resources available, and the characteristics of the problem. Jenkins-Smith (1990) furthered the argument by explaining how the use of policy analysis is contingent on the political landscape. Other public policy scholars underscored the threats to democracy from technocracy through the removal of the average citizen from the policymaking process (Bobrow and Dryzek, 1987; deLeon, 1997).

In response, Hass (2004) described new approaches to policy analysis that are transparent, inclusive, and substantively rich (see also NRC, 1996, and Radin, 2000). Hass's arguments paralleled the recently increasing use of collaborative governance strategies, which strive toward inclusive stakeholder processes for overcoming collective action problems (Ansel and Gash, 2008; Innes and Booher, 2010; Leach and Pelkey, 2001) and for incorporating scientific and technical information with local knowledge in decisionmaking (Ascher, 2007; Montpetit, 2011; Weible, 2008). One result is a policy analysis literature that has developed and diversified its tools and techniques over time (Roe, 1994; Weimer and Vining, 2010). Contributing to this policy analysis research tradition, Howlett (2009) offered PAC, which refers to the ability of individuals and organizations to acquire and use knowledge in the policy process.

At the individual level, PAC comprises several dimensions, including education level, years of experience, and various skills for employing analytical tools and techniques (Wellstead, Stedman, and Lindquist, 2009). Skills can involve different areas of formal training, including the ability to conduct applied research, statistical methods, policy analysis, policy evaluation, trends analysis and forecasting, political feasibility analysis, and modeling of various scenarios. Less analytically focused skills that place greater emphasis on engaging stakeholders in collaboration can include facilitation and consensus building.

PAC also operates at the organizational level. Most individuals do not possess the personal resources to participate in policy issues over prolonged periods. Many policy actors represent government agencies, businesses, nonprofit organizations, or academic and research organizations with extensive resources. Policy actors, thus, attempt to leverage these organizational resources in pursuit of policy objectives.[1] The extent of PAC the organization possesses is determined by whether it has adequate knowledge, skills, and people to respond to a policy issue (Craft and Howlett, 2012; Howlett and Oliphant, 2010) and by the priority the organization assigns to addressing a particular policy issue.

One value in analyzing PAC is to better understand the capacity among policy actors in their use of a variety of tools and techniques of policy analysis. The approach is neither technocratic nor

[1] We define *policy actors* as those individuals seeking to influence government policies in a given topical area.

post-empirical policy analysis. It does not seek to offer advice to clients but rather to develop a better understanding of a particular issue in the management of uncertainty. The PAC approach also works from an assumption that addressing complex problems requires the combination of multiple tools and techniques that range from the technocratic and analytical to the collaborative. Whereas issues from technocracy to uncertainty are certainly important, this article seeks to assess the extent of and differentiate the relative distribution of PAC among actors involved in climate-change and energy issues.

PAC is best viewed as either a concept defined by the generation and use of information in the policy process or as a framework for providing guidance for understanding the generation and use of information in a particular policy subsystem. In positing relationships from a theoretical perspective, PAC is mostly underdeveloped. One of the major theoretical arguments that PAC supports is the existence of positive relationships between policy actors with great PAC and a high probability of shaping policy agendas, affecting the design and content of policies, developing a better understanding of the context in which policies will be implemented, and determining the evaluation of policy outputs and outcomes across levels of government (Howlett, 2009). This article, however, seeks a different focus by exploring the relationships some other concepts identified within PAC have with the extent of involvement in various levels of a government system. Specifically, this article provides a theoretical investigation into whether capacity varies, first by extent of involvement in climate and energy issues at levels from city to international, and second by individual and organizational PAC.

Case Context: Climate and Energy Policies in Colorado

Since the beginning of the industrial age, the burning of fossil fuels has released substantial amounts of GHG into the atmosphere (IPCC, 2007). The accumulation of these gases has resulted in a trapping of heat within the Earth's atmosphere and a gradual warming of the planet. According to the Intergovernmental Panel on Climate Change, the leading international scientific institution on climate-change research, "warming of the climate system is unequivocal …" and "many natural systems are being affected by regional climate changes, particularly temperature increases" (IPCC, 2007: 30–31). Despite these findings and the basic processes that cause climate change being scientifically well established (Mastrandrea and Schneider, 2010), the need for public policies to address climate change remains a contentious issue (Layzer, 2006; Oreskes and Conway, 2010). Advocates and opponents of climate-change policy disagree about the degree to which human actions cause climate change and the need for government intervention through climate and energy policies.

These debates can be found through all levels of government, from the international to the local level. Beginning in the early 1990s, the international community of governments began to consider policy options for addressing climate change. In 1997, the international community adopted the Kyoto Protocol, an international agreement to address climate change. In February of 2005, the Protocol took effect for the 141 countries that had ratified it. Although the United States was originally a signatory, the U.S. Senate did not ratify the treaty and, subsequently, the United States does not participate in the Kyoto Protocol (Layzer, 2006). Whereas the United States showed initial leadership in addressing climate change at the international level, the country has become increasingly hesitant to mitigate its GHG emissions through actions including regulatory or fiscal policies (McKinstry, 2003).

Whereas the federal level is stagnating on climate-change issues, the state and city levels are increasingly active on climate change (Rutland and Ayett, 2008). More than 30 states have created a climate action plan (EPA, 2011). Climate action plans typically outline climate policy goals and identify a set of recommendations that a state can employ to address climate change. Climate policies at the city level often develop independently from state-level actions (Rutland and Ayett, 2008). Hundreds of U.S. cities are members of ICLEI—Local Governments for Sustainability, an international association of local governments that have made a commitment to sustainability. To address climate change, ICLEI formed the Cities for Climate Protection program to assist cities in addressing climate change (Rutland and Ayett, 2008). Similarly, more than 1,000 mayors have signed on to the United States Conference of Mayors' Climate Protection Agreement to advance the goals of the Kyoto Protocol through local government leadership and action (Maggioni, Nelson, and Mazmanian, 2012; USCM, 2009).

To better understand efforts to mitigate and adapt to climate change, this study examines local efforts in Colorado. The state provides an effective case study to examine climate and energy policies because of its vast traditional energy resources, the rise of its renewable energy sector, and its vulnerability to climate change. Colorado has long been a major producer of traditional energy, with several major fossil fuel-rich basins, major production of coalbed methane, and vast reserves and major production of natural gas (U.S. EIA, 2009). In recent years, Colorado's renewable energy sector has grown partially in response to the state's renewable energy portfolio standard, enacted via ballot initiative in 2004 and subsequently strengthened by the legislature in 2010 (DSIRE, 2010). The Colorado case is also informative because of the state's vulnerability to both current and predicted effects of climate change, including shorter and warmer winters and increased periods of drought (Ritter, 2007). Scientists project that, in the ensuing decades, climate change in Colorado will produce temperature increases of 3 to 4 degrees Fahrenheit, longer and more intense wildfires during the summer seasons, and an increase in water shortages.

Former Colorado Governor Bill Ritter launched an initiative to address climate change statewide, which resulted in the creation of the Colorado Climate Action Plan in November 2007. This plan called for a 20-percent reduction of the state emission of GHG 2020. This plan for the state was created in a collaborative manner by a diverse set of stakeholders, including "business and community leaders, conservationists, scientists and concerned citizens" (Ritter, 2007).

Methods

A web questionnaire was administered in the spring of 2011 to policy actors in Colorado actively involved in climate and energy issues at the international, national, state, and local government levels. The sample was collected through a modified snowball sample technique, targeting those individuals involved in Colorado climate and energy issues by first searching the Internet and newspapers for government and nongovernment organizations and the people therein. The online search was complemented by preliminary interviews of five people involved with Denver and

Colorado climate and energy issues. The total sample was 793 individuals, of whom 272 returned fully completed surveys, for a response rate of 34 percent. Another 87 individuals returned partially completed surveys, the inclusion of which equals 359 respondents and a 45-percent response rate. This analysis uses only the completed surveys.

Operational Measures

To examine capacity on climate and energy issues at the city level, this article uses five groups of independent variables: extent of involvement, formal training, advanced degree, organizational capacity and priority of climate and energy issues, and proclimate-change beliefs. The primary dependent variables are the frequency in the use of tools and techniques of policy analysis.

Tools and Techniques Used

To measure the tools and techniques that policy actors use, respondents were asked the following question: "How often have you used the following tools and techniques as part of your work in the past year?" The tools listed included political feasibility analysis, risk analysis, modeling, collaborating with those with whom you agree, collaborating with those with whom you disagree, environmental impact analysis, facilitation and consensus building, economic analysis, and informal tools and techniques. Respondents were asked to respond using a scale consisting of "never," "yearly," "monthly," "weekly," and "daily."[2]

Extent of Involvement

To measure extent of involvement, respondents were asked this question: "At what level (international, national, state, or city) do you currently focus your efforts regarding climate-related issues and/or energy policy?" For each level—international, national, state, and city—respondents could choose "not involved at all," "somewhat involved," or "primary involvement." We coded the responses 0, 1, or 2, respectively.

Individual Capacity: Formal Training

To measure the formal training of policy actors, respondents were asked the following question: "In which of the following areas have you received formal training?" The areas listed were statistics, policy analysis, policy evaluation, trends analysis and forecasting, and modeling. We used a dichotomous code to code whether individuals had received formal training in each of the five areas.

Individual Capacity: Advanced Degree

Respondents were asked, "What is the highest level of formal education you have attained?" Potential responses ranged from "not a high school graduate," "high school graduate," "some college," "bachelor's degree," "master's or professional degree," or "Ph.D., M.D., or J.D." The "master's or

[2] Respondents were also asked about community impact analysis, but so few responded affirmatively that we removed this variable.

professional degree" and "Ph.D., M.D., or J.D." responses were combined into an advanced degree dichotomous variable, with 1 equaling a positive response to one of the two categories and 0 equaling a bachelor degree or less.

Organizational Capacity and Priority of Climate and Energy Issues

To measure organizational capacity, we asked respondents two questions pertaining to organizational resources and priorities. For the question on organizational resources, we asked respondents, "Compared to similar organizations, does your organization have adequate knowledge, skills, and people to respond to climate-related issues and energy policies?" The sample was asked to respond using a 5-point Likert scale consisting of "very low capacity," "low capacity," "medium capacity," "high capacity," and "very high capacity." We coded the responses 1 through 5, respectively. To measure climate and energy issues as an organizational priority, we asked respondents, "Compared with other issues that your organization responds to, how much of a priority are climate-related issues and energy policies?" The sample was asked to respond using a 5-point scale consisting of "much lower," "lower," "about the same," "higher," and "much higher." We coded the responses 1 through 5, respectively. We then created an organizational capacity scale by taking the mean of the two variables (factor loading = 0.88; Cronbach's alpha = 0.70).

Proclimate Change-Beliefs Scale

This study controls for individual beliefs regarding climate issues, although this scale is not a component of individual PAC. The survey asked respondents to report their beliefs on the severity of climate change; its causes; and possible policy approaches for mitigating carbon emissions, including energy and carbon taxes, cap-and-trade systems, and policies promoting renewable energy generation. Respondents answered using a 5-point scale, ranging from "strongly agree" (5) to "strongly disagree" (1). These individual questions were then aggregated by their means into a single-scaled item, called proclimate-change beliefs.[3]

Results

We present the results in two parts. The first part (exhibits 1 through 3) presents the descriptive results for the extent of involvement, formal training, organizational capacity, and proclimate-change beliefs. In addition, exhibit 3 outlines the creation of a scale for collaborative tools and techniques and another scale for analytical tools and techniques. The second part (exhibit 4) presents the explanatory results from the ordered logit models and the ordinary least squares (OLS) regression models to explain the variation in the frequency in the use of tools and techniques.

[3] Respondents were asked to express their extent of agreement and disagreement with the following questions: (1) "The severity of predicted impacts on society from climate change are vastly overstated" (reversed, factor loading = 0.880); (2) "Human behavior is the principal cause of climate change" (factor loading = 0.820); (3) "Decisions about energy and its effect on climate are best left to the economic market, and not to government" (reversed, factor loading = 0.687); (4) "An energy and/or carbon tax is required to combat climate change" (factor loading = 0.800); (5) "A cap and trade system of permits for the emission of greenhouse gas is required to combat climate change" (factor loading = 0.698); and (6) "Government policies to promote renewable energy generation are required to combat climate change" (factor loading = 0.795). We calculated the mean of the five items to create the proclimate change-belief scale (Cronbach's alpha = 0.870).

Descriptive Analysis

Exhibit 1 lists the means for extent of involvement at the city, state, national, and international levels by six organizational affiliations: (1) local government (city or county), (2) nonprofit organization, (3) academic or consultant, (4) business, (5) federal government official, and (6) state government official. The results show that involvement in city-level activities is not restricted to local government officials. The mean values across all organizational affiliation categories indicate many actors are "somewhat involved" in climate or energy issues at the city level, with a statistically significant difference across organizational affiliations for involvement at all levels ($p < 0.01$, based on an independent sample, Kruskal-Wallis Test).

Local government officials indicate they are primarily involved in city-level activities (mean = 1.8). State and federal government officials report the least involvement in city-level activities (means < 1). The policy actors from the remaining organizational affiliations report that they are, on average, "somewhat involved" in city-level activities. Exhibit 1 also shows that actors are most consistently involved in state-level activities (means ranging from 1.2 to 1.7) and least consistently involved in international activities (means ranging from 0.1 to 0.9).

Exhibit 1

Extent of Involvement at Each Level, by Actor Category

Level	Organizational Affiliation (mean)						Total
	Local Government	Nonprofit Organization	Academic or Consultant	Business	Federal Government Official	State Government Official	
City	1.8	1.3	1.1	1.0	0.9	0.8	1.2
State	1.2	1.6	1.2	1.4	1.3	1.7	1.4
National	0.5	1.1	1.1	1.2	1.4	0.7	1.1
International	0.1	0.5	0.9	0.4	0.5	0.2	0.4

Notes: Affiliations are ordered from left to right by the extent of involvement at the city level. Responses were coded as follows: 0 = "not involved at all," 1 = "somewhat involved," and 2 = "primary involvement." A Kruskal-Wallis test indicates $p < 0.01$ for involvement at all levels, indicating a significant difference across affiliations.

Exhibit 2 lists the correlation coefficients between extent of involvement at each level and individual PAC, organizational PAC, and proclimate-change beliefs, and it also lists the total means for the variables.[4] The top part of exhibit 2 presents the data for individual PAC, which is measured by formal training and education level. Overall, the results show no association with involvement at any level. Total means range from 46 percent of respondents reporting formal training in statistics to 24 percent reporting formal training in modeling. In addition, about three-fourths of respondents have an advanced degree.

The middle part of exhibit 2 presents two organizational capacity questions by primary extent of involvement. The total means indicate that, on average, respondents report that their organization

[4] We calculated point-biserial correlation coefficients for the association between extent of involvement at each level and individual PAC, Kendall tau b coefficients for the association between extent of involvement at each level and organizational capacity, and Spearman rank-order correlation coefficients for extent of involvement at each level and proclimate-change beliefs. Results from exhibit 2 are robust across different measures of correlations.

Exhibit 2

Associations Between Extent of Involvement at Each Level and Individual and Organizational PAC and Proclimate-Change Beliefs

	Extent of Involvement (correlation coefficients)				Total Means
	City	State	National	International	
Individual PAC					
Area of formal training					
Statistics	0.05	– 0.01	– 0.09	– 0.12	46%
Policy analysis	0.06	0.03	0.08	0.03	45%
Policy evaluation	0.02	0.08	0.03	0.02	42%
Applied research	– 0.05	– 0.03	0.04	– 0.12	34%
Trends analysis and forecasting	0.01	– 0.05	0.07	– 0.00	25%
Modeling	– 0.07	– 0.04	0.03	– 0.00	24%
Education					
Advanced degree	– 0.03	0.05	0.12	0.01	73%
Organizational PAC					
Organizational priority on climate-related issues and energy policies[a]	– 0.00	0.14*	0.18**	0.18**	3.7
Organizational capacity on climate-related issues and energy policies[b]	– 0.05	0.02	0.22**	0.17**	3.7
Proclimate change-belief scale[c]	0.12	– 0.17*	– 0.07	0.03	3.9

PAC = policy analytical capacity.

**p < 0.05. **p < 0.01.*

[a] Exact wording: "Compared with other issues that your organization responds to, how much of a priority are climate-related issues and energy policies?" (1 = "much lower," 2 = "lower," 3 = "about the same," 4 = "higher," and 5 = "much higher").

[b] Exact wording: "Compared to similar organizations, does your organization have adequate knowledge, skills, and people to respond to climate-related issues and energy policies?" (1 = "very low capacity," 2 = low capacity," 3 = "medium capacity," 4 = "high capacity," and 5 = "very high capacity").

[c] Responses were coded as follows: 1 = "strongly disagree," 2 = "somewhat disagree," 3 = "I neither agree nor disagree," 4 = "somewhat agree," and 5 = "strongly agree."

places a "higher" priority on and has "high capacity" regarding climate and energy issues. Both organizational capacity questions correlate with a great extent of involvement at the national and international levels. A great extent of city-level involvement is not statistically significant in association with either organizational capacity question. Involvement at the state level, however, is associated with respondents reporting a high organizational priority for addressing climate and energy policies. The bottom part of exhibit 2 shows the proclimate-change beliefs by primary level of involvement. Most actors report that they "somewhat agree" (mean of about 4) with the items in the proclimate change-belief scale. No significant association exists between proclimate-change beliefs and involvement at the city, national, or international levels. A negative association, however, emerges between proclimate-change beliefs and involvement at the state level.

To help describe the tools and techniques that actors use, exhibit 3 outlines two scales via factor analysis from nine question items with factor loadings. The first scale encompasses collaborative tools and techniques, including collaborating with those with whom you agree, collaborating with those with whom you disagree, facilitation and consensus building (for example, focus groups and roundtables), and informal tools and techniques (for example, brainstorming and problem mapping). The second scale encompasses analytical tools and techniques, including modeling (for

Exhibit 3

Collaboration and Analytical Scales for Tools and Techniques

Question Items and Scales	Factor Loadings	
	Collaborative	Analytical
Collaborative tools and techniques scale (Cronbach's alpha = 0.75)		
Collaborate with those with whom you agree	**0.78**	0.20
Collaborate with those with whom you disagree	**0.72**	0.06
Facilitation and consensus building (for example, focus groups and roundtables)	**0.71**	0.19
Informal tools and techniques (for example, brainstorming and problem mapping)	**0.72**	0.27
Analytical tools and techniques scale (Cronbach's alpha = 0.70)		
Modeling (for example, climate-change scenarios and energy futures analyses)	0.07	**0.74**
Environmental impact analysis	0.10	**0.55**
Economic analysis (cost-benefit and economic impact analyses)	0.37	**0.63**
Risk analysis and assessment	0.15	**0.78**
Political feasibility analysis (for example, SWOT analysis and polling data)	0.35	**0.55**

SWOT = Strengths, Weaknesses, Opportunities, and Threats.

example, climate-change scenarios and energy futures analyses), environmental impact analysis, economic analysis (cost-benefit and economic impact analyses), risk analysis and assessment, and political feasibility analysis (for example, Strengths, Weaknesses, Opportunities, and Threats [SWOT] analysis and polling data). Cronbach's alpha for both scales is greater than 0.70.

Explanatory Analysis

Exhibit 4 presents the multivariate analysis explaining the variation in the frequency of use of various tools and techniques in climate and energy issues. Ordinal logit modeling was conducted for each tool and technique variable, with the explanatory variables organized by primary level of involvement, an organizational capacity scale, proclimate change-belief scale, the sum of an individual's formal training, and advanced degree. The models show moderate fit, with chi square probability less than 0.000 and pseudo R-square scores ranging from 0.05 to 0.15. The exception is the economic analysis variable, for which the ordered logit model inadequately fits the data. The results of an OLS regression analyses for the collaborative and analytical tools and techniques scales show a good fit, with adjusted R-square values equaling 0.26 and 0.21, respectively. All coefficients in exhibit 4 are unstandardized.

Overall, and with few exceptions, the results indicate that actors with significant city- and state-level involvement are more likely to engage in collaborative techniques than actors with little involvement. By contrast, actors involved in national and international levels are more likely to engage in analytical techniques. The exception is the result for actors operating at the international level, which is significant for collaborating with those with whom they agree and disagree and for the collaborative techniques scale. On further exploration into the data, we find that those involved at the international level frequently report a great extent of involvement at the city and state levels, as well.

For the other variables in exhibit 4, organizational capacity has significant, positive coefficients for six of the nine tools and techniques. Hence, those respondents reporting great organizational

Exhibit 4

Explaining Variation in Frequency of Use of Various Tools and Techniques in Climate and Energy Issues

	Collaborative Tools and Techniques					
	Facilitation and Consensus Building	Informal Tools and Techniques	Collaborate With Those With Whom You Disagree	Collaborate With Those With Whom You Agree		Collaborative Tools and Techniques Scale
Primary level of involvement						
City	0.52**	0.50**	0.40**	0.42**		0.25***
State	0.39	0.40	0.58**	0.49**		0.23**
National	0.02	0.18	0.34	0.43		0.15
International	0.28	0.26	0.61**	0.82**		0.23**
Capacity						
Organizational capacity	0.37**	0.51***	0.20	0.91***		0.25***
Proclimate-change beliefs	0.42**	0.09	– 0.32**	0.27*		0.05
Formal training	– 0.06	– 0.05	– 0.01	– 0.04		0.02
Advanced degree	0.66**	0.35	– 0.20	0.03		0.14
Psuedo R^2	0.06	0.06	0.06	0.15	Adjusted R^2	0.26
Prob > Chi^2	0.00	0.00	0.00	0.00	F-statistic	0.00

	Analytical Tools and Techniques						
	Political Feasibility Analysis	Risk Analysis and Assessment	Modeling	Environ-mental Impact Analysis	Economic Analysis		Analytical Tools and Techniques Scale
Primary level of involvement							
City	0.21	0.07	0.08	0.06	0.30		0.08
State	0.62**	0.19	– 0.04	0.08	0.04		0.09
National	0.02	0.63**	0.92***	0.70**	0.23		0.28***
International	0.38	0.22	0.35	0.46*	0.48*		0.21**
Capacity							
Organizational capacity	0.60***	0.48**	0.54**	– 0.00	0.14		0.14**
Proclimate-change beliefs	0.47**	0.14	0.06	0.11	0.04		0.05
Formal training	0.06	0.03	0.08*	– 0.09	– 0.03		– 0.01
Advanced degree	0.39*	0.45	0.65*	0.77**	0.27		0.26**
Psuedo R^2	0.08	0.06	0.10	0.05	0.02	Adjusted R^2	0.21
Prob > Chi^2	0.00	0.00	0.00	0.00	0.33	F-statistic	0.00

$^*p < 0.10$. $^{**}p < 0.05$. $^{***}p < 0.001$.

Note: Models are ordered logit analysis with robust standard errors except for the two scale-dependent variables, for which ordinary least squares regression was used (coefficients are omitted from exhibit; for the collaborative technique scale the constant = 0.50, and for the analytical techniques scale the constant = 0.17).

capacity are also reporting great frequency in using facilitation and consensus building, informal tools and techniques, collaboration with those with whom they agree, political feasibility analysis, risk analysis and assessment, modeling, and the overall collaborative and analytical scales.

Finally, the proclimate change-belief scale is significant in five out of nine categories. Those who agreed strongly with the proclimate change-belief scale are more likely to engage in facilitation and consensus building, collaborate with those with whom they agree, and engage in political feasibility analysis. They are less likely to collaborate with those with whom they disagree. Of the two remaining individual-level variables, formal training provided little explanatory power in the models and advanced degree was positively associated with four out of the nine tools and techniques, plus the analytical scale.

Discussion and Conclusion

Issues involving technocracy and collaboration plague the use and development of policy-related information. These findings show that the organizational capacity and the tools and techniques of policy analysis used in one salient public policy issue—climate and energy issues—is partially conditioned by the extent of involvement with each level of the governing system. We expand on these results via the following three points.

First, *local capacity to respond to climate and energy issues should not be restricted to local government officials*. To understand city-level involvement in climate and energy issues requires a broader perspective that considers the system of actors engaged at the city level rather than a perspective focusing solely on those actors employed by local government agencies. Actors involved at the city level can be found in other sectors, including nonprofit organizations, academics and consultants, and the business community, and in organizations at higher levels of government, including state and federal agencies.

Second, *the organizational PAC is greater for organizations involved in climate and energy issues at the national and international levels, whereas individual PAC is associated weakly, if at all, with level of involvement.* A high degree of organizational capacity and priority for climate and energy issues is consistently and positively associated with involvement at the national and international levels. This finding supports existing arguments about the barriers of local-level activities to address climate-change issues (for example, Betsill, 2001). Based on this sample of policy actors, however, individual PAC does not vary by the extent of involvement in any level of government.

Third, *collaborative techniques are more likely used at the city, state, and international levels, and analytical techniques are more likely used at national and international levels.* Perhaps through the combination of devolution and political stagnation at the federal level, effort on climate and energy issues has shifted toward city-level activities. The close proximity to citizens and the need for local engagement perhaps motivates these actors to apply tools and techniques of policy analysis that are less technocratic and more engaging, such as facilitation, informal tools (brainstorming), and collaborating with those with whom you agree and disagree. More technocratic tools and techniques (for example, risk analysis, modeling, environmental impact analysis, economic analysis, and political feasibility analysis) are more likely associated with those actors engaged at higher levels of government, especially the national and international levels. One exception involves actors involved at the international level, who are also reporting frequent use of collaborative techniques. The results support the integration of diverse techniques within the toolbox of policy analysts and provide a nuanced understanding that the tools and techniques applied might vary by the contextual situation, as measured here by the extent of involvement at each level.

This article contributes to our understanding of policy actors and processes by exploring the policy capacity of the individuals and organizations involved in the policy process and the tools and techniques they use. Any interpretation of these results clearly should recognize the absence of any criteria of influence or successful decisionmaking in relation to any extent of PAC. Longitudinal and cross-sectional analyses are needed to assess whether PAC actually leads to greater influence or better decisionmaking. Finally, although advancing the literature in innovative measures of PAC, this study is hampered by measures that could still be more detailed and exhaustive, for example, by specifying the quality of the training and education or by capturing network structures.

Despite these caveats, this article provides theoretical insight into our understanding of local-level climate and energy policy and the individuals and organizations involved. By contrast to the debate about whether advanced education and training or more participatory forms of policy analysis and policymaking are needed, this article suggests that addressing complex local policy problems, such as climate change, involves a combination of analytical and collaborative tools and techniques. Given that most actors are involved, to various extents, at the local level, the interpretation should not be one of a strict dichotomy of roles, but rather as reflecting a tendency to use certain tools and techniques to fit particular problems and needs at any particular level of government. Hence, PAC is partially a function of the extent of involvement in government. Among the next steps is to develop rigor in theory and recognition in practice about the roles and relations among actors from different levels of government in public policy issues.

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Public Risks and the Challenges to Climate-Change Adaptation: A Proposed Framework for Planning in the Age of Uncertainty

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Abstract

Previous research and practice suggest that the lack of a public constituency concerned about public risks and the traditional planning paradigm that is chronically deficient in addressing public risks are major challenges to adaptation to climate change. The core features of public risks associated with climate change are uncertainty about the effects of carbon dioxide emissions, broad distribution, and planning horizons that are decades away. In this article, we present new models that are emerging in research and planning practice that link collaborative governance with anticipatory governance. Coupling the models offers a new approach to planning that simultaneously formulates strategic guidance for current decisions to achieve future resiliency goals, and it builds supportive networks of stakeholders. We offer recommendations on how to make the transition to plans that are premised on uncertainty, flexible polices, monitoring, innovation, and feedback. We then recommend future research needed to examine the effectiveness of the planning framework we propose.

Introduction

For certain risks, it is difficult to create and sustain broad public responses. The inconspicuousness of such risks is common in the absence of a major sudden and harmful event (Birkland, 1997). Recent damaging hurricanes and wildfires and the detection of sea-level rise for which the impacts can be reduced have prompted limited reaction among affected populations and public policymakers. For other risks, however, awareness is sufficient stimulus for pervasive public response. Many consumers decided to not purchase a particular brand of automobile because of a widespread alarm about brake failure, for example.

This article focuses on emerging new models of local government planning to deal with risks for which public indifference is the norm, even when awareness of the risks is common. May (1991: 264) distinguished between the phenomena of public risks and private risks. He observed that public indifference seems to be most common in situations of public risk. He drew on Huber's (1986: 90) conception of *public risk*, "defined as a risk that is mass-produced, broadly distributed, temporally remote, and largely outside the individual risk bearer's direct understanding and control." Examples include sea-level rise, floods, ozone depletion, and earthquake risks. By contrast, May (1991: 264) defined *private risks* as "risks [that] are more immediate, focused upon by the individual, and generally understandable." Examples are automobile brake failures, steep stairs in a house, and tainted food.

For public risks, individuals often have incentives to avert losses, but multiple perceptual factors alter the objective decisionmaking that constrains responses.[1] Alternatively, private risks have sufficient incentives for individuals to act (for example, to fix failing brakes or steep stairs). The lack of incentives for public risks creates major challenges for policymakers and planners who must work to shift public perceptions so that the risks are more apparent, less remote, and more within the realm of acceptance of shared responsibility to take action (May, 1991). The situation is particularly troublesome, because many risks are increasingly perceived as public because of growing concentrations of population exposed to hazards and widespread diffusion of blame (Kahan et al., 2011).

The specific focus of this article is climate-change risk and how a new model of planning that draws on emerging concepts from literatures in collaborative governance and anticipatory governance can encourage the public and private sectors to reduce the risks. As documented in this article, the public is well aware of risks from climate change. Climate change-induced risks have produced limited public action, however. The evidence indicates that local efforts aimed at motivating risk-reducing actions are weak and inconsequential. Differences in levels of planning effort are not a function solely of objective risk; fundamental limitations constrain local adaptation to risks from climate change.

We focus on what local governments can do to reduce public risks based on planning that formulates multiple futures and flexible strategies to prepare for change and that builds a supportive public constituency for decisionmaking amid great uncertainty. Where appropriate, we draw on the instructive experiences of four decades of research and practice aimed at mitigating public risks posed by natural hazards (for example, floods, earthquakes, and hurricanes). These experiences inform the understanding of the effects of the planning function of local governments on a community's ability to take self-organized action to reduce public risks.

The Role of Planning

We focus on climate change-adaptation planning because of a growing chorus of calls for this activity to serve as an essential means to build community resiliency in the face of the increasing risks posed by climate change (Godschalk and Anderson, 2012; Quay, 2010, Wilson and Piper,

[1] See Lorenzoni and Pidgeon (2006) for a recent review of the literature.

2010). Resiliency is the ability of a community or society, along with the biophysical systems on which they depend, to resist or absorb the impacts (deaths, damage, losses, and so on) of hazards, rapidly recover from those impacts and reduce future vulnerabilities through adaptive strategies (Chapin III et al., 2009; Peacock et al., 2008).

A local plan can play a pivotal role in making a community more resilient by guiding how a community anticipates and responds to climate-change risks to people and property (Shuford, Rynne, and Mueller, 2010). By steering urban growth away from flood hazard areas, either current or forecast because of increased sea levels and more intense precipitation events, planning programs significantly reduce the possibility of major loss. For existing development in increasingly hazardous areas, planning programs help property owners relocate structures to safer sites, or elevate and strengthen those structures. Planning controls and land acquisition programs can play key roles in protecting ecosystems that build community resiliency to climate change.

The process of creating a plan directly addresses the core characteristics of public risks that inhibit proactive, near-term, individual action. In a study of 60 planmaking processes associated with natural hazard risk reduction, Burby (2003) found that planners motivate broader involvement by directly engaging more groups and by providing public forums for increasing awareness and understanding that public risks are mass-produced and shared problems. Such collaborative efforts expand the choices and opportunities to codevelop risk-reduction strategies.

Generating the information base as part of the planning process makes future risks seem more tangible. For example, in the process of modifying a floodplain map to account for sea-level rise forecasts, participants can see how climate impacts are relevant to their community, neighborhood, or home and how those impacts are similar to and different from the risks they face today.

A planning process that integrates information generation with public engagement also expands prospects for seeking new opportunities to produce *co-benefits* that have a positive effect on multiple interests rather than having narrowly defined benefits that suit individual interests. Protection of greenway corridors along waterways subject to rain-induced flooding exacerbated by climate change offers co-benefits by preserving flood-prone areas that might otherwise experience urban development (Younger et al., 2008). It can also provide alternatives for biking and walking that reduce automobile use and greenhouse gas (GHG) emissions and improve opportunities for physical activities that yield public health benefits. Previous research on the production of co-benefits revealed that information sharing raises knowledge about the sometimes unrecognized benefits (and costs) of household, business, and public-sector activities, which incentivizes an expansion in the number of participants who might not otherwise be involved and increases their acceptance of the need to act differently (Ostrom, 2010).

Recent studies indicated that, where strong plans have been adopted, they have fostered more robust local government actions aimed at reducing the public risks posed by climate change-induced natural hazards, including hurricane surge and inland flooding (Berke et al., 2006; Burby, 2006). Plans will likely be weakened and sparingly implemented, however, because of a set of climate-change challenges. What follows is a review of these challenges and observations about the application of strategies derived from the collaborative and anticipatory governance planning theories for inducing local action.

Challenges to Climate-Change Adaptation

The major challenges to effective adaptation to climate change include a lack of public constituency concerned about the public risks associated with climate change and plans that are chronically deficient in addressing public risks, primarily because a disinterested public creates minimal incentives for community action. Research initiated in the 1970s on local natural hazard mitigation efforts has accumulated a well-developed knowledge base, which is instructive in understanding the more recent emergence of concerns about the challenges to community adaptation to climate change. Much can be gained given the similarities between hazard mitigation and climate-change adaptation. Both hazard mitigation and climate-change adaptation deal with weather events that are likely to be exacerbated by climate change, both rapid-onset (for example, rain-induced flooding and hurricanes) and slow-onset (for example, drought) events (Min et al., 2011).[2] Both are oriented toward the future in dealing with public risks that generate widespread threats. Both focus on anticipating uncertainties and a range of possible futures, rather than responding to yesterday's events. Thus, the relatively well-developed literature on the human dimensions of natural hazards can be useful in understanding community behavior toward climate change, which is critical to formulating policy solutions that address the underlying symptoms of local reluctance to act.

Weak Public Constituency

May (1991) conceived the lack of a public constituency as a major challenge to action on public risks. In the case of climate-change adaptation, a lack of awareness cannot explain this deficiency. Our review of the risk-perception literature indicates that a low level of priority for action consistently accompanies a moderate-to-high level of awareness. Exhibit 1 illustrates the gap between awareness and priority to act based on survey data from several developed countries (Australia, Great Britain, Japan, and the United States). The gap is relevant for studies on climate change and natural hazards, and it is also relevant to the general public and those actors (for example, planners, real estate agents, elected officials, and so forth) who have a major stake in the potential loss to their communities.

The use of survey results raises cautions in terms of interpreting the responses, including the meaning of responses across cultures, perceptions that are not static over time, and that the aggregation of individual responses could potentially hide variations across different population groups. The results are consistent, however, with findings from risk-perception literature on climate change (Bord, Fisher, and O'Connor, 1998; Lorenzoni and Pidgeon, 2006) and natural hazards (Berke, 1998; May, 1991), in that the public is aware of the risks but assigns low priorities to taking action. In accordance with May's (1991: 266) observation, the perceptions "are consistent with the temporal and geographic remoteness, broad distribution of risk, and limited individual understanding associated with public risks."

[2] Scientific studies (for example, IPCC, 2012; Min et al., 2011) indicate growing confidence that climate change exacerbates some weather events (rain-induced flooding, hurricanes, and drought), but the connection is not as straightforward for other weather events (for example, tornadoes). Some climate scientists and scientific organizations, however, increasingly argue that it is irresponsible to avoid a discussion about the potential links to tornadoes (see Romm, 2011, for a discussion of the claims and emerging but tentative evidence).

Exhibit 1

Awareness of and Priority to Natural Hazards and Climate Change

Investigators	Survey Respondents	Awareness	Priority
Natural hazards			
Beatley and Brower (1986)	113 North Carolina residents facing hurricane risks	69% think damaging hurricanes probable in next 20 years	28% concerned about residential property damage
Becker et al. (2007)	479 Australia residents in four flood-prone communities	49% think major flood will affect their community within 5 years; 87% within 20 years	76% do not plan to seek additional information; 84% do not plan to become involved with local groups to discuss how to reduce risk
May (1995)	Managers from five of six public works and from eight of nine water resource departments that implement flood mitigation policy in New South Wales, Australia	Mean of 3.1 for flood threat to communities; 1 = no threat, 5 = very severe threat	Mean of 0.9 based on rating of the number of demands for action by communities from a list of 10 possible actions
Kunreuther (1978)	2,055 U.S. residents in flood-prone areas	50% report medium (> 0.01) or high (> 0.1) annual probability of damaging flood	27% perceive flood as serious problem
Tadahiro (2003)	3,036 Japan residents in Tokai flood disaster area	64% see need for resident-based flood risk management system	31% will participate in such a system if given the opportunity
Climate change			
Borberg et al. (2009)	295 Oregon coastal officials	82% consider climate change will affect Oregon coast this century	45% prepared to devote time or resources to respond; 31% ready to be a leader
Leiserowitz (2005)	551 U.S. residents	97% believe that climate change have adverse affective images (that is, stable negative images) associated with climate change	12% concerned about impacts on their family; 1% concerned about impacts on local community; 68% concerned for people all over the world and nonhuman nature
Moser and Tribbia (2006)	135 California local coastal government managers	54% strongly agree global warming real or already happening	30% acted on climate change issue
Reser et al. (2011)	3,095 Australia residents 1,822 Great Britain residents	74% of Australians think world's climate is changing 78% of British think world's climate is changing	42% of Australians feel sense of urgency to act 36% of British feel sense of urgency to change behavior
Whitmarsh (2008)	589 Great Britain residents in southern England	62% who experienced recent flooding think something should be done about climate change; 78% who experienced recent air pollution think something should be done	35% who experienced flooding have taken action on climate change; 40% who experienced air pollution have taken action

Sources: Adapted from May (1991); Berke (1998)

Several studies illustrate the challenges to stimulating action on issues that lack a public constituency. Moser and Tribbia (2006) found that 54 percent of 135 California coastal managers strongly agree that global warming is real and already happening in their communities but that only 30 percent acted on a climate-change issue. Leiserowitz's (2005) survey of 551 U.S. residents found that 97 percent believe that climate change has adverse affective images (that is, stable negative images) associated with climate change and 68 percent are concerned for people all over the world, but only 12 percent of those surveyed are concerned about impacts on their family and 1 percent are concerned about the impacts on their community. The findings for the local managers are of particular interest, because local managers tend to specialize in risk management more than residents and elected officials do, and they would be expected to place a higher priority on reducing risk. A possible explanation for managers' low level of time and attention given to climate-change adaptation is the lack of a political constituency (Deyle, Bailey, and Matheny, 2007).

A host of studies have revealed that the lack of a public constituency pushing for efforts to reduce losses is also predominant in the natural hazards policy arena. For example, May (1995) found that the floodplain managers charged with implementing flood mitigation policy in New South Wales, Australia, perceive that communities consider floods to be a moderate threat (mean of 3.1; 1 = no threat, 5 = very severe threat), but they report little community demand for action (mean of 0.9, based on the number of demands for action by communities from a list of 10 demands). Similarly, Beatley and Brower (1986) found that 69 percent of North Carolina coastal residents are aware of the potential damages caused by hurricanes, but only 28 percent are concerned about residential property damage.

Deficiencies of Local Plans

The lack of a public constituency, coupled with local officials' own limited concern about risks from climate change (and natural hazards), has created minimal incentives for local governments to address such public risks. Left to their own devices, relatively few at-risk communities would be expected to initiate risk-reduction actions. Recent reviews of contemporary practice concluded that, although the number of local climate change-mitigation initiatives is increasing rapidly (Wheeler, 2008; Zimmerman and Faris, 2011), only a few adaptation initiatives have emerged in the United States (for example, in Chicago, New York City, and Seattle). Zimmerman and Faris (2011) further concluded that, although more than 1,200 communities in the United States have enacted climate change-action plans,[3] only a few plans address the adaptation issues specifically and the vast majority focus on reducing GHG emissions.

The expectation of low levels of community response to public risks is further supported by studies of local natural hazard mitigation planning in both domestic and international settings. Assessments of hazard mitigation plans recently matured to the point at which it was possible to statistically compare findings from multiple studies based on meta-analytic methods. Berke and

[3] More than 1,000 cities, towns, and counties have signed a climate action agreement (USCM, 2009), and more than 1,200 such localities have agreed to mitigate climate-change impacts by reducing GHG emissions through the adoption of climate action plans and other related initiatives (ICLEI, 2009).

Godschalk (2009) conducted a meta-analysis of these studies based on common definitions of plan quality principles (goals, facts, policies, implementation, and monitoring).[4, 5] Exhibit 2 includes definitions of each of the five core principles and associated detailed indicators that serve as evaluation criteria for hazard mitigation plans. Exhibit 3 specifies findings from eight studies that are based on the proportional scores for each principle, ranging from 0 to 1.[6]

The meta-analytical comparisons reveal a host of serious deficiencies with hazard mitigation plans. Across all studies, all five principles of plan quality scored less than 50 percent of the maximum score. The goals principle scored better than 50 percent for two of the studies, and implementation scored better than 50 percent for one study. Common shortcomings identified by these studies include—

- *Goals* that are too narrowly conceived, accounting for efficiency and public safety but not other values critical to long-range resiliency, such as social equity and the protection of natural systems.
- *Fact bases* are typically only based on maps that delineate hazards, and numerical counts of property and population in exposed to hazards, but almost always lack estimates of potential future levels of exposure and alternative future scenarios of exposure to account for uncertainty and the possibility for a range of future changes.
- *Policies* that are narrowly focused on single structural projects (for example, dig drainage culverts, protect electric generators, elevate specific buildings) instead of comprehensive mitigation strategies that coordinate multiple economic, environmental, and social policies and investments in ways that support mitigation.
- *Implementation* elements that commonly do not assign organizational responsibility or identify timelines and sources of funding for carrying out actions.
- *Monitoring* programs that often fail to specify indicators and sources of data to track progress toward plan goals and designate organizations responsible for data collection.

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[4] Meta-analysis offers an alternative to the traditional narrative discussions of research studies, which are subject to several shortcomings: (1) the selective inclusion of studies, often based on the reviewer's own impressionistic view of the quality of a study; (2) the subjective weighting of studies in interpreting findings; and (3) the misleading interpretation of study findings (Wolf, 1986).

[5] The Berke and Godschalk (2009) study examined 16 studies focused on the quality of plans that address a range of issues such as biodiversity, affordable housing, and the rights of indigenous people. For our purposes, we focus only on those studies examined by Berke and Godschalk that account for natural hazard mitigation, as exhibit 3 illustrates. We also include a study by Tang et al. (2008) that was not included in the Berke and Godschalk (2009) meta-analysis.

[6] The Berke and Godschalk (2009) meta-analysis found it impossible to use values directly from each study because individual studies differed in how they measured plan quality characteristics (for example, scales and the number of items for each criterion vary) and computed plan quality scores. As an early and influential article on meta-analysis (Glass, 1977) discussed, a critical element of the meta-analytic procedure involves transforming the statistics of interest (for example, means and standard deviations) into standardized scores that permit the analysis of findings across studies. To create the findings reported in exhibit 3, such a transformation made scores comparable across plan quality characteristics. For studies that reported standardized proportionate scores (for example, Berke et al., 1996; Brody 2003a, 2003b), Berke and Godschalk could use the findings directly. For other studies (for example, Burby and May, 1997; Nelson and French, 2002), Berke and Godschalk transformed scores by plan quality characteristic by first identifying the maximum possible score for characteristics in each study, and then dividing the reported score of each characteristic by the total maximum score to determine a proportionate score.

Exhibit 2

Indicators of the Principles of Plan Quality for Hazard Mitigation Plans

Goals. Reflections of public values that express desired future conditions.
- Enhance community resiliency.
- Protect ecosystem services that support hazard mitigation.
- Protect public safety.
- Reduce property damage.
- Reduce economic impacts.
- Promote equity.

Fact bases. Provide the empirical foundation of current and future conditions to ensure that key hazard problems are identified and prioritized and mitigation policymaking is well informed.
- Maps of current and projected hazards.
  - Delineation of location of hazard.
  - Delineation of magnitude of hazard.
- Exposure (current and projected).
  - Number and characteristics of population exposed (low-income, disabled, minority).
  - Number and total value of different types of public infrastructure exposed.
  - Number and total value of private structures.
  - Number of critical facilities exposed.
  - Loss estimations to public structures.
  - Loss estimations to private structures.

Policies. Specification of general guidance to decisions about land use and development and assure that plan goals are achieved.
- Development regulations (zoning, subdivision, setbacks).
- Taxation and fiscal policies.
- Critical public infrastructure investment policies.
- Structural protection (drainage culverts, seawalls, levees).
- Property acquisition and relocation programs.
- Information dissemination program.
- Protection of natural mitigation features.

Implementation. Involves assignment of organizational responsibilities and identification of proposed timelines and projected costs of implementing proposed policies and actions.
- For each proposed policy and actions, identify—
  - Organization with lead responsibility for implementing proposed policy or action.
  - Proposed timeline for completion or milestones toward completion.
  - Projected cost (for example, funds required, staff time).

Monitoring. Involves tracking performance of the plan and its proposed policies and actions.
- Identifies parties responsible for monitoring progress.
- Includes indicators for measuring performance.
- Identifies obstacles to implementation.
- Includes provisions for public involvement in ongoing monitoring.

Source: Adapted from Berke and Godschalk (2009)

Findings from the individual studies in exhibit 3 further illustrate these shortcomings. For example, Burby and May (1997) reported that 90 local governments in three states (California, Florida, and the North Carolina coastal zone) with mandates that require various hazard provisions in comprehensive plans had significantly higher scores for goals, facts, and policies than 90 local governments in three states (North Carolina noncoastal zone, Texas, and Washington) without mandates. Burby and May concluded, however, that most plans under the mandates considered hazard risks in only

Exhibit 3

Findings on the Quality of Local Natural Hazard Mitigation Plans

Investigators	Sample	Goals	Fact Bases	Policies	Implemen-tation	Monitor-ing
Burby and May (1997)	90 mandated local plans;	0.13	0.34	0.36		
	90 nonmandated local plans	0.03	0.09	0.06		
Berke, Dixon, and Ericksen (1997)	16 New Zealand regional plans;	0.68	0.14	0.11		
	7 Florida regional plans	0.53	0.45	0.23		
Berke et al. (1999)	34 New Zealand local plans;		0.06			0.39
	16 New Zealand regional plans		0.12			0.21
Nelson and French (2002)	19 California local plans	0.18	0.21			
Brody (2003a)	59 Florida and Washington local plans; t_1 = 1991; t_2 = 1999	0.10	0.09	0.05		
		0.13	0.12	0.12		
Brody et al. (2004)	35 Florida local plans	0.36	0.24	0.42	0.30	
Tang et al. (2008)	43 local plans in three Pacific coastal U.S. states	0.40	0.32	0.15	0.10	
Lyles, Berke, and Smith (2012)	115 local coastal plans in six states	0.52	0.39	0.29	0.60	0.35

Note: Scores are standardized ranging from 0 to 1.
Source: Adapted from Berke and Godschalk (2009)

the most rudimentary manner. Berke, Dixon, and Ericksen (1997) compared 16 mandated regional plans in New Zealand with 7 in Florida and found core differences across the principles because of differences in mandate design (for example, clarity of goals, local capacity features, and stringency of sanctions for noncompliance). They also found major gaps in both groups of plans, however, including only general verbal descriptions of the natural hazard problem that sometimes lacked numerical facts and vague policies that were not closely linked to local hazard conditions. Tang et al. (2008) studied tsunami mitigation provisions in 43 local coastal plans in three Pacific states and found that the typical plan contained only a general description of the tsunami problem, that vague policies are not closely linked to local hazard conditions, and that less than one-fourth of plans included implementation and monitoring programs.

Given the considerable public indifference and local official reluctance to act on public risks associated with natural hazards and climate change, the limited support for planning and the resulting weak plans in the case of natural hazard mitigation are not surprising. National and state policy interventions designed to mandate, incentivize, and build local government commitment and capacity to take action have had some positive effects in the case of natural hazard mitigation, and in some cases they have led to innovative hazard mitigation plans (Schwab, 2010). Forward movement on action, however, has been slow and limited in the natural hazard mitigation field. Reviews in the 1990s of federal (May, 1991) and state (Berke, 1998) natural hazard mitigation programs drew similar conclusions about the positive but limited external influence of higher level of government programs. Our review suggests that a similar situation might occur in the case of climate change-adaptation planning.

The Local Government Paradox

Burby (2006) summed up the situation of public indifference and limited influence of external interventions as a *local government paradox*. The paradox arises when local governments fail to anticipate the risks or enact strong plans and effective practices although they are at risk to high levels of losses (Burby, 2006). This situation poses a major obstacle to creating high-quality plans that support community resiliency. For natural hazards, Mileti (1999: 66) found that federal disaster relief covered only a small proportion of total U.S. disaster losses between 1977 and 1997 and that most of the losses are not insured, because they are "borne by victims." The implications of failing to enact strong climate change-adaptation plans are daunting. In California alone, for example, $2.5 trillion in real estate assets are at risk from extreme, climate change-induced weather events, sea-level rise, and wildfires, with a projected annual price tag of up to $3.9 billion during this century (Roland-Holst and Kahrl, 2008).

We would expect that hazard mitigation would be a high priority for local officials. As the data on local planning for natural hazards reveal, the paradox is that at-risk local governments are reluctant to take risk-reducing actions, because such hazards are low on their list of priorities. As noted previously, early signs of the comparatively slow response to climate change-adaptation planning unsurprisingly reveal a similar pattern of limited local action.

Although much remains to learn about natural hazards and their effect on natural and built environments, the local government paradox is not one of insufficient scientific and technical knowledge. The past four decades have seen numerous advances in our understanding of risk-reduction practices for natural hazards (Mileti, 1999; NRC, 2006). Despite the growth of a technical knowledge base, the implementation of existing knowledge in natural hazard risk-reduction practices has been limited, as reflected in the quality of local hazard mitigation plans. Scientific groups reviewing the hazard mitigation programs (NRC, 2006) and numerous organizations representing the professions active on issues of the built environment and risk reduction (Thomas et al., 2011) have raised concerns about this situation. Attention has been shifting from technical concerns linked to structural engineering, flood hydrology, and hurricane forecasts to governance approaches aimed at motivating the adoption of risk-reduction actions.

Local action on climate-change adaptation is further constrained relative to action on natural hazards mitigation, because greater scientific uncertainty exists about how natural climate systems will respond over time and how successfully social systems will reduce GHG emissions (Blanco et al., 2009). In a 2009 report, *Global Climate Change Impacts in the United States,* a group of leading scientists agreed that "climate will be continually changing, moving at a relatively rapid rate, outside the range to which society has adapted in the past, [but] the precise amounts and timing of these changes will not be known with certainty" (USGCRP, 2009: 11). The high level of uncertainty could pose an even greater obstacle to climate-change adaptation compared with natural hazard mitigation (Camacho, 2009; Hallegatte, 2009; Patt, Klein, and de la Vega-Leinert, 2005; Popper, Lempert, and Bankes, 2005).

The traditional planning approach of *predict and plan* further constrains action, because local governments are not well equipped to deal with the complex, uncertain, and accelerating changes linked to climate change (Barben et al., 2007; Quay 2010). *Predict and plan* is Quay's (2010) phrase to describe the current practice of physical urban and regional planning, in which most planning forecasts future trends or a future desired state and then identifies the infrastructure and land use requirements needed to accommodate or create this future. This approach has long been rooted in planning practice, wherein forecasts of population and employment drive physical planmaking (for example, Chapin, 1965), and it is clearly evident in hazard mitigation plans (see exhibit 3). Quay (2010: 498) further observed that "the [traditional] approach worked when social and environmental systems were stable and predictable over short periods of time; however, when uncertainty and complexity are high this is not the case, making forecasting difficult."

Drawing on Rittel and Weber's (1973) analogy of wicked public planning problems, which are difficult or nearly impossible to solve, Quay (2010) observed that the characteristics of widely shared climate-change risks (uncertainty about the causes and effects, lack of an immediate or ultimate test of a solution, and planners' liability for the consequences of their actions) pose major obstacles to local climate change-adaptation planning. As evidenced by the serious deficiencies in contemporary local hazard mitigation planning, the situation points to the difficulties of engaging reluctant communities and individuals to be involved in climate change-adaptation planning and to improve their understanding of the need for a greater shared responsibility for addressing public risks.

Expanding the Scope of Planning

In response to these deficiencies, new models are emerging in scholarly literature and practice that extend well-established traditions of consensus building in collaborative governance and link this new thinking to the emerging model of anticipatory governance.

New Conceptions of Collaborative Governance

The traditional approach to collaborative governance is to bring diverse private and public stakeholders together in a consensus-oriented forum for decisionmaking (Innes and Booher, 2010). This literature emerged in the late 1980s in response to failures of top-down decisionmaking processes prioritizing elite or technical knowledge, and it focuses instead on a process of shared learning and understanding through authentic dialogue (Innes, 2004). Planning processes are truly collaborative when "all the affected interests jointly engage in face to face dialogue, bringing their various perspectives to the table to deliberate on the problems they face together" (Innes and Booher, 2010: 6).

During the past 30 years, collaboration has encompassed activities such as joint ventures, regulatory negotiation, public-private partnerships, community gatherings and public meetings, and other settings in which stakeholders with a shared interest assemble to diagnose a problem and develop an understanding of how to address it. This process emphasizes transferring technical knowledge from experts to participants and tapping the ordinary knowledge of participants to produce new knowledge through their interaction (Deyle and Slotterback, 2009). The ultimate aim of collaborative processes is to reduce adversarial relationships, redress power and resource disparities among stakeholders, and achieve consensus (Innes and Booher, 2010).

Recent literature has extended the collaborative governance model to embrace the concept of communities of practice. Rather than resolving conflicts and achieving agreement to solve specific problems, the purpose of communities of practice is expanding collaborative partnerships and cultivating expertise. Goldstein and Butler (2010: 240) maintained that "… a community of practice is assembled not around a problem, but around a core domain [of issues] that its members know and care about. Activities around this common domain may include critiquing existing practice, developing innovative approaches, or imparting traditional practices to new members." Rather than bridging ideological or expertise boundaries to achieve agreement on a course of action, communities of practice strengthen connections among participants who "aim for good collective practice" (Goldstein and Butler, 2010: 240).

Within communities of practice, participants gain status and authority based on respect and trust rather than on formal authority, because involvement is voluntary. Participants "cultivate a sense of belonging by sharing stories from experience and demonstrating the skills and techniques associated with their practice" (Goldstein and Butler 2010: 240). Goldstein and Butler's (2010) study of the U.S. fire management learning network concluded that, rather than paying attention to building consensus, the network fostered the expertise of managers in ecological protection and cultivated an expanding network of collaboratives by linking localized planning efforts with regional communities of practice. They maintained that the new approach might amplify the potential for fundamental change in the culture and practice of public risk management. In addition, as evidenced by the growth of the learning network, individuals who benefit from participation in a community of practice can become motivated to nurture and distribute expertise in other locales and, in turn, expand and sustain broader regional and national networks. Finally, Goldstein and Butler (2010) argued that linking multistakeholder collaborations and communities of practice can provide autonomy for individual collaboratives while also fostering cohesion across collaboratives.

Anticipatory Governance

Anticipatory governance is "a new model for planning and decision making under high uncertainty based on concepts of foresight, flexibility, and a wide range of futures to anticipate adaptation strategies, and then monitoring change and uses of these strategies to guide decision making" (Quay, 2010: 497). Instead of attempting to avoid or deny uncertainty, anticipatory governance aims to explore uncertainty and its implications for guiding current and future decisionmaking. This model of planning recognizes the limitations of managing built, natural, and social environments based on previous experience, and it offers opportunities to build local networks and problemsolving capacity amid great uncertainty about the future. Fuerth (2012: 1) contended that anticipatory governance "provide[s] a way to use foresight, networks, and feedback to reduce risk, improve planning…by mobilizing the full capacities of government, and increase capacity to respond to events at earlier stages, just barely visible at the event horizons."

Most of this literature is new, not yet well defined in theory, and only beginning to be applied to planning practice. For example, Godschalk and Anderson (2012) recently called for the integration of anticipatory governance concepts into the next generation of comprehensive plans.

Because anticipatory governance recognizes that some aspects of the future are uncertain and that forecasts should represent a range of plausible futures, scenario planning has emerged as a core means to apply new concepts (Fuerth 2009, 2012; Quay, 2010). In the case of climate change, plans that include a range of future climatic conditions and impacts provide foresight and enhance local ability to adapt to uncertainty. Planners would rely on foresight and modeling methods as a means to help identify and mobilize responses to new challenges when they are still nascent (Hopkins and Zapata, 2007). They would avoid reliance on historical data, because they should not expect past trends to be valid in the development of future trends. The aim of scenarios is to bound the future but in a flexible way that permits learning and adjustment as the future unfolds.

Coupling the Collaborative and Anticipatory Models

Our conception of climate change-adaptation planning entails integrating the collaborative approach now dominant in planning with the anticipatory governance model. Emerging new models of collaborative governance would embrace the traditional practice of authentic dialogue, wherein stakeholders and experts fashion plans and policies together, but they would also emphasize building and expanding a core network of members focused on the public risks associated with climate-change adaptation. Anticipatory governance would address the twin climate-change phenomena of acceleration and complexity and would help identify otherwise unforeseeable events sooner. We suggest that this coupling could help communities confront a new class of complex and rapidly changing challenges linked to climate change and simultaneously build a public constituency by engaging multiple stakeholders.

The integrated approach would explicitly recognize that local governance capacity to plan needs to be improved to foster interactive dialogue between experts and stakeholders. Such a dialogue would construct plausible futures that are well understood and technically informed, and it would create flexible strategies that are publicly relevant, tangible, and adaptable across a range of future impacts. It would also focus on the expansion of networks of actors among typically compartmentalized public agencies, private-sector groups, and nonprofit groups.

Our reading of scholarship and practice suggests that planning that provides effective adaptation strategies and builds a public constituency amid conditions of great uncertainty should consist of specific actions across multiple stages of decisionmaking. Specifically, we use Quay's (2010) broad stages of anticipatory governance but extend his formulation to embrace the concepts of collaborative planning. These stages are to (1) develop a knowledge base through collaborative scenario formation that anticipates multiple futures and associated impacts, (2) formulate flexible adaptation policies, and (3) create a program of action for implementation of polices and monitoring outcomes. For each stage, we describe the core concepts and examples from climate change-adaptation planning practice in which local governments are applying concepts of collaborative and anticipatory governance.

Develop a Knowledge Base That Anticipates Multiple Futures

Amid great uncertainty, the knowledge base for local planmaking and implementation should consider a range of possible future scenarios rather than a forecast premised on a single future scenario based on previous experience and the historic range of previous variability (Fuerth, 2009; Quay, 2010). Scenario development can employ a range of methods and approaches (aggregated averages, sensitivity analysis of factors or decisions driving the scenarios, identification of unacceptable scenarios or worst cases, and assessment of common and different impacts among the scenarios).

Local planmaking that accounts for a range of possible future climate conditions and associated impacts on human, built, and natural systems will provide local governments the foresight to reduce risks and to increase their ability to anticipate and adapt to events at early rather than later stages of their development.

Scenarios are generally thought of as cogent stories intended to aid decisionmakers. They are intended to foster imagination and facilitate critical thinking about how a future might unfold. The practice of scenario planning should not be solely be expert driven but also facilitate public participation with focus groups, roundtable discussions, or Delphi methods. Thus, involving the lay public, a diverse range of stakeholder groups, and experts in the process of developing and evaluating scenarios enables the integration of expert knowledge with lay knowledge of existing conditions and future concerns (Innes and Booher, 2010).

The Denver and London climate change-adaptation planning efforts offer two distinct approaches to using scenario-planning concepts, but both entail weaving expertise into multistakeholder collaboration and fostering the expansion of a network of collaborators. The initial work of Denver Water, a public utility separate from the government of the city of Denver, focused on constructing simple, normative scenarios that served as imaginative stories. The scenarios use metaphors such as "traditional future," "hot water," "green revolution," and "economic woes," with each scenario having alternative impacts on future water supply and demand (Denver Water, 2008). The scenarios were initially established by planning staff at Denver Water, then reviewed by water resource experts and the Denver Board of Water Commissioners. A second initiative of Denver Water's scenario development involved a more expansive probabilistic futures analysis, which aimed at fostering a broader involvement among water managers and interest groups and at embracing a stronger technical and scientific basis for scenario construction (Quay, 2010). It includes a multistakeholder collaborative from state agencies, local agencies, and interest groups (conservation groups, real estate development interests, and stormwater utilities) who are working with practitioners from organizations with considerable technical expertise (for example, Western Water Assessment and the National Center for Atmospheric Research).

Like Denver's second initiative, London's approach emphasizes the construction of predictive scenarios based on statistical probabilities of occurrence that involve modeling (see exhibits 4 and 5). In developing the first local climate change-adaptation plan in the United Kingdom in 2007 (City of London, 2007) and updating it in 2010 (City of London, 2010), planners were keenly interested in including a wide range of stakeholders from within city government. They facilitated a series of small working meetings to identify and appraise climate change-adaptation action within collaborative groups of stakeholders and representatives from different departments (planning, economic development, children's and adults' services, and others). Representatives would host workshops pertinent to their area of administration. The intent was for the groups to exchange information, receive technical advice from invited experts, and aid in the creation of cooperative solutions. London planners also organized citywide meetings in which department leaders could exchange ideas, compare individual department plans, and seek better ways to innovate and make progress. The citywide effort facilitated sharing ideas and resources across departments, making work at individual departments more consistent. The goal was not only to create a climate change-adaptation plan but also to gain initial acceptance and build inhouse capacity among city staff.

Exhibit 4

London Climate Action Plan

Predictive modeling

London initially explored four major climate risk factors: temperature, precipitation, sea-level rise and extreme events. To define these factors, climate specialists examined temperature and precipitation results from multiple climate-change models for two emission scenarios defined by the IPCC Working Group III report (Nakićenović et al., 2000) in each of two future 30-year periods. The United Kingdom Environment Agency projections were used to estimate the rise of the River Thames in the range 0.2 to 0.9 meters by 2100, with a worst case scenario of 2.7 meters.

The committee estimated the most likely range for each factor in each future period, including the 33- to 66-percent likely events range, and the 10- to 90-percent extreme events range. The probabilistic projections were used to illustrate ranges of future changes in climate variables over a selected location. The information on low-probability (extreme) events will be particularly relevant for contingency planning.

To illustrate how the average change and probabilistic ranges for factors are presented in the London climate change-adaptation plan, exhibit 5 shows the average projected future increase and possible ranges in the wettest winter day for London in a high greenhouse gas emissions scenario. In this scenario, the likely range of change in average summer rainfall is +1 to +9 percent by the 2020s and +7 to +19 percent by the 2050s.

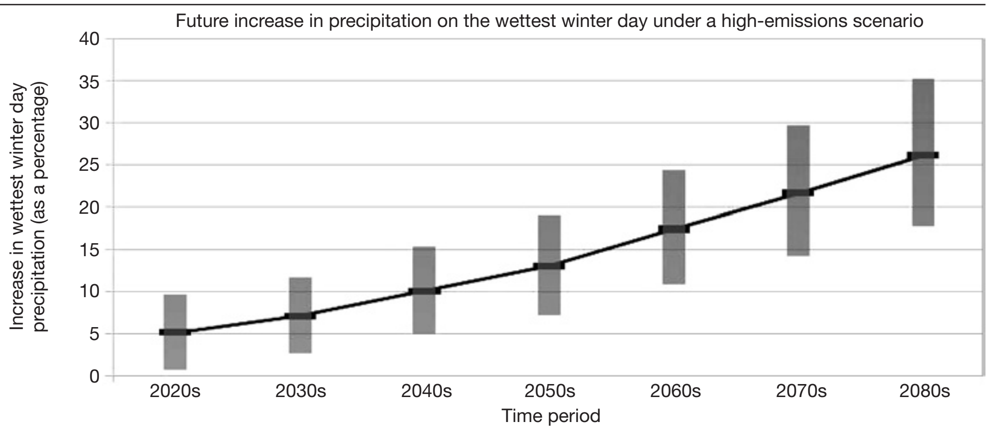
Engagement

Staff from across city, metropolitan, and national government agencies were then asked to identify which social, economic, and infrastructure systems would be vulnerable to impact from the climate risk factors using these probabilities. Next, planners facilitated four smaller working meetings among these experts to identify and appraise adaptation action to assess the climate risks, with representatives from different departments (including planning, economic development, children's and adults' services, and others) hosting various workshops pertinent to their area of administration. During these meetings, agency staff were also asked to assess how an impact caused by a change in the risk factor would affect the scope of responsibilities of their agencies and to determine and prioritize subsequent actions.

Source: City of London (2010)

Exhibit 5

Rise in Winter Precipitation in City of London Because of Climate Change



Notes: The black line shows the central estimate (50th percentile) of the increase in precipitation on the wettest winter day for the high-emissions scenario. The wide gray bars show the likely range of change (33rd to 66th percentiles). The error bars show the 10th and 90th percentile events (future increase in precipitation on the wettest winter day is very unlikely to be outside this range).

Source: City of London (2010: 11)

In 2010, the climate change-adaptation plan was updated (City of London, 2010) and integrated into the city's Local Development Framework, adopted in 2011 (City of London, 2011). The framework is a comprehensive spatial plan that includes strategies focused on climate change and other ongoing city development goals and programs (for example, environment, economic development, and health). The goal of the next cycle of climate change-adaptation planning is to engage broader stakeholder involvement that includes partners from across the metropolitan region (City of London, 2010).

Formulate Flexible Adaptation Policies

After scenarios are complete, the next step is to craft flexible policies (to be linked to appropriate monitoring systems, as we will discuss). Analysis of the risk-reduction effects of potential policies across a range of scenarios can be used to develop integrated adaptation plan polices. Policies and strategies (an integrated set of policies) represents the heart of a plan, because they guide public and private decisions to achieve a desired state of resiliency, but climate-change policies must be designed to be adaptive.

The anticipatory governance literature suggests that adaptation policies can be arranged into two broad classes of action (Chakraborty et al., 2011; Hallegatte, 2009; Quay, 2010). *Contingent* policies are tailored to a specific future. If a particular policy is preferred under one set of changes but not under other sets of changes, then the policy is contingent. If a future outlined by a particular scenario does not materialize, then the policy aligned with that scenario will remain unused, but without such a policy a community risks being unprepared. The *worst case* option is an instance of a contingent policy. *Robust* policies are those that have a positive effect across many possible futures and can preserve future options. These policies offer a robust decision that yields preferable results under multiple scenarios, and include two options. The *no-regrets* option is justified by current climate conditions, and further justified when climate change is considered across many possible scenarios. The *low-regrets* option is low cost in the short term and can be adapted over time to address several possible scenarios. This latter option allows for the distribution of costs over time as opposed to one-time lump sum investments to carry out a particular policy that might be abandoned.

A combination of robust and contingent policies offers a flexible approach that can be implemented as needed. Work associated with the *City of Punta Gorda Adaptation Plan* (Beever et al., 2009) and with transportation and land use planning for the Charlotte County-Punta Gorda area (Chapin, Deyle, and Higgins, 2010) in southwest Florida illustrates how a range of robust and contingent policies, linked to land use and emergency preparedness, are packaged and applied in the context of a growing, hurricane-prone region subject to sea-level rise. For example, exhibits 6 and 7 illustrate the transportation and land use planning effort. Similarly, the London plan uses primarily robust policies that offer a comprehensive set of low-regrets and no-regrets options (see exhibit 8). Whenever possible, the London plan attempts to use these policies in ways that generate co-benefits (or win-wins). For example, the installation of green roofs enables climate-change adaptation by reducing stormwater runoff and generates benefits for climate-change mitigation by reducing electricity consumption to heat and cool buildings and GHG emissions.

Exhibit 6

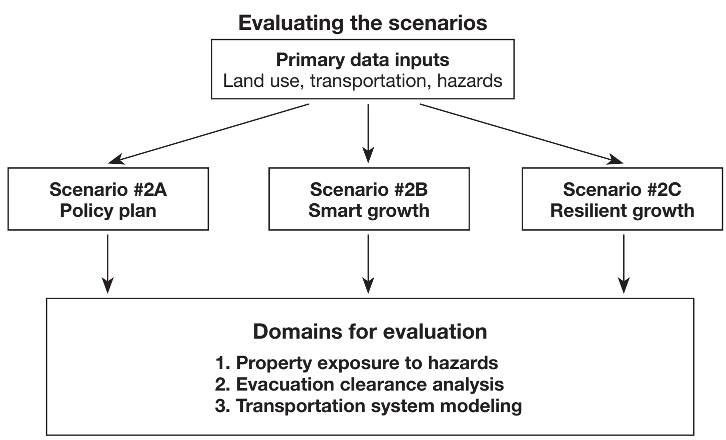
City of Punta Gorda Adaptation Planning Polices

Alternative climate-change and urban-growth futures for the City of Punta Gorda, Florida, adaptation plan (Beever et al., 2009) included robust policies that would work well across all scenarios and, under a transportation planning initiative for Charlotte County-Punta Gorda, included a worst case policy focused on altering urban land use pattern to reduce property loss (Chapin, Deyle, and Higgins, 2010). One example of a robust policy arose from the finding that all scenarios of sea-level rise impacts on hurricane surge penetration, assuming no further urban growth, showed evacuation capacity to be adequate to meet existing demand, even in the worst case hurricane event. In all scenarios of future urban growth patterns (see exhibit 8), however, growth from new development would either trigger the need for an expansion of highway capacity (more lanes) for evacuation or require significant demand reduction through alternative modes of evacuation (for example, more bus service and carpooling). In response, the city has a concurrency requirement to ensure expansion of transportation capacity to accommodate additional growth.

The pilot planning project included a worst case scenario portraying the severity of potential property loss from smart growth development patterns to be greater than that of the other two development scenarios (see exhibit 7). The smart growth land use scenario consists of three conditions: (1) development is constrained to a smaller urban service area, (2) a range of housing types are developed in or near identified urban centers, and (3) commercial development is targeted to identified urban centers. Using this scenario, it would be possible for local planners to modify traditionally accepted model land use regulations and infrastructure investment schemes that often support smart growth development in dangerous locations (Berke, Song, and Stevens, 2009).

Exhibit 7

Evaluating the Impacts of Future Scenarios, Punta Gorda, Florida



Source: Chapin, Deyle, and Higgins (2010)

In the Florida and London cases, the collaborative planning processes supported development of flexible policies that require joint actions by participants. Both planning efforts involved a policy formation that engaged government agencies that normally focus on single policy domains (for example, emergency management, transportation, land use, and economic development).

Although the intent of the Punta Gorda and London efforts was to build commitment to acting cooperatively, the engagement processes were distinct. London worked internally at first, and then externally expanded the network, whereas Punta Gorda attempted to expand the network up

Exhibit 8

Adaptation Actions To Manage Flood Risks in the City of London's Climate Change-Adaptation Plan

Research and monitoring

- *No regrets.* The City of London should work to identify and map flash flood 'hotspots' and assign responsibility for coordination and liaison on flood risk management in order to ensure its practical implementation.
- *Low regrets.* The City of London should improve the monitoring and recording of gully overflows linked to heavy rainfall events and assess the capacity of sewers managed by the City of London to cope with increasing rainfall due to climate change, as well as coordinating with the Thames Tideway Tunnel project.

Policy

- *No regrets.* The draft LDF (Local Development Framework) includes policies on Flood Risk and Sustainable Design and Climate Change, which promote the use of sustainable drainage systems (SuDs), such as green roofs, and street enhancements. Sustainable drainage systems such as green roofs should be encouraged as part of new developments, redevelopments, and major refurbishments the LDF planning agreements should be used to secure long-term commitment to the management and maintenance of SuDs.
- *Low regrets.* The City of London LDF should require that drainage systems in all developments have the capacity to cope with heavier rainfall events expected over their lifetimes, taking account of climate change.

Practical actions

- *Low regrets.* The City of London should encourage businesses to consider relocating flood-sensitive IT equipment and archives to areas with low risk of flooding. The Contingency Planning Department should encourage businesses with assets and equipment that need to be on site, to move them away from locations at higher risk of flooding, such as basements.
- *No regrets.* Developers should be encouraged to install sustainable drainage systems and green roofs in targeted flash flood 'hotspots' for new developments, redevelopments, or major refurbishments.
- *Win-win* and *No regrets.* The City of London Corporation should consider installing sustainable drainage systems, green roofs, or green walls on City of London-owned car parks and buildings, when they are refurbished or replaced.
- *Low regrets.* The City of London should examine a range of incentives to encourage sustainable drainage systems and green roofs.

Source: City of London (2010: 18)

front. As noted previously, London planners focused within city government in the 2007 planning process, but the scope of engagement expanded when the plan was integrated into the 2011 Local Development Framework (City of London, 2011). Developing the framework, a comprehensive spatial plan that coordinates climate-change adaptation with other ongoing city development goals and programs, involved extensive public involvement and review, as discussed in the public participation plan (City of London, 2011). The Punta Gorda initiative involved an extensive effort to include the public and a broad range of stakeholders, beyond government agencies, affected by policy outcomes (Beever et al., 2009; NOAA, 2010). Planners emphasized the codevelopment of information, engaged climate scientists, and designed a bottom-up review process for selection of strategies.

Create a Program for Implementation Action and Monitoring

By contrast to a fixed predict-and-plan approach, an adaptive approach is premised on the idea that communities are dynamic and changing, and plans must be revised in a continuing process. For a plan to be influential in guiding decisionmaking, it should contain a flexible program of actions, including the tracking of action items and the resiliency of outcomes of such actions. Such a program decreases the likelihood of the common occurrence whereby local plans languish or are forgotten (Laurian et al., 2004).

For climate-change adaptation, this approach would mean (science permitting) identifying and monitoring the climate factors most closely tied to local effects, to allow for sufficient time to respond through action. Because climate change will unfold during the next 100 years, decisions on implementation, monitoring, and adaptive actions should take place incrementally over a long period (Quay, 2010; Wilson and Piper, 2010). Indicators of change should be monitored on a regular basis, and decisions to implement anticipated adaptation strategies considered in light of actual trends.

As with the knowledge base and policy stages, collaborative approaches are essential in the action and monitoring stage. Adaptive implementation and monitoring are socially constructed processes that require the engagement of experts and stakeholders, especially those with on-the-ground local knowledge (Innes and Booher, 2010). Given the scientific limitations of climate-change research, and the uncertainties of how different population groups (for example, those defined by race, class, and gender), and stakeholder interests (for example, businesses and environmentalists) are affected by climate change, many kinds of knowledge will be important for ongoing problemsolving. Given such complexity, expert and lay participants need to work together to improve their shared experiences of the effects of change. Moreover, ways are needed of jointly analyzing data derived from indicators of change. As noted previously, broad-based communities of practice are useful for providing participants forums for comparing their plans with those of their peers, sharing ideas, and developing innovations (Goldstein and Butler, 2010). This benefit should extend not only to developing plans, but also to participants sharing experiences of the challenges they have faced in implementation and monitoring and sharing insights on the approaches they have taken that have supported effective implementation and monitoring.

To date, of the few adaptation planning efforts, all are in the early stages of developing structured monitoring programs. London indicated that it will monitor implementation of the actions in the plan at 6-month intervals at interdepartmental working group meetings and through annual reports to sustainability officers responsible for coordinating the strategy (City of London, 2010). Punta Gorda's plan described the importance of engaging a network of stakeholders—including the most vulnerable groups—in ongoing monitoring, the need for "carefully developed sets of indicators," and the value of "mainstreaming" adaptation to generate co-benefits for other community goals and objectives (Beever et al., 2009: 316–319). In terms of ongoing monitoring, a table in the plan lists six main adaptation actions and details the relevant measures of the physical environment, a responsible agency for collecting data, and primary target goals.

A major challenge to moving forward is the current state of climate science. By the time change in temperature, precipitation, and sea levels are detected locally, it may be too late to adapt. Quay (2010) observed that global climatic indicators may be the best option to monitor changes. For example, changes detected in El Nino and in ocean current oscillations could be applied to consider potential trends at the regional and local scales. Quay (2010) noted, however, that how local government planning programs can use these broader trends is not clear.

The United Kingdom is one of the most advanced countries where local governments are furthest along in setting indicators of climate change, primarily because of technical assistance from the national government. Specifically, each local government throughout the country is responsible for gauging progress in the context of *The Local Government Performance Framework*, introduced by the national government in 2007 (UK Department for Communities and Local Government, 2007). The framework includes a set of 198 national indicators that local governments must use to measure their progress toward the national priorities. Local governments have yet to begin their annual reporting against national indicators.

Conclusions and Implications for Policy and Future Research

Our discussion of adaptation planning for public risks illustrates the special challenges to local governments and the public in addressing such risks. A chronic lack of a public constituency supportive of action on climate change poses a significant obstacle to local government to take planning seriously as a means to avert future losses.

Public risks, as defined previously, pose the generic difficulty of creating and sustaining public support and action. Devising strategies for dealing with public risks, especially those generated by climate change, requires a rethinking of the traditional predict-and-plan approach used in most of contemporary planning practice. The accelerating rates of change and increasing levels of future uncertainties associated with climate change are not well suited to the traditional approach. The risks are too uncertain, diffuse, temporally remote, and indirect to assign blame and attach responsibility.

We argue that coupling the collaborative and anticipatory governance models of policymaking offers a new approach in the modification of traditional planning for addressing public risks associated with climate change. The main thrust involves increasing acceptance of shared responsibility for addressing public risks. Although the concepts of collaborative governance and, to a lesser extent, anticipatory governance are not new, when coupled they offer a novel governance framework that accounts for public risks throughout the planning process, from futures analysis to policy formation, implementation, and monitoring.

A core premise of this new framework is that climate science and policies should use a set of flexible forecasts rather than depend on a single forecast. Collaborative governance calls for authentic dialogue, wherein stakeholders and experts fashion plans and policies together, whereas anticipatory governance offers guidance for planning practice amid conditions of accelerating change and great uncertainty. Furthermore, given the early stages of climate change-adaptation planning and uncertainties about future impacts, the emphasis would be on cultivating a community of practice, with the aim of building the local planning capacity to engage scientific and technical expertise (Goldstein and Butler, 2010). Embracing the uncertainties of climate science will likely be difficult for many local planners, decisionmakers, stakeholders, and the public. Most planning efforts in natural hazard mitigation have performed poorly in dealing with only one future, let alone multiple ones. Developing scenarios that provide cogent stories that prompt critical thinking and considering combinations of no-regrets, low-regrets, and contingent actions, however, should make adaptation planning more evocative, tangible, and contemporarily relevant for all parties. As a staged approach, the London effort could be instructive, given an initial focus on developing inhouse capability within city government agencies and an ultimate goal of imparting their know-how to others in the metropolitan area.

The transition to plans premised on multiple future scenarios, more flexible polices, and implementation more closely tied to monitoring is in the early stages, as illustrated by the diverse approaches of the early innovators discussed in this article. For example, London is using simple probabilities to specify climate changes and possible impacts, but Denver uses plausible storylines and metaphors of alternative futures. Punta Gorda proposes flexible robust policies that are desirable across a range of futures and contingent policies that are most appropriate if a worst case event were to occur. London's policies produce co-benefits whenever possible. The three innovators are dissimilar in terms of population (small to large city), location (coastal to high plains), and national context (United Kingdom and United States), and key climatic changes of concern (coastal flooding and sea-level rise and water supply). These differences suggest that the approaches we are describing can be applied across multiple contexts.

Finally, research is needed to examine the effectiveness of the planning framework this article proposes. The combination of anticipatory governance and collaborative planning has great potential but is dominated by normative thinking. The bulk of the research is composed of single-case studies that are not comparable given the lack of common variables and measurements. Its subjective and heuristic nature requires critical examination that emphasizes comparative analysis. In general, the planning field includes few systematic, validated analyses of planning processes. An exemplary exception, Deyle and Slotterback (2009) examined how the attributes of a collaborative planning process affect the level of group learning, agreement on strategies, and strength of supportive community networks based on pretest-posttest surveys of participants before and after the planning process in eight local governments in Florida. The field of planning, especially climate change-adaptation planning, would gain in scientific standing and policy relevance if more research, as exemplified by Deyle and Slotterback, were conducted to examine its comparative performance and underlying conceptual premises.

Many questions remain unanswered that merit serious investigation. Will the use of scenarios lead to better integration of climate-science knowledge into decisions and plans aimed at adapting to climate change? How can social networks that circulate technical knowledge about climate change be engaged more effectively in collaborative climate change-planning processes? How do the attributes of planning processes influence the formation and sustained implementation of climate action plans? What are the core indicators needed for assessing local capacity for climate-change adaptation, planning processes, plans, and resiliency outcomes?

In sum, the emergence of climate change-adaptation planning by local governments offers laboratories for testing new ideas on how best to motivate communities to take action to avert loss. Planning researchers should carefully evaluate these experiments as they evolve and educate the public and planning practitioners about how best to advance resilient communities.

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Social Actors and Key Policy Levers for Mitigating the Greenhouse Gas Footprint of U.S. Cities

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Abstract

This article links policy outputs in city climate action plans with environmental outcomes. This task is challenging because different human activities in cities vary in terms of their contributions to greenhouse gas (GHG) emissions and because the engineered infrastructures that support these activities extend well beyond the city scale. I present a generalizable quantitative approach that uses the transboundary infrastructure supply chain GHG emission footprints of cities to identify key actors and policy levers most effective in reducing the global GHG impact of cities. This infrastructure supply chain GHG emission footprint represents the life-cycle energy associated with provisioning key infrastructure services—water, energy, food, shelter, sanitation, mobility, connectivity, and public spaces—to support the activities of households, businesses, and industries in cities.

Introduction: Greenhouse Gas Footprints of Cities and Mitigation Plans

Cities are hubs of human activity; the everyday actions of myriad households, businesses, and industries located within a city's geopolitical boundary. Measuring greenhouse gas (GHG) emissions associated with cities is confounded by the relatively small spatial scale of cities compared with the large-scale engineered infrastructures in which they are embedded; that is, the electricity grid, transportation networks, water-supply lines, and wastewater treatment networks that serve cities. As a result, human activities in cities are highly dependent on transboundary infrastructure provisions, defined formally as the provision of water, energy, food, shelter (building materials), sanitation/waste management, mobility, connectivity, and public spaces to homes, businesses, and industries located within the city (Chavez and Ramaswami, 2013; Ramaswami, in press). In addition to infrastructures, there is also the movement of other goods and services between cities resulting in the flow of embodied GHG between cities. To address these confounding factors, cities have started measuring not only direct energy use and GHG emissions within city boundaries (called a *source-based GHG emissions inventory*), but also transboundary, life-cycle-based *GHG emission footprints* of cities that are based upon human activities. First developed for the city of Denver in 2006, *infrastructure supply chain* GHG emissions footprints combine the life-cycle energy (inboundary and transboundary) associated with provisioning key infrastructure services with communitywide collective use of these infrastructures by homes, businesses, and industries colocated in cities (Ramaswami et al., 2008). Consider for example, water or electricity supply to a city that supports communitywide use of water and energy, respectively.

The resulting transboundary infrastructure supply chain footprints have since been tested in more than 20 U.S. cities and show that direct inboundary GHG emissions can contribute less than one-half of a city's overall infrastructure-related GHG emissions footprint, particularly in cities that import a significant percentage of their electricity, such as Denver (shown in exhibit 1a). Environmental Protection Agency (EPA) statistics (EPA, 2011) indicate that less than 5 percent of U.S. counties have significant electric power generation infrastructure within their geopolitical boundaries; thus, about 95 percent of U.S. cities import electricity similar to the case of Denver in exhibit 1a. Even after transboundary GHG emissions associated with imported electric power are allocated to cities, transboundary contributions from the provision of other infrastructures—such as energy supply (fuel) for transportation, fuel supply for the built environment, food supply, construction materials (for example, cement), water supply, and sanitation (wastewater treatment)—can be significant. See exhibit 1a, in which all the infrastructure sectors are mapped to human activities; for example, the use of cars in a city results in direct inboundary tailpipe emission (shown solid), whereas the transboundary energy to produce fuel used by the vehicles is shown hatched. All transportation-sector GHGs (that is, GHGs associated with cars, trucks, SUVs, and airlines and the fuel processed to supply them) are shown grouped together (labeled as Trucks and SUVs and as Cars in exhibit 1a). Likewise, energy supply to buildings, inclusive of electricity and fossil fuels, are separated out as commercial-industrial (Comm/Ind), Residential, and Government in exhibit 1a, and they are collectively called the *buildings-energy sector* in the text. The transboundary impacts of infrastructure provision (hatched) are clearly significant, and comparable with inboundary GHGs (solid).

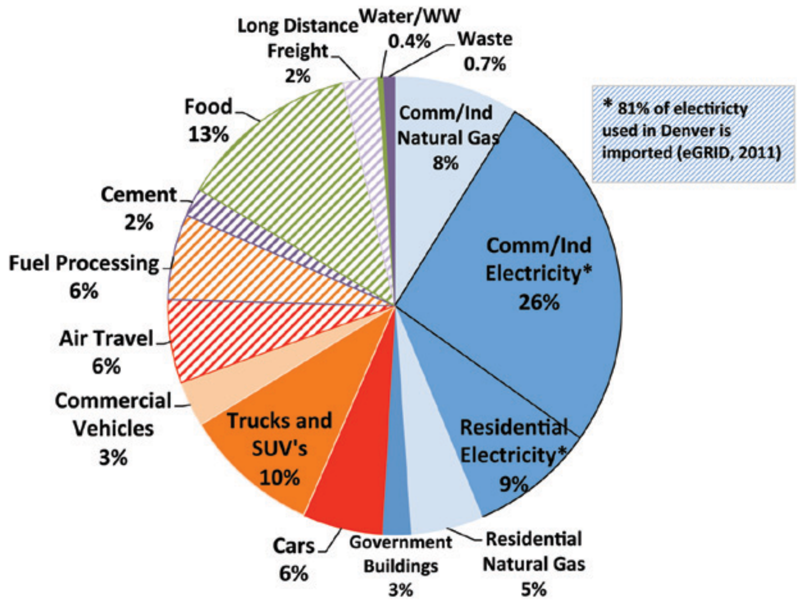
Indeed, as seen in exhibit 1b, the production of food, transport fuels, water, and building materials can add a significant 48 percent to the GHG emissions traditionally being accounted for by cities that focused only on the use of electricity and the burning of fossil fuels within city boundaries (Hillman and Ramaswami, 2010). (See exhibit 1b.) The additional consideration of these materials flowing to cities is sometimes also referred to as the materials sector, differentiating it from the energy sector.

The proportions of GHG emissions from the different infrastructures mapped to human activities (for example, cars, residential buildings, and air travel are sectors) shown exhibit 1 have been observed by Hillman and Ramaswami (2010) to be similar across large U.S. cities, when the U.S. average electricity generation is applied to all the cities. Furthermore, when transboundary infrastructure contributions are included, the per capita GHG emissions of U.S. cities with populations greater than 100,000 are consistent with U.S. per capita GHG emission (within ±10 percent of ~25 metric tonnes of carbon-dioxide equivalents released to the atmosphere per person). This finding suggests that the challenge of artificial truncation of infrastructures at city geopolitical boundaries may have been overcome. (See exhibit 1b.)

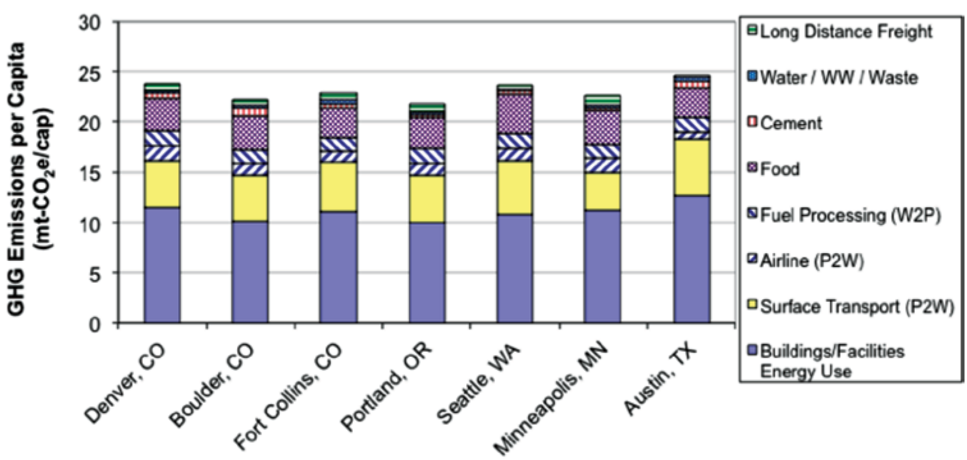
Exhibit 1

An Infrastructure Supply Chain GHG Emissions Footprint for Denver (a); GHG Emissions From Different Infrastructure Sectors for Seven U.S. Cities (b)

(a)



(b)



Sources: (a) Ramaswami et al. (2008); (b) Hillman and Ramaswami (2010)

Recent research has also compared the communitywide infrastructure supply-chain GHG footprint of cities with consumption-based footprints that address lifecycle GHGs from the use of all goods and services (for example, infrastructure plus noninfrastructure goods like furniture and clothing) by a subset of the community—its final consumers, which are predominantly the households (Chavez and Ramaswami, 2013, 2011; Ramaswami et al., 2011). In consumption-based footprints, the activities of local businesses and industries that export goods and services elsewhere are excluded. There is increasing consensus that a communitywide infrastructure GHG footprint and a separate consumption-based GHG footprint offer complementary views of the city, addressing infrastructure/economic production activities and consumption, respectively (Baynes et al., 2011; Chavez and Ramaswami, 2013; Ramaswami, Chavez, and Chertow, 2013).

Several cities now report inboundary plus transboundary GHG emissions, together reported as communitywide supply-chain footprints (Ramaswami, Chavez, and Chertow, 2013; Ramaswami et al., 2011). This method is also becoming standardized in city GHG reporting protocols. For example, ICLEI—Local Governments for Sustainability recently released for public comment a draft community GHG emissions-accounting protocol intended for use by its more than 500 member cities. The protocol includes several infrastructure supply chain emissions discussed previously; for example, transboundary GHG emissions from producing fuel, producing electricity, provisioning commuter travel, and providing water, wastewater, and waste treatment services in cities (Chavez and Ramaswami, 2011; ICLEI, 2010). In Europe, the Greater London Authority and the British Standards Institution are developing a publicly available standard for GHG accounting for cities, which addresses both direct-plus-supply-chain GHG emissions, with a focus on infrastructures serving the whole community, and consumption-based GHGs that are associated predominantly with households (BSI, 2012). The infrastructure supply chain method is expected to stimulate more creative cross-scale and cross-sector urban planning strategies for mitigating GHG emissions, addressing the supply chain that connects energy and materials users in cities with the producers of key infrastructure services; that is, water, energy, mobility and transportation, food, and key urban construction materials. The construction of such footprints enables actions that reduce demand for energy and material use in key infrastructures within cities to be coupled with actions that focus on cleaner production of these infrastructures and often transcend the city scale.

Denver, for example, is considering several strategies to mitigate its communitywide infrastructure supply chain GHG emissions footprint (exhibit 1a), which are described in its climate action plan (CAP) (Greenprint, 2007). These strategies can be organized broadly as—

- Reducing demand for energy use in buildings-energy sector through local voluntary or regulatory programs that target local homes and businesses.
- Promoting cleaner electricity generation by working with the state's public utilities commission (PUC) and legislators, reflecting cross-scale linkage with state-scale policies.
- Reducing demand for transportation through coordination with regional metropolitan planning organizations (MPOs) that implement mass transit and shape the overall regional commuter shed. Reducing demand for transport requires cross-scale coordination between individual cities and with entities such as regional councils of governments representing multiple cities in metropolitan areas.

- Promoting the production and penetration of alternative transportation fuels, such as natural gas and biofuels, in conjunction and across scale with state-scale policies.
- Working on supply chain strategies in the production of key infrastructure materials and their disposal in waste; for example, substituting recycled materials for cement in concrete, promoting waste-to-energy projects, recycling, and so on.
- Working on cross-sector substitutions; for example, substituting telepresence for air travel, which will require coordination with regional MPOs and businesses that provide information and communications technology services, to promote dematerialization in the transportation sector.

The focus of this article is on the first two strategies that shape both inboundary and transboundary GHG from the buildings-energy sector. Note, the right-hand side of the pie chart in exhibit 1a shows the GHG contributions from the buildings-energy sector.

The objective of this article is to identify most important actor categories and the key levers to mitigate the GHG emissions footprint of the buildings-energy sector, using Denver as a case study. We achieve our objective in three steps.

- We first describe broad strategies and related program designs—classified as voluntary versus regulatory—for reducing the GHG emissions in the buildings-energy sector in Denver. We identify key actor categories associated with the different program designs.
- We conduct quantitative analysis of different GHG mitigation programs being implemented in Denver, and those proposed for implementation in Denver, modeled after successful programs tested in other cities nationwide. Such quantitative analysis identifies programs and actor categories, that is, key levers that have highest impact in shaping environmental outcomes (that is, GHG emissions).
- We discuss the implications of this work for future research on city CAPs and their implementation for mitigating the GHG emissions associated with cities.

The article makes an important contribution in linking policy outputs in city CAPs with environmental outcomes. For example, studies that evaluate the effectiveness of city CAPs often check off the presence or absence of policies in different sectors: buildings, energy supply, waste management, local government, transportation and tree planting (Krause, 2011; Tang et al., 2010). However, as seen in exhibit 1, not all sectors are the same in terms of contributions to GHG emissions—for example, waste management and local government operations are often small contributors particularly when the government does not own or operate energy utilities for the larger community. Furthermore, the impact of *different program designs*—whether voluntary, regulatory, or behavioral—on environmental outcomes is rarely addressed. This article presents a generalizable quantitative approach to connect policy outputs, that is, different program designs, with corresponding environmental outcomes.

Quantifying environmental outcomes arising from city CAPs or sustainability plans is relatively new. A few studies have conducted a qualitative analysis of CAPs based on assessment of content items, and concluded that they have largely been ineffective in reducing energy use and GHG emissions (Bassett and Shandas, 2010; Boswell, Greve, and Seale, 2010; Wheeler, 2008). Studies at the national scale have developed the concept of climate wedges to quantify six key strategies that can reduce U.S. GHG emissions with current technologies (Pacala and Socolow, 2006)—however, no specific city-level policies are explored. Dietz et al. (2009) conduct top-down analysis to evaluate the impact of behavioral interventions on U.S. household energy use. They address the impact of program design both on the adoption of energy efficiency retrofits and on energy conservation behaviors in the context of reducing household energy use. They apply "behavioral plasticity" to get a more realistic assessment of the percentage of homes that would adopt more energy efficient retrofits among the existing housing stock requiring such upgrades. However, this national-scale analysis does not address how specific city policies may shape adoption rates, nor how local features such as urban form or the building rental stock or home sales trend in different cities may affect outcomes from specific city-scale policies. For example, the effectiveness of a time-of-sale policy that would upgrade homes at their time of sale would depend on local trends in the sale of residential and commercial properties; the effectiveness of smart growth measures depends on current local spatial feature of cities. Ramaswami et al. (2012a) conducted a first such bottom-up study that compared participation rates in different program designs used in city CAPs, incorporating city-specific features and comparing voluntary versus regulatory program designs. Details of the quantitative analysis are found in Ramaswami et al. (2012a), along with a detailed appendix that describes the calculations (Ramaswami et al., 2012b). Results for the buildings-energy sector are presented here to illustrate how key actors and policy levers associated with the buildings-energy sector of cities can be identified in a unified analysis that addresses both the production of energy and its use in city buildings.

Building Sector Strategies and Actors in a SEIS Framework

Broad strategies that are used to reduce GHG emissions from the buildings-energy sector of cities are shown in exhibit 2, column 1. The same strategy can be implemented in different ways yielding different program designs denoted in exhibit 2 (A–C, columns 3–4), based upon the spatial scale they are implemented at (city-scale or linked with the state), and the voluntary or regulatory/mandatory nature of the program design.

City-Scale Voluntary Programs for Building Upgrades (A1). Voluntary program designs are used most often by a vast majority of cities in implementing their CAPs. For example, a review of 55 city CAPs indicated that more than 98 percent included voluntary programs such as the ones shown in exhibit 2–A1 (Ramaswami et al., 2012a). These programs use financial incentives to promote the increased adoption of energy efficiency upgrades by homes and businesses both in the existing building stock and in new construction. The programs may include free mail-in programs for compact florescent lamps (CFLs), door-to-door outreach for low-cost weatherization, free basic whole-home upgrades for low-income homes, and loan programs for higher cost home energy upgrades. Many low-cost items such as CFLs are given away for free (to the community), and rebates are provided by local governments for higher cost items such as attic insulation and whole-home upgrades. Local governments often raise one-time funds to run these campaigns or tap into state, federal, or electric utility grants to institutionalize these programs. See state-scale and utility programs described subsequently (B2). However, the major onus for implementing these voluntary building upgrades falls upon the individual home or business, an actor category we refer to as the *individual user*.

Exhibit 2

Broad Strategies for Reducing Energy Use and GHG Emissions Associated With the Buildings-Energy Sector in Cities in the Next 5 Years (1 of 2)

Strategy/Nudge (participating unit)	Strategy Effectiveness per Unit	Five-Year Participation Rates in Various Programs	
		1. Voluntary	2. Policy/Regulatory
A. City-Scale Programs for Building Upgrades: Voluntary and Regulatory			
Installing two CFLs (per home)	~1.5% reduction in household electricity (Tachibana and Brattesani, 2003)	50% homes participate in a free mail-in program (Tachibana and Brattesani, 2003) 8–10% homes participate in free door-to-door outreach (Marshall, 2009)	Various proposed state or federal phase-out policies for incandescent bulbs will result in 100% of homes installing at least 2 CFLs. [None in effect 2007–12]
Low-cost weatherization (per home)	5% reduction in household natural gas (Blasnik, 2006)	2–4% homes take the additional step to weatherize in door-to-door outreach (Marshall, 2009)	See below for ToS/Date Certain Ordinances
Basic whole home energy upgrades—medium cost (per home)	2.8% reductions in household electricity & 13.6% decrease in natural gas (Blasnik, 2006)	0.4% of homes participate after which budget is expended in a low-income free home upgrade program	20% of homes would participate with a hypothetical time-of-sale (ToS) ordinance (City of Berkeley, 2010), and ~35% in a date-certain ordinance for rentals (City of Boulder, 2010), modeled after similar city regulations in Berkeley, CA & Boulder, CO
Higher cost home energy upgrades (per home)	1.7 mt-CO_2e/HH (diverse upgrades: windows, solar heaters, attic fans, and so on [CSLP, 2010])	<<0.1% participate (ENERGY STAR, 2007) in numerous national energy efficiency loan programs	2.6% of homes would participate in an opt-in bond program, as tested in Boulder (CSLP, 2010).
New "green" buildings (per unit commercial & res. square feet)	20–30% energy savings per square foot (ENERGY STAR, n.d.; Turner and Frankel, 2008).	5% of new construction is voluntarily built green (Simons, Choi, and Simons, 2009); the annual new construction in Denver is ~1% of the total stock	76% of new construction participates in a hypothetical green buildings mandate for properties >20,000 sf, modeled after San Francisco (Buchanan, 2008)
B. Green Energy Purchase and Production: Utility and State-Scale Programs			
Commercial-industrial DSM	Utility programs reduce electricity demand: 0 mt-CO_2e per kWh saved	NA	*Voluntary DSM program* in Denver (Xcel Energy, 2009) targets 1.5% electricity savings in 5 years
Green electricity production or purchase (utility kWh)	Windpower or other renewables emit: 0 mt-CO_2e/kWh	Up to 5% electricity is voluntarily purchased green—per national data (Bird and Brown, 2006)	Colorado's renewable portfolio standard (RPS) requires 30% electricity from renewables by 2030 (State of Colorado, 2010)

Exhibit 2

Broad Strategies for Reducing Energy Use and GHG Emissions Associated With the Buildings-Energy Sector in Cities in the Next 5 Years (2 of 2)

Strategy/Nudge (participating unit)	Strategy Effectiveness per Unit	Five-Year Participation Rates in Various Programs	
		1. Voluntary	2. Policy/Regulatory
C. Innovative Behavioral Interventions: Voluntary and Regulatory			
Behavioral feedback (home)	2%–4% reduction in electricity use via bill feedback (Allcott and Mullainathan, 2010; Opower, n.d.)	NA	100% of homes would participate in monthly bill feedback provided by electric utilities
	6%–12% reduction using real-time displays (Darby, 2006; Fischer, 2008)	4% homes are assumed to participate using a door-to-door outreach model (Marshall, 2009) to install the displays	100% of homes participate in a hypothetical mandated energy meters policy (similar to laws requiring carbon monoxide detectors in all homes)
Price feedback: carbon tax	0.15%–0.35% reduction in electricity use per % increase in cost (Bernstein and Griffin, 2005)	NA	1.6% weighted average local carbon tax applies to all users, modeled after Boulder, CO (Brouillard and Van Pelt, 2007)

CFL = compact florescent lamp. DSM = demand-side management. NA = not applicable.

Note: Specific program designs are characterized by different participation rates computed over a 5-year period from 2007 through 2012 for near-term analysis.

Source: Adapted from Ramaswami et al. (2012a)

City-Scale Regulations for Building Upgrades (A2). A few cities have started experimenting with local regulations including both mandates and opt-in programs to upgrade the current building stock. Examples include the residential and commercial energy conservation ordinances pioneered in Berkeley and San Francisco, California, that require properties be upgraded to basic energy-efficiency standards at the time-of-sale (City of Berkeley, 2010), and the date-certain smart regulations that require energy upgrades of rental properties by a fixed date, presently being tested in Boulder, Colorado (City of Boulder, 2010). Such policies mandate the installation of basic energy efficiency upgrades either at the time of sale or within a fixed time period (for date-certain). A new innovative opt-in bond program in Boulder institutionalizes the financing of high-cost building energy upgrades wherein loans for these upgrades are linked with the property and repaid via special property taxes assessments rather than by the individual homeowner who makes the initial investment (CSLP, 2010). This removes an important barrier that often inhibits individual owners (residential or commercial) to invest in high-cost upgrades when they may sell the property prior to recouping the energy savings. In the case of new construction, cities such as San Francisco require Leadership in Energy and Environmental Design (LEED) certification for all new commercial construction projects larger than 20,000 square feet (Buchanan, 2008). In all these examples, the *policy actor* category becomes very important wherein policy actors include not only elected and government officials, but also nongovernmental organizations, the media, advocacy groups, and others involved with policy development.

Voluntary Green Energy Purchase Programs (B1). While strategies A1–A2 focus on upgrading buildings in a community to become more energy efficient, several programs initiated by energy utilities promote green electricity purchases by their customers. Local governments sometimes work with utilities to publicize these green-purchasing programs. For example, Xcel Energy in Colorado is one of the largest carriers of third party-provided and green-e-certified wind energy. Its WindSource™ program makes certified green energy purchases available to its customers at a small incremental cost of about 2 cents/kWh (Xcel Energy, 2011). Denver's CAP includes a partnership that promotes information about this program in the community. National studies show a high level of engagement of individual homes and businesses in making these green purchases with as much as 15 percent energy use purchased green on a voluntary basis (Bird and Brown, 2006). While the individual user makes the green energy purchase, the electric utility plays a critical role in designing and offering such programs, reflecting the important role of another actor category—the infrastructure *designer-operator*.

Green Energy Production: State-Scale and Utility Regulation (B2). While electric utilities may offer voluntary green purchasing programs, regulations at the state-scale impact the penetration of clean energy generation technologies into the utility's grid mix. Colorado has passed the landmark renewable portfolio standard (RPS) requiring 30 percent renewables in the electricity generation portfolio of investor-owned utilities by the year 2020, including carveouts for wind and solar energy (State of Colorado, 2010). Utility demand-side management (DSM) programs are an important complement for renewable energy resource planning in utilities. Electric utilities and state PUCs institutionalize the recovery of DSM funds via utility bills, which are subsequently applied to provide rebates and incentives to enhance adoption of energy efficiency upgrades by industrial, commercial, and residential sectors. Utility DSM programs typically focus on the commercial-industrial sector. Policy actors at the state scale play an important role in the design of both RPS and DSM programs. Likewise, policy actors at the federal scale may shape other policies governing electric utilities including pollution regulations addressing GHGs.

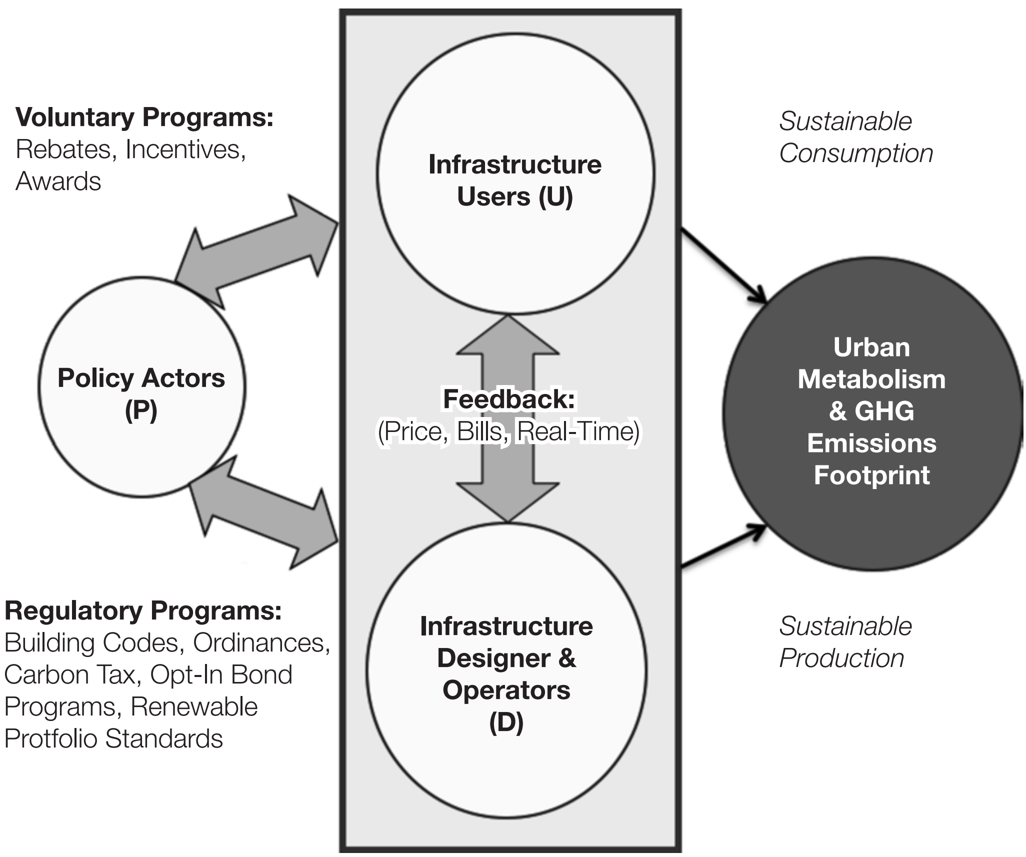
Innovative Behavioral Interventions (C). In addition to addressing energy demand via efficiency upgrades and energy supply via renewables in the electricity portfolio, a few cities and electric utilities are also working together to implement innovative behavioral interventions that promote energy conservation practices using pricing signals and/or feedback on energy use. The feedback may be provided on monthly bills that show monthly energy use compared to peers with suitable social norming messages (Opower, n.d.), or, via real-time energy feedback devices (that is, energy meters) that show the user their instantaneous energy use. Some of these feedback devices cost less that $100 to install and have yielded an average of 6 to 12 percent energy use reduction in pilot studies (Darby, 2006; Fischer, 2008). While some cities/utilities are providing these meters to homes on a voluntary basis (Mendyk, Kihm, and Pigg, 2010), others such as Southern California Edison are requiring real-time energy feedback and time-of-use pricing communitywide (SCE, 2012). Policies that require energy information meters in all homes can be particularly impactful and such proposals are being explored in numerous countries/states. A few cities, for example, Boulder, have developed programs with their investor-owned utilities to apply carbon taxes on electricity use to provide modest price signals to promote energy conservation and to raise funds for efficiency programs. Energy feedback, social norming, and price signals are all expected to shape the energy use behaviors of individuals, and as such involve all three actor categories—individual users, infrastructure designer-operator, and policy actors.

A review of the above strategies reveals three categories of actors who can shape the GHG footprint of the buildings-energy sector in cities. The categorization of actors reflects their unique and specialized function as described below (Ramaswami et al., forthcoming)—

- Individual infrastructure users within the city boundary, that is, households and firms, shape the demand for energy in the buildings of a city. Studies have shown that behavioral change among individual users capacity to reduce energy use by 2 percent communitywide (Allcott and Mullainathan, 2010; Opower, n.d.), thus their importance in establishing a sustainable consumption pathway to reduce the GHG footprint of cities (exhibit 3).
- Infrastructure designer-operators in the above examples include electric utilities, building architects, and engineers, many of whom may operate within the city boundary as well as

Exhibit 3

The Role of Policy Actors in Shaping the Design of GHG Mitigation Programs, Working in Coordination With Individual Users and Infrastructure Designer-Operators



GHG = greenhouse gas.

Note: All three actor categories interact with each other in different program designs and influence GHG mitigation outcomes.

Source: Ramaswami et al. (2012a)

transcend the city scale. This category can shape both energy use via efficiency upgrades and new green building designs, as well as sustainable energy production in utilities and distributed generation facilities.

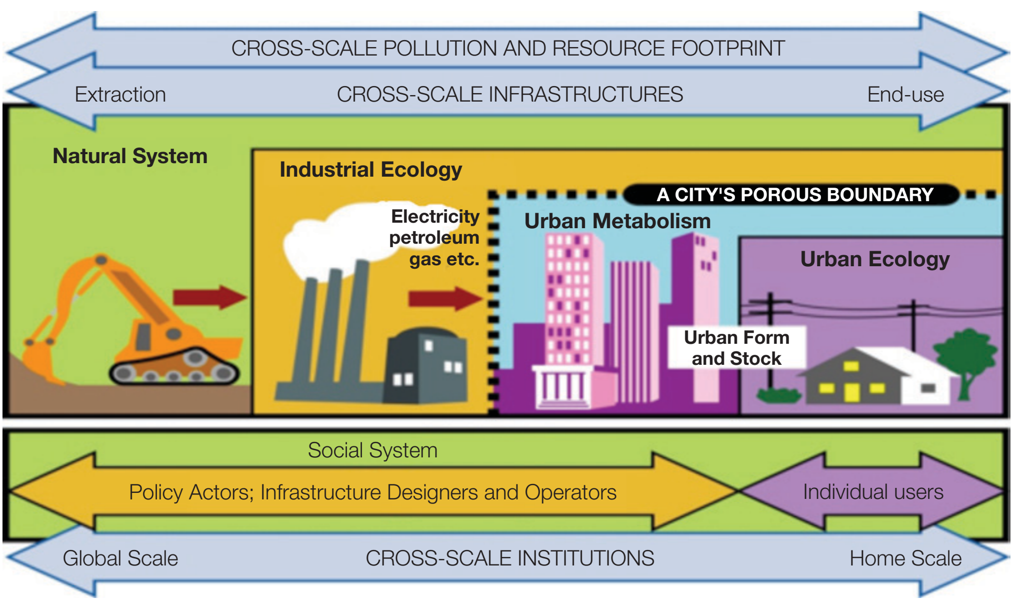
- Policy actors shape the policy process both within the city scale and across scale, thus operating at local, state, national, and global scales, generating city regulations, state electricity portfolio standards, federal energy efficiency tax credits, and global carbon trading programs, respectively, as examples of outputs from this actor category across spatial scale.

Exhibit 3 illustrates the interactions among the different actor categories. Policy actors shape the behavior of individual users and of infrastructure designer-operators in voluntary or regulatory program designs. The infrastructure designer-operators (for example, electric utilities) and the individual users also interact with each other, particularly in the context of price and behavioral feedback programs. Understanding such interactions among actor categories can be important in the design of effective GHG mitigation programs.

The three actor categories can be also visualized to interact with each other across spatial scale, shaping infrastructures and their associated footprints toward sustainability goals. These interactions are illustrated in a social-ecological-infrastructural systems (SEIS) framework for developing sustainable city systems (Ramaswami et al., forthcoming)—see exhibit 4. The SEIS framework builds upon the social-ecological systems framework by explicitly incorporating transboundary

Exhibit 4

Three Categories of Actors Shown in the Social Subsystem Shape the Pollution (GHG) Footprint of Cities



GHG = greenhouse gas.

Source: Reproduced from Ramaswami et al. (2012a) infrastructures serving cities. The SEIS framework recognizes that natural resources (such as water and fossil fuels) are transformed and conveyed over large distances to people in cities via engineered infrastructures such as the electric power grid, water pipelines, and transportation networks. The transboundary infrastructures can contribute a significant portion to the GHG footprint of cities, as seen in exhibit 1a–b. Thus mapping and understanding social actors associated with these footprints—both within and across the city boundary—is important.

Several theories and frameworks drawn from the social sciences can lead to a better understanding of the actors and their interactions. For example, theories around social norming (Schultz et al., 2007) are helping design energy conservation outreach programs aimed at individual users (Allcott and Mullainathan, 2010; Opower, n.d.). Club theory describes interactions between infrastructure designer-operators and policy actors as they shape the designs and outcomes from voluntary environmental programs (Prakash and Potoski, 2007), while frameworks such as those of institutional analysis and development (Ostrom, 2005), institutional collective action (Feiock, 2007), and advocacy coalition (Weible and Nohrstedt, in press) describe policy actor interactions with other actors and with resource systems in a general context. Integrating the social actors (and associated theories) into the SEIS framework explicitly addresses the physically based context of material-energy flows in cities conveyed by transboundary infrastructures, connecting actors within the city boundary who typically shape energy efficiency and demand reduction with actors across scale, for example, the producers of energy (electric utilities) and associated cross-scale policy actors such as state and federal regulators who guide their actions. While the framework itself is not the topic of this article, a conceptual and theoretical understanding of actors in the SEIS framework promotes an improved understanding on both cross-scale and cross-actor interactions that are important in GHG footprint mitigation, discussed in the concluding section of this article.

The next section identifies most important program designs and the actors and the spatial scale that yield significant GHG mitigation.

Program Designs and GHG Impact

Exhibit 2 shows broad strategies (column 1) for GHG mitigation in the buildings-energy sector described in the previous section. Each strategy is associated with a strategy effectiveness per unit (shown in column 2), for example, the average measured reduction in energy use per home, which does not vary very much in a given city or climate zone. Data gathered from more than 1,500 low-income homes retrofitted in Colorado shows an average net natural gas savings of 13.6 percent with a 90-percent confidence interval around the mean of about 10 percent (Blasnik, 2006).

Depending on how each strategy is implemented in a program—particularly whether is designed to be voluntary or regulatory—yields a number of alternate program designs (columns 3–4). Different program designs are seen to be associated with widely varying participation rates, where the participation rate in exhibit 2 represents the percentage of homes or businesses adopting that particular strategy in a particular program configuration in a 5-year period. The participation rates can vary by a factor of 2 to 5 (200 to 500 percent) and even over a few orders of magnitude when comparing a voluntary city-scale program with its regulatory counterpart. These aspects are detailed in the following sections.

Lower Participation Rates in City-Scale Voluntary Building Upgrade Programs

Participation rates in voluntary programs vary widely based not only on the level of financial incentives offered but also on the modality of outreach. Typically, the participation rates are higher (as high as 50 percent) when low-cost items are offered for free as in the case of the free CFLs provided in the m*ail-in program* (Tachibana and Brattesani, 2003). However, uptake of the same two free CFLs decreases to about 8 to 10 percent of homes knocked on in *door-to-door outreach programs that handed free CFLs* in three neighborhoods in Denver (Marshall, 2009). The voluntary participation rate decreased further as the cost of the retrofits increases even modestly and is typically as low as 2 to 4 percent in *door-to-door weatherization programs* that require a small monetary commitment from homes and/or followup by the home dwellers after the first visit by volunteers (Marshall, 2009). Even if all neighborhoods in Denver were to be reached via neighborhood knock-on-door programs over a 5-year period from 2007 to 2012 (the period for our short-term analysis) we expect at best 4 percent participation for adopting lower cost upgrades such as pipe and attic insulation. The rates seen in Denver are similar to those seen in energy efficiency programs tracked in many other U.S. states, wherein the homeowner must make a modest financial commitment (Hirst, 1984; Stern, 2002); only a select few communities in the United States report higher participation rates (Stern et al., 1985). Indeed, federal EPA's guidelines for deployment of weatherization programs consider outreach to 4 percent of homes over 5 years an aggressive goal (EPA, 2009), reflecting the reality observed on the ground. Participation rates are lower still at <<1 percent when homes seek to make voluntary *higher cost investments for home upgrades* such a solar hot water heaters, new windows, and so on, as reported in national studies (ENERGY STAR, 2007). See exhibit 2, column 3 (A1).

It is important to note that participation rates in voluntary programs are linked with the level of financial incentives offered. When whole-home upgrades are offered *free of cost to low-income homes* the program gets saturated and hence becomes funding limited and is able to retrofit only a small percentage (0.4 percent) of low-income homes per year (Arapahoe County, 2009). Because large financial incentives cannot be offered to the whole population, participation rates in voluntary energy upgrade programs generally tend to be low, overall. However, as noted previously, these typical city-scale voluntary programs are very popular and feature in almost all of the 55 city CAPs analyzed by Ramaswami et al. (2012a). Although popular, few cities are tracking the participation rates explicitly as shown in exhibit 2, identifying how many homes were targeted and how many participated (or not), which would provide important information on the program's overall impact.

Higher Participation Rates in City Regulations for Building Upgrades

Compared to the voluntary program design, the corresponding policy approaches can significantly increase participation rates by many orders of magnitude for the same strategy. See exhibit 2—column 4 (A2). For example in *time-of-sale (ToS) ordinances* that have been tried and tested in Berkeley and San Francisco, homes are required to have basic energy efficiency features such as weatherstripping, pipe and attic insulation at the time of their sale, or they pay into an escrow fund that finances these upgrades shortly after the sale of the home. Using home sales data for Denver, a similar program in Denver is estimated to reach 20 percent of homes over a 5-year period (versus only 4 percent in a neighborhood voluntary outreach program). Likewise *a date-certain ordinance* that requires rental properties be upgraded to basic energy efficiency standards by a fixed future date, is an innovative policy that addresses the rental buildings market where there are little incentives (absent the policy) for landlords to upgrade their rental units. Modeled after a smart regulations policy recently adopted in Boulder, a *date-certain ordinance for rentals* would directly transform the 30 percent of the building stock in Denver identified as rental. An *opt-in bond program* provides investment capital for those homes wishing to invest in higher end upgrades such as solar hot water heaters, new windows, geothermal systems, and so on, with a special property tax assessment linked with the home (rather than the homeowner) used for repayment of the loans.

The previously described approaches address the old (existing building stock in cities). Similar differences in voluntary and regulatory city-scale programs are seen also for the case of new construction—with about 1 percent of the total built area in Denver added as new construction over 5 years. Voluntary adoption of green building codes in Denver is estimated to be among the highest in the nation at 5 percent of new construction (Simons, Choi, and Simons, 2009), which means only 0.005 percent of Denver's total building stock is likely to be impacted annually using a voluntary penetration model. In contrast, green building mandates that require all new construction (or large commercial projects) meet LEED or ENERGY STAR will impact almost all of the new building stock added to a city, at about 1 percent over 5 years. Such mandates are already operational in a few cities such as San Francisco (Buchanan, 2008). Thus, orders of magnitude differences in participation rates are seen between voluntary city-scale programs (A1) versus city regulation (A2).

Broadest Impact of State-Scale or Utilitywide Policies

While the above city-scale voluntary and regulatory programs address building upgrades in separate sectors—for example, homes versus commercial buildings, and new versus old construction—state regulations on utilities (for example, Colorado's RPS) impact all of the electricity used in a community. Likewise, an electricity carbon tax (such as one instituted in Boulder) impacts all users of electricity. Such systemwide regulations effectively foster a 100-percent participation rate.

Promise of Innovative Behavioral Intervention Programs

Behavioral interventions that combine social norming and feedback devices show potential for high impact. The unit strategy effectiveness of using feedback devices is among the highest of all strategies in exhibit 2 yielding 6- to 12-percent electricity savings per home in pilot tests. However, the impact on GHG is much reduced when only a few homes voluntarily adopt the meters, assuming a 4-percent participation rate in a program wherein the meters are distributed in door-to-door outreach mode. In contrast, 100-percent participation may be fostered in a hypothetical regulatory scenario if such devices are required to be installed in all homes, similar to recent mandates requiring carbon monoxide detectors in all Colorado homes. The GHG impact can also vary widely based on the program design, even when a lower 6-percent electricity savings are assumed for communitywide meters use.

A Generalized Approach To Compute GHG Impact of Different Programs

The differences in participation rates in different program designs in exhibit 2 translate to widely varying GHG impact of the different designs. The GHG impact of each program design over the short term (5 years from 2007 to 2012) can be computed in a *bottom-up* analysis as the product of the observed strategy effectiveness per unit (column 2) and the percentage of units participating in the particular program design (column 3 or 4). (See exhibit 2.) Detailed computations are shown in Ramaswami et al. (2012b). Quick back-of-the-envelope computations illustrating the GHG impact of different program designs are shown here in exhibit 5. For example, the strategy effectiveness of installing two CFLs in place of incandescent bulbs is observed to yield about 1.5-percent savings of the household electricity use based on a field study in Colorado (Blasnik, 2006). In a mail-in program design, one can expect 50 percent of homes to participate, based on field studies of participation rates. Since household electricity use is 9 percent of Denver's overall GHG footprint and 18 percent of the buildings-energy sector footprint, which is one-half of the whole (see exhibit 1a), one can expect the following impact on the building-energy sector GHG footprint from a mail-in program offering two free CFLs—

GHG percentage Reduction = (1.5-percent reduction in household electricity use per home) x (50 percent participating homes) x (18-percent contribution of household electricity to the Building Sector Footprint) = 0.14-percent reduction in Buildings-Energy sector GHGs.

The above represents a generalized approach to compute the short-term GHG mitigation impact of various program designs using locally specific data, for example, data gathered or estimated on strategy effectiveness in the region (vary by climate regions) and participation rates measured explicitly in the different program types as the percentage of homes targeted that participate.

Exhibit 5

Back-of-the-Envelope Computations That Estimate the GHG Impact for Various City-Scale Voluntary (A1) and Policy/Regulatory (A2) Building Upgrade Programs (1 of 2)

Voluntary Programs (A1)	Computation Details	GHG Impact Estimate
Free CFL giveaway: mail-in program	Electricity: (1.5% reduction in household electricity use per home) × (50% participating homes) × (18% contribution of household electricity to the Building Sector Footprint)	**0.14%**
Door-to-door outreach: low-cost weatherization	Natural Gas: (5% reduction in household natural gas use per home) × (2% participating homes) × (10% contribution of household natural gas to the Building Sector Footprint)	**0.01%**
Low-income free home upgrade program	Electricity: (2.8% reduction in household electricity use per home) × (0.4% participating homes) × (18% contribution of household electricity to the Building Sector Footprint) Natural Gas: (13.6% reduction in household natural gas use per home) × (0.4% participating homes) × (10% contribution of household natural gas to the Building Sector Footprint)	Household Electricity = **0.003%** Household Natural Gas = **0.006%** TOTAL = **0.01%**
Energy efficiency loan programs	GHG: (21% reduction in household GHGs per home) × (0.01% participating homes) × (28% contribution of household GHGs to the Building Sector Footprint)	**0.001%**

Exhibit 5

Back-of-the-Envelope Computations That Estimate the GHG Impact for Various City-Scale Voluntary (A1) and Policy/Regulatory (A2) Building Upgrade Programs (2 of 2)

Voluntary Programs (A1)	Computation Details	GHG Effect Estimate
Voluntary penetration of new green buildings at 5%	Commercial: (10% reduction in commercial energy use intensity in Green Buildings) × (5% penetration of Green Buildings in new construction) × (1% new construction square footage) × (72% contribution of commercial GHGs to the Building Sector Footprint) Residential: (20% reduction in residential energy use) × (76% penetration of Green Buildings in new construction) × (6% increase in housing stock in 5y) × (28% contribution of household GHGs to the Building Sector)	Commercial buildings = **0.0036%** Residential buildings = **0.014%** **Total = 0.017%**
TOTAL Impact of All Voluntary Programs on Buildings-Energy GHG		**~ 0.18%**

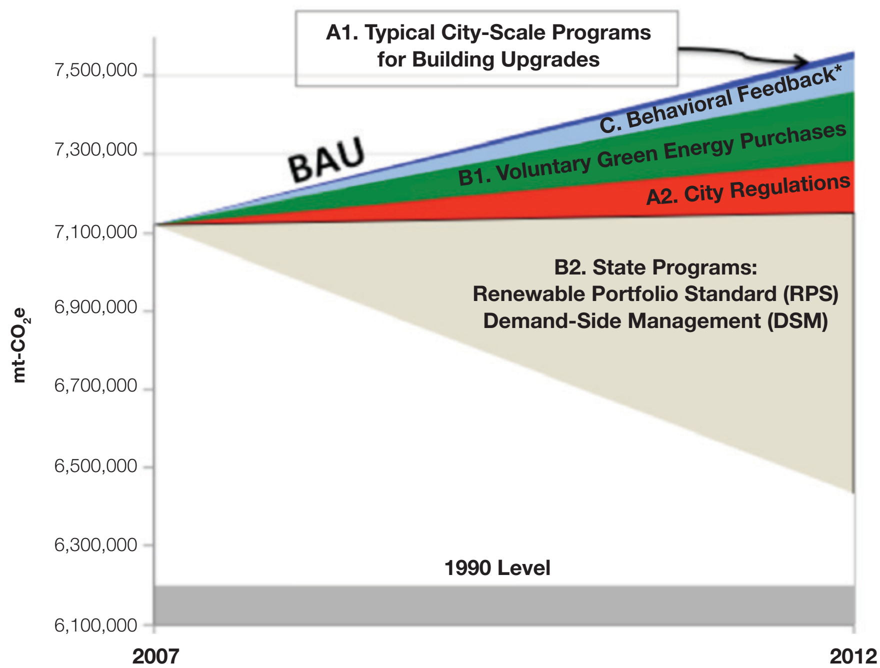
Policy/ Regulatory Programs (A2)	Computation Details	GHG Effect Estimate
TOS ordinance	Electricity: (2.8% reduction in household electricity use per home) × (20% participating homes) × (18% contribution of household electricity to the Building Sector Footprint) Natural gas: (13.6% reduction in household natural gas use per home) × (20% participating homes) × (10% contribution of household natural gas to the buildings-sector footprint)	Household Electricity = **0.1%** Household Natural Gas = **0.3%** **TOTAL ToS = 0.4%**
Date-certain ordinance for rental properties	Electricity: (2.8% reduction in household electricity use per home) × (30% participating homes) × (18% contribution of household electricity to the Building Sector Footprint) Natural Gas: (13.6% reduction in household natural gas use per home) × (30% participating homes) × (10% contribution of household natural gas to the Building Sector Footprint)	Household Electricity = **0.2%** Household Natural Gas = **0.5%** **TOTAL Date Certain = 0.7%**
Opt-in bond program	(21% reduction in household GHGs per home) × (2.6% participating homes) × (28% contribution of household GHGs to the Building Sector)	**0.16%**
Green buildings mandate	Commercial: (10% reduction in commercial energy use intensity in Green Buildings) × (76% penetration of Green Buildings in new construction) × (1% increase in building stock in 5y) × (72% contribution of commercial GHGs to the Building Sector Footprint) Residential: (20% reduction in residential energy use) × (76% penetration of Green Buildings in new construction) × (6% increase in housing stock in 5y) × (28% contribution of household GHGs to the Building Sector Footprint)	Commercial buildings = **0.05%** Residential buildings = **0.28%** **Total = 0.3%**
TOTAL Impact of All Regulatory Programs on Buildings-Energy GHG		**~ 1.8%**

CFL = compact florescent lamp. GHG = greenhouse gas. TOS = time-of-sale.

Note that a long-term analysis will need to carefully address when participation rates reach the maximum possible penetration rates in a community. The near-term analysis is conducted carefully to ensure there is no double counting across programs, for example, CFLs are not counted again in a neighborhood weatherization program. Similarly, the impact of policy/regulatory approaches shows the additional impact beyond what may be achieved in voluntary programs. Lastly, energy use reductions from efficiency, conservation, and taxation programs are computed first, before computing the GHG impact of programs that address electricity generation such as the RPS. The overall results—combining the impact of voluntary energy efficiency and conservation programs, policy approaches toward the same, taxation polices, and energy generation regulations—are shown in a near-term GHG mitigation wedge (exhibit 6) for Denver.

Exhibit 6

GHG Mitigation Impact in Buildings-Energy Sector Simulated for Denver, for Various Program Designs



** The impact of behavioral feedback devices when energy display meters are assumed to be installed in all homes.*
Source: Adapted from Ramaswami et al. (2012a)

Identifying Key Actors and Levers

So, which program designs and which actor categories are most important in their ability to reduce GHG impact of Denver's buildings-energy sector? Exhibit 6 shows the following—

- **Efficacy of typical city-scale building upgrade programs (A1).** All of voluntary building-sector outreach programs that cities engage in, together, yield less than 0.2-percent GHG mitigation over 5 years in the buildings-energy sector, barely visible in exhibit 6. With annual GHG emissions increasing at 1.2 percent each year in a business-as-usual scenario (BAU in exhibit 6), these voluntary programs have virtually no impact.

- **Impact of a few city-scale regulations for building upgrades (A2).** In contrast, a few strategic city regulatory programs such as ToS ordinances, date-certain regulations for rentals, mandated green buildings, and local carbon taxes can have a much higher impact at ~1.8 percent over 5 years but have not diffused beyond a few cities.
- **Voluntary programs to stimulate purchases of green energy (B1).** Both among homes and businesses, this is an underutilized strategy that has high impact potential for GHG mitigation, yielding as much as 2.4-percent GHG mitigation over 5 years. A combination of A2 and B1 can yield GHG stabilization; that is, a bending of the curve so that 2012 GHG levels are level with 2007 levels.
- **Cross-scale linkage to state regulation and utility programs (B2).** State regulations that require clean electricity generation have the largest impact on GHG mitigation at 9.5 percent, as seen in exhibit 6, demonstrating the importance of cross-scale linkages. In conjunction with the city actions, measureable reductions in GHG can now be seen generating a downward curve in exhibit 6.
- **New voluntary energy conservation programs that employ behavioral feedback.** Such programs can also have a significant impact, but more study is needed to assess the long-term field performance of feedback devices to evaluate persistence in energy savings.
- **A portfolio approach combining a few effective voluntary programs.** A few key local city-scale regulations combined with supportive state-level policies can yield significant reduction in building-sector GHG in the near term in as little as 5 years, as shown in exhibit 6.

Implication for Assessing, Implementing, and Reporting On Community CAPs

This article draws useful insights for assessing, implementing, and reporting on communitywide CAPs with focus on GHG mitigation strategies.

Content analysis of CAPs. Exhibits 1a–b show that GHG contributions from different infrastructure sectors are not the same. Thus, when conducting a content analysis of CAPs, policies in the different sectors should not be given equal consideration in GHG mitigation. In general, buildings-energy and transportation sectors dominate the communitywide GHG footprints of cities and policies in these sectors should have greater weight when evaluating CAPs compared to say waste and recycling in U.S. cities.

Program design for implementing CAPs. Further, this article has shown that not all programs have the same GHG impact, even though they may address the same broad GHG mitigation strategy. Thus, when implementing CAPs, local governments must carefully consider the impact of program design on GHG mitigation potential using data from other cities customized to the local context, such as described in this article.

A portfolio approach. Such an approach is recommended wherein a few voluntary programs found to be most effective are combined with a few strategic city-scale regulations. Such an approach is essential because few cities would have the resources to pursue all the strategies listed in exhibit 2. Most important are cross-scale linkages with state programs and regulations that can have broad impact, such as Colorado's RPS. A strategic portfolio mix of high-impact voluntary programs, a few key local city-scale regulations, combined with supportive state-level policies can yield significant reduction in building-sector GHG in the near term in as little as 5 years, as shown in exhibit 6.

A generalized quantitative approach. An approach to estimate the GHG impact of alternative program designs provided in this article can assist in selecting the portfolio components based on local physical and social context.

Program evaluation post implementation. This article suggests that cities must evaluate their energy outreach programs post implementation using data on actual participation rates achieved in different program designers, and if possible record actual energy savings in target and control populations.

Redesign. Based on program evaluation outcomes, cities may consider new approaches to increase participation in voluntary programs using opinion leaders and social networks. For example, Denver is testing a new approach wherein opinion leaders are identified a priori in a community and trained to distribute information on energy feedback devices. Participation rates in this experimental program will be compared with the same when the feedback devices are distributed at random in a comparable control neighborhood. Cities may also consider new regulations as they are piloted in other cities, for example, rental properties addressed in Boulder's smart regulations. Finally, fostering linkages across the city scale, the regional scale, and state-scale programs is important as seen in exhibit 6.

Theoretical understanding facilitated by the SEIS framework. Theories around social norming and planned behavior (Schultz et al., 2007) are helping design messaging to promote conservation behaviors in response to various feedback devices (Allcott and Mullainathan, 2010; Opower, n.d.). Field studies of social networks in communities (Valente and Schuster, 2002) combined with theories of diffusion of innovation (Rogers, 2003) may inform the diffusion of energy efficiency upgrades among individual users, while network studies across cities may inform how innovative policies and programs diffuse across cities. Club theory (Prakash and Potoski, 2007) may help explain the interactions between policy actors and infrastructure designer-operator groups in designing utility-led programs such as green purchasing. Policy actors play a pivotal role in the design of all the programs and in coordinating all three actor categories. Frameworks such as those of institutional collective action (Feiock, 2007) and advocacy coalition (Weible and Nohrstedt, in press) can help promote a better understanding of how policy actors' interactions with the other actors and across spatial scale shape the design and implementation of various GHG mitigation strategies shown in exhibit 2.

Thus, linking actors (exhibits 3 and 4) with footprints (exhibit 1) and with associated policies/programs (exhibit 2), connects policy outputs with the environmental outcomes shown in exhibit 6. Integrating such data-driven quantitative analysis with social actor theories in the SEIS framework provides a platform to assess and redesign GHG mitigation programs in cities taking a holistic approach that connects numerous social actors who shape both energy use and energy generation within and across the city scale.

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Local Governments and Sustainable Development From a Latin American Perspective

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Abstract

Over the years, an important debate has taken place over the role of national governments in advancing sustainable development. In particular, this debate has concentrated on the actions that developed and developing countries should take to decrease greenhouse gas emissions. The debate has advanced very little, however, because of the distributional consequences of these actions. Given the limitations of national efforts, this article addresses the importance of building a research agenda on the role that local governments could play in adopting sustainable strategies and policies. Understanding this role is relevant not only for U.S. cities but also for local governments in developing nations, given the difficulties of placing sustainable development on their national agendas.

Introduction

The idea of sustainable development was first introduced in the United Nations' (UN's) 1987 Brundtland Commission report. The report defined *sustainable development* as an appropriate rate of development that meets people's standard needs without compromising the ability of future generations to meet their needs. The UN developed major policy action at the first Rio Earth Summit in 1992, hosted by the government of Brazil. This summit led to Agenda 21, which created the "Blueprint for Sustainable Development," the first international action plan that expected developed and developing countries alike to meet and agree on how to diminish their carbon footprint. International agreements such as the most recent proposed in Cancun, Mexico (2010), in Copenhagen, Denmark (2009), and at Rio+20 (2012), however, have had difficulty establishing the acceptable criteria for many goals, such as the amount of pollutants to eliminate. At the heart of this global debate is the question of which countries are more likely and responsible to adopt the criteria and to take concrete action to eliminate carbon dioxide (CO_2) and decrease greenhouse gas (GHG) emissions.

Cities and local governments need to be involved for sustainable development to advance. Recent evidence suggests that cities are major contributors to CO_2 emissions. Cities house more than 50 percent of the world's population, a figure estimated to exceed 60 percent by 2030 (OECD, 2001). They also consume 60 to 80 percent of global energy production, which represents an equivalent percentage of global CO_2 and GHG emissions (OECD, 2001). Major sources of GHG come from the use of electricity, heating and industrial fuel, industrial processes, ground transportation, aviation, and solid waste. According to OECD (2001), people's lifestyles, not urbanization, is at the heart of the problem. The success of a compact city is based on using transport links appropriately, planning the correct mixture of land uses, and providing high-quality urban services.

The Example of Sustainability in Mexican Local Governments

In Mexico, as in most Latin American countries, promoting sustainability has not been on the agenda of national, state, or local governments. Other than the participation of the national governments in various summits, most national agencies, regional governments, and municipalities have not adopted policies explicitly intended to promote sustainable development. Only recently have the efforts of various levels of government been intended to tackle environmental issues. Few state governments have introduced mitigation policies or policies to advance goals such as the protection and renewal of natural resources. For instance, in Mexico, some states have adopted programs for water reservoir protection, energy saving, and reforestation. Other states have adopted and implemented environmental education programs to raise societal awareness about the effect of human activity on the environment and programs to promote recycling reusable materials, with little to no success.

Surprisingly, city governments are adopting adaptation policies without their respective nation states necessarily signing on to these global agreements. In this sense, the government of Mexico City deserves specific attention, because it has the most cutting-edge policies and programs on sustainable development in Mexico. Because of its sizable population and budget capacity, Mexico City has characteristics closer to those of a state government than a municipality. The city's public report on climate change (Vasques, Del Valle, and Salinas, 2008) cited program plans to be implemented between 2008 and 2012 and beyond. The report set a goal of reducing CO_2 emissions by 7 million tons by 2012, which represents 12 percent of annual GHG emissions in Mexico City alone.

Despite such isolated efforts, the current challenge for Mexican and Latin American local governments is to create a minimum base from which to start promoting sustainable policies. For instance, creating more compact and tidy cities and preventing urban sprawl seem to be imperative. As traditionally designed by Spanish colonizers, city centers in Latin American cities consist of a main plaza, cathedral, public schools, and government buildings (Grindle, 2007; Ward, 1998). Beyond the urban center, however, most modern cities in these countries are characterized by random, unplanned growth, with large areas of housing facing inadequate accessibility to jobs and public services, and often to schools, parks, and mass transit options.

Appropriate urban growth is particularly important in rapidly urbanizing areas in developing countries such as Mexico, which has recently experienced a pronounced population growth and a high level of population density. According to the National Institute of Geography and Statistics, in 1950, slightly less than 43 percent of Mexico's population (more than 2,500 inhabitants) lived in urban areas. In 1990, that number reached 71 percent. The latest figure, recorded in 2010, suggested that the urban population of Mexico had reached 78 percent of the national population.

Scale, Instruments, and Models of Governance

The articles in this symposium provide new insights directly relevant to the Latin American context. These ideas have the potential not only to stimulate research, but also to inform policy development in Latin American local governments. They could particularly help local governments to move from cyclical debates regarding the pertinence of the concept, redefinitions of terms, or the relevance of adopting sustainable policies (Barton, 2006; Bernal, 2004; Lezama and Domínguez, 2006; Lomnitz, 2005) to specific policies and programs that could be adopted and implemented at the local, state, or national level. The scale of the response, the specific instruments that could be used, and the applicable models of governance are important topics that deserve attention to identify the extent to which sustainable policies are viable in cities, not only in the United States, but also in developing countries.

The symposium articles make a consistent case that local governments are an appropriate level at which to address problems and policies associated with sustainability. Svara, Watt, and Jang (2013) show that sustainable policies are adopted when they are linked to specific economic benefits for local governments and communities. In the same sense, Portney (2013) and Hawkins and Wang (2013) make the argument about the compatibility of environmental protection and economic development. These studies could teach scholars and policymakers in Latin American the importance of appealing to local groups to advance sustainable policies. The previously mentioned studies, however, assume that economic growth is linked to more opportunities and jobs for most members of these communities, which would fulfill the social sphere of environmental policies. This assumption is hard to make for Mexico and other Latin American countries that are characterized by the concentration of income and opportunities in urban areas. Therefore, in these countries, making the case that protecting the environment can provide some sort of social justice at the same time may be more important to help rally public support to these policies, as it has in the case of policies that promote public transportation and mobility.

A second issue regarding the pertinence of the local level to adopting environmental and sustainability policies relates to resources—in particular, technical and financial resources—that local governments need to advance the adoption and implementation of these policies. For instance, the kinds of impact fees that Burge and Ihlanfeldt (2013) suggest require technology and technical expertise as well as professional planners who understand the complexity of growth management. They also require commitments from elected officials who are willing to leave the politically profitable business of deciding land uses to manage urban growth. Finally, adopting these instruments will require local governments to have a long-term perspective based on stable institutions that extend beyond elected authorities. These three elements are missing in Mexico and in most Latin American local governments (Rondón, 2009).

In addition, some of the technologies associated with energy saving and more efficient management of natural resources require substantial investments, which are particularly scarce in local governments that depend on transfers from national governments to deliver public services. For instance, according to Cabrero and Orihuela (2011), only about 20 percent of municipal revenue in Mexico was collected locally in 2008, and the remainder of public funds was transferred from the state or federal government.

The lack of resources in developing countries, however, has also been a recurring argument for developing countries' lack of commitment and involvement to adopting sustainable policies (Bernal, 2004; Chacón, 2009; Rondón, 2009; Rosales and Sánchez, 2011). This situation is related to another major factor in the global debate regarding whether developed or developing countries are responsible for the global climate crisis and how the international community can deal with these problems on an equal playing field. The bottom line of this debate relates to the cost of implementing instruments that contribute to sustainable development. In this sense, various articles in this symposium provide some examples of low-cost instruments of potential use in developing countries. For instance, Ramaswami (2013) discusses policies and programs that do not require substantial investments, such as reducing the demand for transportation energy through coordination with regional organizations or providing feedback to consumers via bills to promote a behavioral change. As Ramaswami notes, these policies may have a limited effect on GHG emissions but could be a first step.

Svara, Watt, and Jang (2013) also provide many policies and programs that would have marginal costs for local governments. Regarding all the programs and instruments that could be labeled as sustainable, however, Latin American countries face a similar situation as U.S. local governments. At first, it appears that any program could be labeled as part of a sustainable development program. For this reason, sustainable programs initially become a series of bins, wherein local governments or public agencies mix existing programs and actions that enable them to gain support from new interest groups. Some governments or public agencies, however, seem to take this opportunity to innovate and to generate new programs that allow for the integration of the "three Es": economy, ecology, and equity. Little is known about how this transition happens and what makes it possible. The responses to these questions are important to help local governments, in general, understand how they could develop sustainable programs, rather than merely repackaging what they are doing already.

Finally, the governance topic is also very relevant for Latin American countries. It seems that, for Latin American scholars and policymakers, the adoption and implementation of sustainable policies is basically a governmental affair (Barton, 2006; Miguel et al., 2011; Rosales and Sánchez, 2011) that, at best, concerns the private sector and local communities (Rondón, 2009). Sustainability is therefore often seen as a policy that should start from national initiatives and that only requires coordination among the different levels of government to be adopted and implemented. This perspective is limited compared with that offered by the articles in this symposium.

Previous research has shown that policies associated with sustainability, such as compact development, have important redistributive consequences for interest groups in cities (Ramírez de la Cruz, 2009). In these cases, the interest groups likely to champion and oppose sustainable policies need to be actively incorporated into the adoption debate and made participants in implementing the instrument. The active participation from environmental groups is even more important in developing democracies, which lack the institutions and civic community that could serve as a counterbalance to economic growth interest (Denhardt et al., 2009). For this reason, the role of international networks such as ICLEI—Local Governments for Sustainability—are of particular importance (Daley, Sharp, and Bae, 2013; Weible and Elgin, 2013). In cities in developing countries, as in U.S. cities, these networks seem to provide public awareness and support for mayors to adopt and promote sustainable policies, as in the previously described case of Mexico City, which has been an active member of ICLEI. In addition, these networks can provide incentives to mayors looking to advance in their political careers by giving them national and international exposure and a reputation for being progressive. The articles in this symposium, taken together, make the argument that local co-benefits or the alignment of political and environmental incentives motivate sustainability. The example of Mexico suggests that aligning political incentives with sustainability is critical in the Latin American context as well, but the relevant co-benefits may be very different.

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Point of Contention: Property Taxes

For this issue's Point of Contention, we asked four well-known public economics specialists to argue either for or against the following proposition—"Relative to the other revenue sources generally available to local government, the property tax generally is superior on efficiency grounds, because it induces less undesirable behavior and avoidance, and on equity grounds, because it bears less harshly on those less able to afford it."

Three Points in Favor, One Big Flaw

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Some of the text in this article comes from my unpublished comment on Fischel (2010).

The statement as written is almost certainly true, but it does not necessarily imply that the property tax alone should fund local governments and schools. Let us begin with the basic truth of the statement, and then discuss why property taxes should be a principal, but not the lone, source of funding for local government and schools.

The property tax has three strengths to recommend it. First, in economics jargon, it is a tax on something that is fairly inelastically supplied (that is, real estate) in the medium (and sometimes long) run, and hence it does not create much deadweight loss. In other words, owners of real estate generally cannot physically move their buildings, so a somewhat higher tax rate does not change their medium-term behavior much; therefore, society does not suffer much loss of overall income or welfare from property owner reactions to tax changes.

Second, as a benefits tax, the property tax aligns the interests of government service providers with those of government service users (that is, taxpayers). In an ideal world, the *tax price* of government goods is unity. That is, the marginal cost to taxpayers of a service is equal to its actual cost. If they pay less at the margin, taxpayers will demand more services; if they pay more at the margin, they will demand fewer.

When property taxes fund services, property owners have the incentive to demand services up to the point at which benefits equal costs—the point at which property values reach their highest levels. Fischel (2010) hypothesized (and I think demonstrated) that in a world with a median-voter model of government decisionmaking, ad valorem property taxes lead to optimal and efficient service provision.

The most common criticism of the property tax is that it is regressive, which is true at a particular location at a particular point in time. As Aaron (1975) noted in his groundbreaking book, however, the property tax likely falls largely on holders of capital, who are on average richer than those who do not hold capital, and so the tax may well be progressive. Moreover, lifetime housing consumption is proportional to lifetime income, and consequently although a tax on housing at any point in time may be regressive, during the life cycle, it is not.

Although the property tax has virtues and should, in my view, be a principal source of local government spending, relying on it can produce one profoundly unfair outcome.

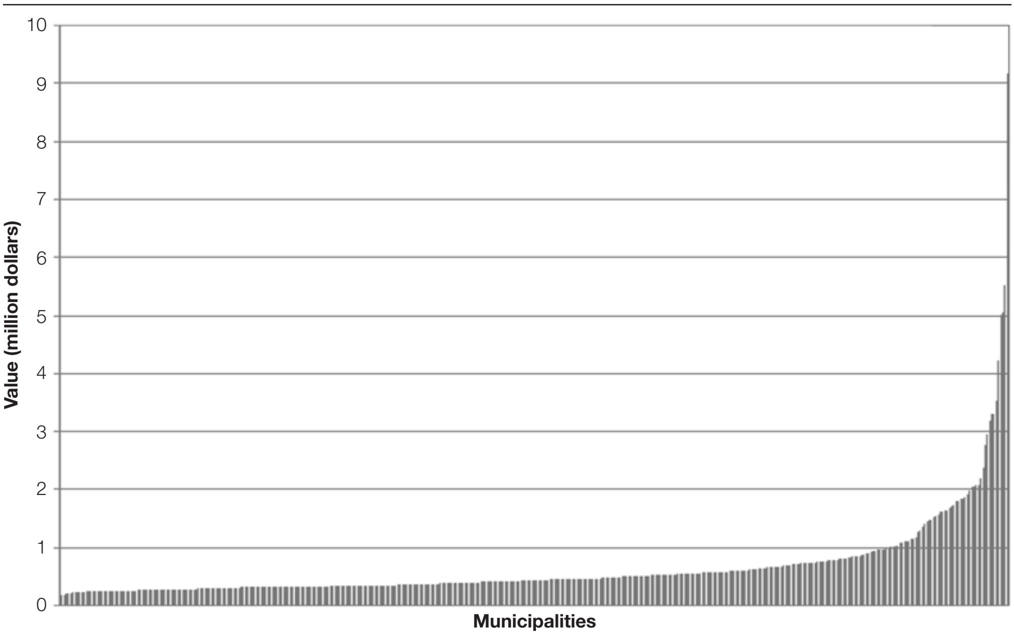
Differences in property values (and particularly commercial property values) lead to differences in tax prices that produce unequal outcomes for school children.

As Oates (1969) showed, in a municipality where schools are funded locally, higher school spending produces higher property values. We can infer from this finding that the net benefits of schools are greater than the net costs of funding them; moreover, this inequality may be self-reinforcing.

I will use Wisconsin as an example to illustrate the problem. Wisconsin effectively illustrates two dilemmas we face when using the property tax to finance schools. First, in 2006, the distribution of property values per pupil was both highly dispersed and skewed (exhibit 1). The average school district in Wisconsin had taxable property values per pupil of $664,000, and the standard deviation of property values was $773,000. The dispersion is not driven only by outliers: at the top quartile of the property value distribution, property value per pupil is roughly double the value at the lowest quartile of the distribution.

Exhibit 1

Property Value per Pupil, Wisconsin, FY 2006–07



FY = fiscal year.

Also, the tax price of schools varies dramatically. In the town of Brookfield, more than 50 percent of property value comes from commercial property, so the tax price of schools is quite low. In the city of Wisconsin Rapids, on the other hand, substantial sections of manufacturing property are exempt from the property tax, and farmland is taxed at use value.[1] Because of this disparity, residential property comprises a disproportionately large share of the tax base, and the tax price for schools is higher there than elsewhere.

Of course, direct methods do exist for redistributing resources across districts and putting children on a level playing field: vouchers that do not tie children to their local schools. Nechyba (2000) argues that it makes no policy sense for geography to determine child outcomes. I tend to like school vouchers myself, yet it is the nexus of geography and schools that leads to the positive outcomes that Fischel and others have attributed to property-tax-based school funding. Moreover, as a practical matter, it can be difficult for parents to transport children across large metropolitan areas to obtain good schooling.

Compounding the dilemma is the fact that the evidence, much of which Fischel (2010) cited, suggests that central government funding of education does not work very well. Public school systems in California used to be jewels of the state. During the years when most school funding has flowed through the state government in Sacramento, public schools in California have deteriorated.

So where does this leave us? Perhaps an answer arises from a simple insight of microeconomics: what matters is not the price at which you buy everything, but the price at which you buy the last thing. The best policy (or perhaps I should say second best policy) might be one in which all schoolchildren have access to the minimum level of resources necessary to receive an adequate education. I think there might be a consensus about what constitutes this minimum: proficient reading and math test scores at the grade school level and sufficient numbers of classes to prepare students for college at the high school level.

Each school district would receive the funding necessary to provide the minimum level of education. This minimum level might not include things such as advanced placement courses. From an efficiency standpoint, the ideal tax would be a lump-sum tax leveled at the state—or perhaps even federal—level. Such a tax would, of course, be politically infeasible and regressive. The least distortionary tax I can think of is a sales tax or a value-added tax. Any spending a community did beyond the bare minimum would be determined and financed by the community via the property tax. By implementing this tax policy, the marginal tax price of marginal improvements in education would be close to unity. Such plans exist and are known as foundation plans. Andrew Reschovsky, among others, has designed such plans.[2]

[1] If farmland were taxed as, for example, potential new residential property, the same land would nearly always be worth more than its agricultural value.

[2] For an example, see https://docs.google.com/viewer?a=v&q=cache:sQugQPpztyMJ:citeseerx.ist.psu.edu/viewdoc/download?doi%3D10.1.1.152.881%26rep%3Drep1%26type%3Dpdf+school+finance+network+wisconsin&hl=en&gl=us&pid=bl&srcid=ADGEESgEN75LGC2eNYiVdSmAzCfEUYBIU7cewDWovPFk4uc3if_ax-2__2xb3tc7GHe89VZqOH910xXgrPq_H6X3GDyf8pH-Y_CnQHsiTfeXdZWexovaU4X6peOeKxidSazPaB1An9l-&sig=AHIEtbTr7GKqG3VsuAVOWFEWa4dZJu_WYQ.

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A Convenient Truth: Property Taxes and Revenue Stability

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Local governments in the United States typically rely on several main sources of own-source revenues, including individual income taxes, general sales taxes, specific excise taxes, fees and charges, and local property taxes. Of these sources, the dominant is by far the property tax. According to the United States Census Bureau (http://www.census.gov/govs/estimate), local property taxes accounted for roughly three-fourths of total local government tax revenues and for nearly one-half of total local own-source revenues (including fees and charges) in 2010.

A natural question is whether this heavy reliance is appropriate. Many approaches have been used to examine how a local government should determine its tax policies, including what might be termed an "optimal tax" approach, a "portfolio" approach, a "tax smoothing" approach, a "political economy" approach, and a "tax assignment" approach, among many others. In all cases, the appropriate tax structure represents a tradeoff among conflicting goals (for example, efficiency, equity, adequacy, growth, stability, simplicity, and electability), chosen subject to various constraints (for example, achieving a revenue target, minimizing revenue volatility, meeting distributional requirements, and satisfying constituents).

In this broader context, local government reliance on the property tax has strengths and weaknesses. There is some evidence that the property tax has at least a proportional and often a progressive effect on the distribution of income. Given the relative immobility of the base, the tax is unlikely to seriously distort land markets, and it may in some circumstances actually improve the efficiency of resource use. The immobility of the tax base also makes it easy to identify and capture that base and enables the properties to be the natural collateral in cases of nonpayment. Because of its immobility, the property tax base also captures the value of location-specific capital investments and benefits from local government programs and services not otherwise captured through various fees, user charges, and other taxes. The property tax tends to fall on those with a greater ability to pay because immobile property can be the primary repository of wealth. Because property can be assessed by physical inspection, the tax is difficult to evade; indeed, local government officials are well situated to collect the tax. As a highly visible and politically sensitive revenue instrument, the property tax can serve as a perfect tax to encourage more responsive, efficient, and accountable local governments, especially because the tax can be viewed in part as payment for local services.

The property tax also has major problems. The property tax is often rated in polls as among the least popular of all taxes. It is a highly visible tax to taxpayers because they typically pay it directly.

Property tax administration is often arbitrary and idiosyncratic, especially in the procedures used to determine the value of properties; when the procedures used to generate this assessed value are performed incompetently, or even corruptly, individuals rightly perceive the tax as unfair. The tax base is typically distributed across local governments in very uneven ways, which contributes to extreme fiscal disparities across jurisdictions. Perhaps as a result, the property tax is often perceived by individuals as a regressive tax, one in which greater burdens are imposed on lower income than on higher income households.

Finally, the revenue potential of the property tax is seldom fully realized, due largely to significant administrative problems in identifying properties, valuing them, adjusting valuation over time, collecting revenues, and enforcing penalties. Revenue also suffers from politically imposed restrictions on property tax administration and revenue growth. These factors make the property tax an especially inelastic source of revenues. Exemptions are one problem. Governmental, educational, religious, agricultural, and nonprofit properties are frequently exempt from the property tax. Exemption thresholds are common for low-value properties, and owner-occupied, residential, or agricultural properties often receive differential (and lower) valuations than commercial or industrial properties. It is common to provide exemptions and tax relief for social purposes aimed at low-income families, widows, and retired and elderly people. Valuation is another problem. Property transactions do not occur at regular intervals, a practice that makes it necessary to impose the tax on some estimate of each property's value and to use some method to adjust this value over time for changes in prices. Experience also demonstrates that it is difficult to generate large amounts of additional new revenues from the property tax via short-term reforms. Both problems make the property tax an especially inelastic source of revenues, one that does not grow automatically, or even easily, over time.

Many of these claims—especially about its progressive effect on the distribution of income and its nondistortionary effects on resource allocation—have not gone uncontested, as documented in Oates (2001) and Bahl, Martinez-Vazquez, and Youngman (2010). Views on the many effects of the property tax are often wildly conflicting.

Even so, one largely uncontested feature of the property tax—its inelasticity—that is often cited as a weakness of the tax has, I believe, proven to be an important and neglected advantage in the recent national economic recession. Indeed, local government reliance on the property tax rather than on more elastic revenue sources like income, sales, and excise taxes has—so far, in any event—helped local governments to avoid some of the more severe difficulties experienced by many other governments in the "Great Recession" that lasted officially from December 2007 to June 2009. Given the institutional realities of property tax administration, it may take several assessment cycles (for example, many years) before changes in market property values are reflected in assessed values and, ultimately, in property tax collections. Local jurisdictions also routinely adjust millage rates to bring revenues in line with expenditures; this feature is, of course, available for other taxes, but it is a far more common occurrence for the local property tax.

Indeed, recent work by Alm, Buschman, and Sjoquist (2011, 2009) documented that, despite the overall decline in property values in the United States attributable to the bursting of the housing bubble before the start of the Great Recession, the experiences of local governments were quite varied. Indeed, many local governments were able to avoid the significant negative budgetary effects that afflicted state and federal governments. Although housing price declines clearly affected property tax revenues in many jurisdictions, they did so with a significant lag, and they could be offset, at least in part and at least for a time, by discretionary policy changes.

These findings suggest that local government reliance on the property tax has been a largely positive feature in recent years; that is, local government reliance on the property tax has proven to be "a convenient truth." This reliance seems likely to continue in at least some form for the immediate future, and much evidence suggests that this reliance should not be discouraged.

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Usually the Best Available Tax, but It's a Complex Question

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Introduction

The property tax is a highly unpopular tax. Not only do survey respondents consider it unfair, states across the country have long imposed limitations of various kinds on property tax revenues. Not surprisingly, local government reliance on property taxes in the United States has declined during the past few decades. In 1977, the year before California enacted Proposition 13, property taxes accounted for 81 percent of local government tax revenue and 59 percent of the own-source general revenues of local governments. In 2010, these percentages stood at 75 and 48 percent, respectively. Nevertheless, the property tax remains the mainstay of local government finance in the United States, with local government collecting $462 billion in property tax revenues in the 12 months ending July 2012 (U.S. Census Bureau, 2012).

Attempts to further restrict property tax use may accelerate in the near future. The sharp drop in housing prices in many parts of the country, the continued economic uncertainty, the aging of the population, and the retirement of the baby boom generation are all likely to increase political opposition to the property tax.

The *Point of Contention* statement implies that a shift from the property tax to alternative sources of revenue will result in a reduction in the overall efficiency and the fairness of local public finance in the United States. Although a strong case can be made on both efficiency and equity grounds for the superiority of the property tax relative to a local sales tax, continuing uncertainty about both the efficiency and incidence of the property tax prevents us from making definitive statements about the superiority of the property tax relative to a local income tax.

Efficiency

Any tax levied by a local government could potentially influence individuals to take actions to avoid the tax. As long as tax rates differ across jurisdictions, high property tax or local income tax rates may encourage households or businesses to move to a lower tax jurisdiction. If sales tax rate differentials are large, high local sales taxes are likely to encourage some consumers to make their purchases in places with lower rates.[1] Because avoiding local sales taxes is in most cases relatively easy compared with moving to a new community, one can conclude that property taxes and local income taxes are superior on efficiency grounds to local sales taxes. Comparing the efficiency of income and property taxes is much more complicated.

Whether any tax is likely to distort behavior depends on demand and supply elasticities and, consequently, on the incidence of the tax. Although economists generally agree that the burden of the income tax falls on those who earn income, the incidence of the property tax remains quite controversial. Probably the most widely accepted theory of property tax incidence is the *capital-tax view*, which was previously called the "new view." Under this view, if the supply of capital in the United States is inelastic and if all real property is taxed at the same rate, capital would flow away from real property in the long run, and the burden of the property tax would fall on all owners of capital. Under the more realistic assumption that capital will flow out of the country in response to a lower rate of return, some of the property tax burden will likely be shifted to labor.

The property tax, of course, is not a national tax, and property tax rates vary substantially. According to the capital-tax view, the incidence of the deviations from the national average property tax rate will be borne by the users of capital, because capital will tend to flow from jurisdictions with above-average tax rates to places with below-average rates. These so-called *excise tax effects* will lower wages on (immobile) labor, raise local prices (including rents), and reduce the returns to land in jurisdictions with above-average tax rates, with the opposite effect in jurisdictions with below-average tax rates. Property tax rates greater than the national average cause both household and business capital to migrate to lower tax jurisdictions. The result is an inefficient allocation of capital. Also, as Zodrow and Mieszkowski (1986a) pointed out, the potential loss of capital may lead to an underprovision of local public goods in jurisdictions with above-average property tax rates. Furthermore, the excise tax effects of above-average property tax rates may discourage investments in housing improvements. If high property tax rates are not matched by high levels of local public services, the high property tax rates will be capitalized into lower land values. Given the immobility of land, a portion of the burden of the property tax rests on current landowners. Because land is in fixed supply, these landowners are unable to take any actions to avoid the tax. As a result, the portion of the tax borne by landowners creates no distortions.

In many ways, the distortion created by a system of local income taxes would be similar to the distortion created by the property tax. Because a household's residential location and housing consumption are linked, under either system, tax rate differentials would be capitalized into housing and land prices. Oates and Schwab (2004) pointed out, however, that although both homeowners and renters pay local income taxes, fiscal illusion on the part of tenants may lead them to believe that they bear little or none of the burden of property taxation. The result, especially in cities with substantial rental property, may be an overprovision of local public goods.

An alternative theory of property tax incidence is the *benefit view*. Under this view, based on the seminal article by Tiebout (1956), homeowners choose among competing jurisdictions to find a local government that provides their desired mix of local public services at an acceptable tax rate.

[1] Within the typical metropolitan area, retail establishments tend to be concentrated in a few jurisdictions, suggesting that spatial disparities in sales tax bases are generally larger than disparities in property tax or income tax bases.

Later work by Hamilton (1975) demonstrated that using property taxes to fund local governments, combined with a system of zoning, can guarantee an efficient allocation of local public goods. In a setting where mobile households choose among a set of different jurisdictions, the property tax effectively serves as the price households pay for their preferred mix of local public services.

Would the replacement of the local property tax with a local income tax lead to an increase in economic distortions generated by taxpayers choosing to work less or choosing to move to lower tax rate jurisdictions? As Oates and Schwab (2004) argued, if housing consumption is perfectly correlated with income, then the income tax would be converted into a perfect benefit tax, again resulting in an efficient allocation of local public goods. In reality, we do not expect the correlation between income and housing consumption to be perfect. The result is that a local income tax will generate some efficiency loses. Based on a general-equilibrium model, however, Goodspeed (1989) suggested that the efficiency losses from a local income tax would be relatively modest.

One important difference between a local property tax and an income tax is that property taxes are levied on the owners of all types of property, whereas income taxes are levied only on residents and perhaps commuters. Thus, a switch from property taxation to individual income taxation would eliminate most taxation of commercial and industrial property. An efficient system of local public finance would tax local businesses at a level equal to the marginal costs of the local public services they receive. The failure to tax business would thus be expected to result in an inefficient allocation of resources.

Although we can conclude that the property tax is a relatively efficient local government tax, the limitations on assessment growth and on property tax levies and rates imposed by state governments or voter-initiated state constitutional amendments can create economic distortions. For example, annual limits on the growth rate of assessed values found in a number of states, including California, have created *lock-in effects*, which distort behavior by discouraging long-time homeowners from selling their homes. However, as McGuire (2001) pointed out, if the property tax were replaced by a local income or sales tax, it is highly likely that, over time, state legislature would also impose inefficiency-creating limitations on these taxes.

Equity

Any tax that "bears less harshly on those less able to afford it" is considered a *progressive* tax. In a recent paper, Fischel, Oates, and Youngman (2011: 1) asserted that despite 50 years of analysis, "our understanding of the incidence of local property taxes is in a sad state." On the one hand, in enacting property tax relief measures targeted at households with low incomes, state and local government policymakers frequently assert that the property tax is unfair because low-income households tend to face heavier burdens than households with higher incomes. Underlying these statements is a belief that statutory incidence determines the distribution of tax burdens and that housing expenditures as a fraction of income are greater for low-income than high-income households.

On the other hand, many public finance economists accept the capital-tax view of property tax incidence. According to this view, from a national perspective, the average rate of property taxation generates a burden on all owners of capital. Because capital ownership is highly progressive, the incidence of this portion of the tax is also progressive. Because property tax rates vary substantially across the country, the burden of the positive and negative deviations around the average, referred to as the excise tax effects, fall on immobile factors such as landowners, local consumers, and labor. Supporters of the capital-tax view argue that, in the aggregate, the negative and positive excise tax effects cancel each other out (Zodrow and Mieszkowski, 1986b). Thus, we can conclude that from a national perspective the complete burden of the property tax falls on capital and is therefore progressive.

Supporters of the benefit view reject this conclusion. They argue that because the property tax is only the price that households pay to receive their desired mix of local public services, the question of tax incidence, or fairness, is not relevant.

I argue that policymakers and most economists tend to underestimate the complexity of the property tax incidence issue. These assertions about the incidence of the property tax do contain some truths. I will attempt to demonstrate, however, that no blanket statement about property tax incidence is justified; a more nuanced approach is necessary.

For several reasons, policymakers tend to overestimate the property tax burdens faced by low-income households. Policy debates are primarily focused on the property tax paid by homeowners (their statutory liability), and it appears that most policymakers assume that the entire burden of the tax falls on the owners, failing to recognize or acknowledge the capital-tax view that, in the long run at least, a portion of the tax burden will be borne by all owners of capital.

Empirical studies based on the statutory incidence of the property tax tend to overestimate the regressivity of the property tax on homeowners.[2] In these studies, average tax burdens are calculated by dividing statutory tax liabilities for a single year by a measure of annual household income. It is well recognized that calculating tax burdens based on annual data leads to an annual income bias. The argument, originally made by Friedman (1957), is that in cases such as housing, wherein consumption decisions are made on the basis of long-run income, calculating tax burdens using income data for a single year will yield far greater tax burdens for low-income households than burdens calculated on the basis of long-run or lifetime income. These differences in tax burdens occur because many people who have low incomes in any given year are only temporarily poor. Conversely, the use of annual income will bias average tax burdens downward on high-income households as long as some households with high annual incomes are only temporarily rich.

The empirical literature includes several attempts to account for the effect of the annual income bias when calculating tax burdens. Metcalf (1994) and Poterba (1989) used annual expenditures as a proxy for lifetime income. Chernick and Reschovsky (1997) criticized the use of expenditure data as an indicator of lifetime income and proposed the use of data on income and tax payments over a period of at least several years. Using longitudinal data on income and property tax payments covering a period of 11 years, Chernick and Reschovsky (1993) found that the property tax burden on homeowners remains mildly regressive. In a recent study of property tax burdens on homeowners, Boldt, Caruth, and Reschovsky (2010) calculated tax burdens using 6 years of

[2] One example of a study that provides state-level estimates of the distribution of state and local taxes, including the property tax, is Davis et al. (2009).

income and tax data and a comprehensive measure of income that included an estimate of imputed rents. Compared with tax burden calculations based on annual data, property tax regressivity was reduced but not eliminated. Metcalf (1994), who assumed that capital bears the burden of the property tax, found that the highest tax burdens remain on households in the two lowest income quintiles (in his case, with income measured by annual expenditures).

According to the capital-tax view of property tax incidence, the excise tax effects borne by local consumers, landowners, and workers will cancel each other out. The validity of this statement depends on empirical evidence about the relationship between effective property tax rates and income. If property tax rates are uncorrelated with income, then from a national perspective the excise tax effects cancel out and the property tax can be seen as a progressive tax on capital. Not surprisingly, given the absence of a national dataset on effective property tax rates, very little empirical evidence exists at the national level on the spatial correlation between effective tax rates and incomes. A study of this question by Aaron (1975) is now out of date. Gravelle (2007: 889) found that "the excise tax effect of the property tax neither strongly increases nor decreases the progressivity of the property tax as a whole." This finding led her to conclude that the property tax can "continue to be viewed as a general tax on capital" (Gravelle, 2007: 890). Unfortunately, the Gravelle study was based on somewhat questionable estimates of the average effective property tax rate by state. The property tax is a local government tax, and the intrastate variation in rates may well exceed the interstate variation measured by Gravelle.

Even if future research confirms that, across the nation, effective property tax rates are uncorrelated with income and therefore that the excise tax effects have no net effect on tax progressivity, the question remains whether it makes any sense to think about property tax incidence from a national perspective. The property tax in the United States is a local tax. All policy decisions related to the property tax are made at the local government level or, in the case of tax limitations or assessment rules, at the state government level. In a state with above-average tax rates, local property owners, consumers, and labor bear part of the burden of the tax. The effect of the tax on these local residents will likely influence property tax policy in that state. The fact that taxpayers in states with below-average tax rates benefit from offsetting excise tax effects seems largely irrelevant to any policy discussions related to the property tax in high-tax locations.

To the extent that excise tax effects influence the incidence of the property tax in any given state, it is worth noting that the distribution of tax burdens can also be influenced by various institutional factors. As shown by several studies conducted in the 1970s and 1980s, property tax assessment practices can substantially reduce the progressivity of the tax by systematically assessing low-value properties at a higher proportion of their value than high-value properties. On the other hand, many states have enacted circuit breakers and other property tax relief policies designed to reduce the net property tax burden of certain, often low-income, households.[3] Finally, the ability of taxpayers who itemize their deductions on their federal returns to deduct property tax payments serves to reduce the net burden of the property tax, especially on taxpayers with moderate to high incomes.

[3] No comprehensive studies appear to have tried to calculate the degree to which targeted tax relief measures have reduced property tax burdens. In a study of property tax circuit breakers, Bowman et al. (2009) reported that, in most states with circuit breaker programs, the value of total tax relief was less than 2 percent of state property tax collections. Only in New Jersey and Michigan did the cost of circuit breaker programs exceed 5 percent of total collections.

In an interesting paper, Nechyba (2001: 119) concluded his analysis of the two views of property tax incidence by stating that "there may not be one right model. The different assumptions underlying the two different views are likely to hold to varying degrees from one setting to another; one view may be more appropriate in one case than in another." Fischel, Oates, and Youngman (2011) took Nechyba's suggestion and attempted to explicitly define the settings in which each view is most appropriate. They argued that the benefit view fits best in suburban portions of metropolitan areas, but the capital-tax view is most appropriate in cities and in rural areas.[4] They also point out that in states, such as California, where public education financing is primarily conducted by the state government and local governments are prevented from raising property taxes to increase spending on local public goods, the benefit view is weakened.

Although it is not possible to make a general statement about the progressivity of the property tax, it is possible to speculate that the replacement of the property tax with a local sales tax would, in the average state, increase tax burdens on those households with limited resources, and the substitution of a local income tax for the property tax may slightly reduce the tax burden on low-income households.

Economists generally agree that the burden of the sales tax rests primarily on consumers and the burden of the individual income tax on income earners. The progressivity of each tax, however, varies substantially across states depending on the breadth of the sales tax base and the tax rate structure, exclusions, exemptions, and deductions that define local income tax system in each state. The distributional analysis of state tax systems conducted by the Institute of Taxation and Economic Policy (Davis et al., 2009) indicated that state and local sales tax distribution is regressive in every state, although the burden on households in the bottom income quintile varies substantially even when comparing states employing identical sales tax rates. Although state income tax systems are at least mildly progressive, local income taxes, where they exist, are usually levied at a flat rate on only earnings or payrolls, and thus they may be somewhat regressive when calculated relative to a broad measure of ability to pay.

Conclusions

The *Point of Contention* statement asserts that the property tax is superior to alternative local government revenue sources on both equity and efficiency grounds. I have tried to make the case in this article that any comparison among local government revenue sources is complicated by the fact that no definitive statement about either the efficiency or the equity of the property tax is justified. Given the current state of both the theory and the empirical evidence related to the property tax, I think the best approach is to accept that both the efficiency and equity of the property tax will be different in different settings.

It is nevertheless possible to reach a few general conclusions. On both efficiency and equity grounds, the property tax and the local income tax are preferable to the sales tax in many settings. Not only is the sales tax likely to place heavier burdens on low-income households than the other

[4] The authors pointed out that, in locations where the benefit view is most likely to hold, a local income tax would also tend to operate as a benefits tax.

two taxes, it makes tax avoidance much easier. Comparisons between the property tax and the income tax are much more difficult, although on efficiency grounds the property tax may dominate the income tax in many settings.

Note that the property tax does have several advantages over other local government revenue sources on grounds not directly related to efficiency or equity. First, property tax revenues have tended to be much more stable over business cycles than revenue from local sales or income taxes. The past decade has demonstrated the importance of stable local government revenue sources. Sharp declines in state government tax revenues following the recessions of both 2001 and 2007 through 2009 led to large cuts in state fiscal assistance to local governments. Without a relatively stable source of local government revenue from the property tax, local governments would undoubtedly have had to cut services even more than they did. Second, for property owners without escrow accounts, the fact that annual property taxes are usually made in one or more large installment payments increases the salience of the tax. Although the visibility of the property tax undoubtedly increases opposition to the tax, it has the positive effect of enhancing taxpayers' awareness of the cost of local government. As a result, they are more likely to demand efficient public service provision by their local government. This awareness of the costs of government may be less true in the case of income taxes withheld from paychecks or sales taxes collected from individual transactions.

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The Property Tax Is a Bad Tax, but It Need Not Be

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Economists have long argued over the nature of the property tax—is it a benefits tax or a capital tax with local excise tax effects? Those who see it as a benefits tax draw upon the pioneering efforts of Tiebout (1956) to argue that households equate taxes paid with the value of public services received by "voting with their feet." According to one of the leading advocates of this position (Hamilton, 1975a), the existence of choice among communities, combined with the use of zoning to exclude free riders, transforms the suburban public economy into a quasi-market, with the property tax serving as the price for public goods. If this case holds, as Hamilton (1975b: 13) pointed out, "... then this price should not distort the housing market any more than the price of eggs should distort the housing market." According to those who see the property tax as a capital/excise tax, the national average rate of taxation is a tax on capital, and local differences from the national average rate produce local excise effects.

Regardless of which of the two views of the property tax one subscribes to, to many economists the property tax does not look like such a bad tax. Two principles are used to judge whether a tax is fair: the benefits principle and the ability-to-pay principle. The benefits principle maintains that taxes paid should rise in proportion to the benefits received from public services. The ability-to-pay principle has two alternative interpretations. One is that higher income households should pay more in taxes, and the other is that the burden of taxation, measured as taxes paid as a percentage of income, should be lower for lower income households. If the tax incidence by income class is *progressive* and not *regressive*, the tax satisfies either interpretation of the ability-to-pay principle. Obviously, if the property tax is the price for local public services, it satisfies the benefits principle of just taxation. If the tax is a capital/excise tax, it should be judged on the ability-to-pay criterion of just taxation. As it turns out, the property tax incidence by income class is a complicated issue, but the fact that the property tax is, in part, a capital tax suggests that it may be a progressive tax.

If the property tax is a just tax in the eyes of many economists, why, from the 1970s through today, has it been reported as the least popular tax in repeated surveys of American taxpayers? Cabral and Hoxby (2010: 20) reviewed the survey evidence from 1972 to 2005 and concluded the following: "The property tax starts out unpopular in 1972 and ends up still unpopular in 2005: in both years, about 38 percent of adults stated that it was the worst tax." The alternatives from which the survey respondents had to choose, all of which they liked more than the property tax, were the federal income tax, the Social Security tax, state income taxes, and state sales taxes. Cabral and Hoxby's answer as to why the property tax is the least popular of all taxes was that it is the most *salient*, by which they meant that the property tax is the tax that people are the most aware of paying. Landowners pay property taxes by writing one or two checks a year, which makes the taxpayer acutely aware of the tax and its amount. By contrast, most people pay their income and payroll taxes through payroll withholding, so no physical act of payment is required except when too little has been withheld. In practice, most taxpayers do not have to write a check to the Internal Revenue Service at the end of the tax year, but rather they receive a tax refund, which surely contributes to the popularity of the income tax by comparison with the property tax. Although sales and excise taxes are directly paid by the consumer at the time of purchase, they are part of the gross price of goods and services and are not paid separately from the price, which makes them less transparent to the average consumer. Moreover, the taxpayer pays sales taxes incrementally with each additional purchase and is not confronted with an annual total sales tax bill, so he or she may not be fully aware of just how much sales tax is being paid.

The salience of the property tax, however, is not the only reason for the difference of opinion between the average taxpayer and many economists on whether the property tax is a good or bad tax. The property tax that economists have long debated is an ad valorem tax; that is, it is levied as a percentage of the market value of the property. This tax, however, is not the property tax that now exists in most communities throughout the United States. After the property tax in practice is recognized as something other than an ad valorem tax, it is just as easy for the economist to disdain the property tax as the average taxpayer, although the two groups' dislike of the tax may not be similarly rooted.

Why, then, is the property tax not an ad valorem tax and why does that make a difference in whether the tax is bad or good? Regarding the first question, two factors cause the property tax to differ from an ad valorem tax. First, for many homeowners, state laws restricting increases in assessed values and local lags in assessment practices have broken the connection between the assessed value and the fair market value of their homes. A very useful resource on property taxation in the United States is the Lincoln Institute of Land Policy's website, "Significant Features of the Property Tax" (http://www.lincolninst.edu/subcenters/significant-features-property-tax/). By my count, 18 states and Washington, D.C., are identified as having legal limitations on how much the assessed value of an individual home can increase from one year to the next. In Florida, for example, assessed value can increase annually by 3 percent or the rate of inflation, whichever is less. The Lincoln Institute also identifies 11 states that freeze assessed values on the homes of selected groups of taxpayers, such as elderly, low-income, or disabled people.

Regarding lags in assessment practices, another Lincoln Institute report by Haveman and Sexton (2008) found that 27 states do not require annual assessment, with a 3- to 5-year lag in reassessment quite common. In effect, assessment lags are like the previously mentioned, legally mandated assessment caps, wherein the cap has been set at 0 percent. Regardless of whether an assessment-increase cap is because of legislation or a lag in reassessment, the volatility that housing markets have experienced during the past decade resulted in wide divergences between assessed and market values; hence, by many indications, the property tax is not an ad valorem tax.

A second factor that divorces assessed values from market values adds to these indications. Baer (2003) reported that homestead exemptions existed in 40 states and Washington, D.C., by the year

2000. These exemptions provide owner-occupants with reductions in their assessed values. To illustrate, in Florida, the homestead exemption is $50,000. Say two people each buy a $200,000 house; for one, it will be his primary residence, but for the other, it will be a second home. The assessed value of the first owner's home is $150,000, but that of the second owner's home is $200,000 (that is, the full market value of the home). For homesteaders, the property tax is not an ad valorem tax.

Turning to whether the property tax is a good or bad tax, if assessed values do not reflect market values, the property tax cannot be seen as a good tax based on either of economists' views of the property tax or on either of the principles of just taxation. Consider the possibility that the property tax is the price of public goods where property is assessed at acquisition rather than market value. Acquisition value taxation is a trait that many assessment-increase cap programs have in common. If zoning has done its job to create homogeneous market values throughout the community, people are still potentially paying vastly different property taxes depending on when they first moved into the community. Hence, the property tax is no longer a quid pro quo for the receipt of public services, no quasi-market for public goods exists, and the tax can no longer be judged a good tax based on the benefits view of just taxation.

When we switch to the ability-to-pay criterion of just taxation, the effect of assessment caps on the regressivity or progressivity of the tax will depend on whether the market values of low-income households' homes increase faster or slower than the market values of high-income households' homes. Where acquisition-based assessment is combined with the cap, the regressivity or progressivity of the tax will also depend on differences in turnover rates between low- and high-income households. I have seen no empirical analysis of property tax incidence by income class that accounts for the property tax's non-ad valorem nature, but one carefully done study found that assessment caps diminish the vertical equity of the property tax, when vertical equity is defined as low- and high-valued homes having the same effective tax rate (Moore, 2008). Moore's results showed that, under an assessment cap system, higher valued properties have a lower effective tax rate than lower valued properties. Moore did not explore whether this system results in a regressive tax, because household income information was not available. Housing, however, is clearly a *normal* good (in general, people demand higher quality housing as their incomes grow). If the effective tax rate declines with house value, it surely will also decline with income, rendering the property tax a regressive tax, which would make it an unjust tax based on the ability-to-pay principle.

Moore also investigated how the vertical equity of the property tax is affected by homestead exemptions and found that these exemptions, too, cause effective tax rates to be lower on more expensive homes. On the surface, this finding would seem to be counterintuitive, because homestead exemptions, which are constant dollar amounts, knock a larger percentage off the market values of less valuable homes. Remember, however, that the homestead exemption is provided to only a select group of buyers. Lower valued homes that are bought to be rented or to be used as a second home are assessed at full market value.

In addition to the benefits and ability-to-pay principles of just taxation, which are used to compare the fairness of alternative taxes, a third principle of just taxation, *horizontal equity*, applies strictly to the property tax. This principle states that homeowners living in the same taxing jurisdiction should pay the same effective tax rate; the latter equals the nominal tax rate, which is the same for everyone, times the ratio of assessed value to market value, which may not be the same for everyone. The difference between assessed and market values resulting from an assessment cap typically disappears when a home changes ownership. That is, at the time of the sale the assessed value is reset to market value (or to the statutory assessed-to-market value ratio, which may not be 100 percent). This reset results in homeowners within the same jurisdiction paying different effective tax rates depending on how long they have lived in their homes. This discrepancy violates the horizontal equity provision that homeowners occupying equally valued homes should pay identical amounts of property taxes. Obviously, homestead exemptions also violate horizontal equity because homeowners with equally valued homes pay different effective tax rates depending on whether the home is occupied by the buyer.

In summary, because the property tax is not an ad valorem tax, it fails on all three principles of just taxation. Therefore, it should be judged by all economists as a bad tax. This conclusion begs the question as to whether local governments should continue to use the property tax. The answer to this question might depend on whether alternative taxes are more just. It may also depend on whether property tax reforms can make it a true ad valorem tax. Computer-assisted mass appraisal systems have progressed to the point at which they are quite capable of placing, on each property on the tax roll, an accurate estimate of its market value on an annual basis. In fact, having evaluated the performance of Florida's 67 property tax assessors, I have seen in practice that market-value assessment is not a problem. The problem in Florida, and in a growing number of other states, is that caps on increases in assessed values have broken the close tie that needs to exist between assessed and market values.

Not surprisingly, my policy recommendation is to eliminate all assessment caps, all lags in assessment practices, and all homestead exemptions. The most likely criticism of my recommendation is that caps on assessment increases protect homeowners from unpredictable changes in their property taxes. These caps, it would be argued, were especially necessary during the recent housing price boom, when housing prices appreciated at historically unprecedented rates. An alternative solution to the problem of escalating property tax payments resulting from housing price inflation exists, however. Under a market-value-based approach to property taxation, property tax payments need not rise as housing price inflation occurs, because the nominal tax rate can be reduced to maintain current levels. The tax that achieves this goal is sometimes referred to as the *rollback* rate because it rolls back tax revenues to what they were before housing prices rose.

If the solution to making the property tax an ad valorem tax is so simple, why has the rollback rate not been adopted more frequently? The answer, of course, is that local politicians, for good or evil, desire greater tax revenues and are therefore reluctant to cut tax rates even when tax bases are rising. Nothing, however, prevents states from passing legislation that would institutionalize the rollback rate, which has, in fact, recently happened in the state of Florida. If local politicians want more tax revenues, they should go to voters and ask for an increase in the property tax rate. If revenues rise because of house price inflation, the tax should be rolled back to maintain current revenues. Making taxpayers aware of the rollbacks may also alter the relative unpopularity of the tax.

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The Market for Real Estate Brokerage Services in Low- and High-Income Neighborhoods: A Six-City Study

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Abstract

In this article, we examine the market structure for real estate brokerage services across six large metropolitan statistical areas (MSAs) to see whether low-income neighborhoods, or neighborhoods where house prices are low, are as well served by real estate professionals as higher income or higher priced neighborhoods. We collect more than 300,000 real estate listings and compute the Herfindahl-Hirschman Index for each ZIP Code neighborhood in each MSA. When we divide neighborhoods based on income, house value, and race, we find no evidence that access is worse in disadvantaged areas; that is, the market structure for brokerage services is at least as competitive in less advantaged neighborhoods. We also analyze market leaders in the six MSAs and find that some firms, however, specialize in particular market segments.

Introduction

Residents of low-income or minority neighborhoods pay higher prices and have fewer choices for a variety of products and services. Underserved sectors include supermarkets, banks, and large drug stores,[1] credit cards,[2] gasoline retailing,[3] and insurance.[4] Allegations of "retail redlining" have led to lawsuits against companies such as General Motors Company, Wal-Mart Stores, Inc., and Burger King Corporation.[5] Although differences in the performance of housing markets in low-income or minority neighborhoods have been extensively studied, most of the attention has been focused on possible redlining practices by mortgage lenders.[6] Little attention has been paid to real estate middlemen—brokers and agents—in assessing the performance of urban real estate markets.[7]

This lack of attention is surprising, given that housing market outcomes vary greatly. Homeownership rates differ among various economic and demographic groups. Two dimensions that have probably attracted the most attention are income and race. Very low-income households have homeownership rates that are 37 percentage points lower than the rate for high-income households, whereas homeownership rates for minority households lag behind those of White households by 24 percentage points (Bunce and Reeder, 2007). Some evidence suggests that house prices paid also differ across groups. In a study of four cities, Bayer et al. (2012) found that African-American and Hispanic homebuyers paid a premium of 3 percent—a difference not explained by variation in buyer income, wealth, or access to credit.

The type and degree of services demanded by buyers and sellers differ for low- versus high-priced houses. Real estate markets tend to be thicker in lower price ranges. Product heterogeneity tends to be greater in higher price ranges. Broad agreement also exists that real estate markets are local and not national in geographic scope. Real estate brokers and agents thus compete in local markets. In large metropolitan areas, most agents and many brokers tend to specialize even more and compete in submarkets and neighborhoods within the larger metropolitan market area. This outcome is not surprising, because sellers and buyers value the localized knowledge that agents and brokers bring to the transaction.

[1] Alwitt and Donley (1997) used Chicago as a case study and found that lower income ZIP Codes have fewer and smaller outlets than other ZIP Codes for supermarkets, banks, and large drug stores.

[2] Cohen-Cole (2011) found that, after controlling for place-specific factors, qualitatively large differences exist in the amount of credit offered to similarly qualified applicants living in African-American versus White areas.

[3] Myers et al. (2011) analyzed gasoline retailing and found that prices are higher in lower income areas, partially because of low competition and inelastic demand.

[4] Ong and Stoll (2007) found that variations in auto insurance costs occur because of both risk and redlining factors, and that African-American and low-income neighborhoods are adversely affected. Regan (2007) focused on insurance availability and found a positive correlation between the proportion of minority homeowners in a state and the share of more restrictive dwelling fire policies.

[5] See Myers et al. (2011) for an extensive discussion of retail redlining.

[6] In the context of the Fair Housing Act, redlining is "the practice of denying a creditworthy applicant a loan for housing in a certain neighborhood even though the applicant may otherwise be eligible for the loan." Redlining based on racial composition is illegal, whereas redlining based on economic factors is legal. See http://www.federalreserve.gov/boarddocs/supmanual/cch/fair_lend_fhact.pdf.

[7] Myers (2004) studied racial housing price differentials and controls for neighborhood effects. She suggested that one possible source of racial housing price differentials is supplier price discrimination by real estate brokers and agents.

Given all these aspects of housing markets, the question that naturally arises is, "Are the residents of low-income neighborhoods as well served by real estate agents and brokers as the residents of high-income neighborhoods?" In light of Hsieh and Moretti's (2003) finding that when the average price of land in a city increases the fraction of real estate brokers relative to population increases and the productivity of a typical real estate agent falls, one can imagine that even in areas that are geographically proximate, different neighborhoods have different clienteles and are ripe for specialization, which may result in lower income neighborhoods being differentially served by real estate brokers and agents.

For this reason, we investigate whether submarkets within broader metropolitan markets face different levels of competitiveness among real estate brokers. This research builds on our previous work that analyzes market concentration in small, medium, and large real estate markets (Beck, Scott, and Yelowitz, 2012). We have gathered data for six large metropolitan statistical areas (MSAs): Atlanta-Sandy Springs-Marietta, GA (Atlanta MSA); Boston-Cambridge-Quincy, MA-NH (Boston MSA); Chicago-Joliet-Naperville, IL-IN-WI (Chicago MSA); Dallas-Fort Worth-Arlington, TX (Dallas MSA); Los Angeles-Long Beach-Santa Ana, CA (Los Angeles MSA); and Washington-Arlington-Alexandria, DC-VA-MD-WV (Washington, DC MSA). These MSAs were chosen for their geographic diversity, income diversity, and very different average house prices. Demographic information on income, house values, population, racial composition, and homeownership were obtained at the ZIP Code level from the 2000 census. These data were merged with information we gathered in 2011 from the National Association of REALTORS® (NAR) website (http://www.REALTOR.com) on listings by broker for each ZIP Code neighborhood.

Our final sample consists of 1,321 ZIP Codes in these six MSAs, which can be merged with the Census Bureau's American FactFinder data and which had at least 50 multiple listing service (MLS) listings. We compute Herfindahl-Hirschman Indices (HHIs) for each MSA and then for each ZIP Code within the six MSAs.[8] After presenting ZIP Code-level summary statistics for each MSA, we analyze HHIs at the ZIP Code level. We regress ZIP Code-level HHI on racial composition, median house price, median household income, and a measure of the heterogeneity of the housing stock in the neighborhood. We find that submarkets are less concentrated in neighborhoods with heterogeneity in the housing stock and greater percent non-White, but they are more concentrated in neighborhoods with higher average prices. To see whether real estate brokers tend to specialize by neighborhood, we also identify the real estate brokers with the largest market shares in low-income, low house-price, and high percentage-minority neighborhoods compared with those in high-income, high house-price, and low percentage-minority neighborhoods. We find many cases in which the market leaders differ substantially by neighborhood.

Income and Racial Gaps in Homeownership

Considerable effort has gone into understanding the determinants of homeownership rates by income, racial, and ethnic status.[9] Haurin, Herbert, and Rosenthal (2007) assessed the extent of

[8] HHI is calculated by summing the squared market shares (expressed as a percentage) of all firms on the supply side of a market. A monopoly market thus has an HHI of 10,000, and a market of atomistic firms has an HHI that approaches zero.

[9] *Cityscape* recently devoted two symposia to recent research on low-income and minority homeownership (Bunce and Reeder, 2007; Reeder, 2008).

differences in homeownership rates among different socioeconomic groups and reviewed existing research on possible explanations for these differences. They first discussed factors that affect the formation of households, and then turned to the propensity for homeownership.

In addition to factors that influence household demand for homeownership, Haurin, Herbert, and Rosenthal (2007) evaluated three types of supply constraints that may restrict different households' access to single-family housing: (1) the supply of mortgage credit may affect low-income and minority households differently, (2) racial discrimination may exist in mortgage markets, and (3) the type of housing stock may vary across different neighborhoods.

Racial or ethnic discrimination that affects access to homeownership can occur at several different levels. Munnell et al. (1996) supplemented data generated as a result of the Home Mortgage Disclosure Act with data collected by the Federal Reserve Bank of Boston from lending institutions on financial, employment, and property characteristics to see whether race plays a role in the lending decision. They found significant disparities between minority and White rejection rates, even after controlling for other factors. Yinger (1991) used data from the 1989 U.S. Department of Housing and Urban Development (HUD) Housing Discrimination Study that conducted fair housing audits. He found statistically significant differences in the treatment of African Americans and Whites and in the treatment of Hispanics and Anglos by sales and rental agents. Ondrich, Stricker, and Yinger (1998) used a similar approach to investigate the treatment of Whites, African Americans, and Hispanics by real estate brokers and also found evidence of discrimination.

These and many other studies have examined person-based discrimination. A related issue is whether the various parties involved in the supply of housing treat different types of neighborhoods differently. Berkovec et al. (1994) used individual loan records from HUD along with census tract data to study default risk characteristics and performance of Federal Housing Administration-insured mortgages. They found that loans in high-income and high house-price census tracts are less likely to default. They found no strong relationship between racial characteristics of a neighborhood and likelihood of default. Tootell (1996) addressed the issue of redlining directly by studying the racial composition of the neighborhood while controlling for the race of the applicant. He found that the racial composition of the neighborhood where a property is located is not significantly related to the lending decision. More recently, Ghent, Hernández-Murillo, and Owyang (2012) examined subprime loan pricing during 2005, and found evidence of redlining and adverse pricing for African Americans and Hispanics.

Conceptual Framework

Yet to be analyzed is whether the supply of real estate professionals and market structure of real estate brokerage differs by neighborhood characteristics.[10] In a nondiscriminatory competitive

[10] In one part of the study by Ondrich, Ross, and Yinger (2003), the authors used paired-audit study data (the housing discrimination study) to examine whether real estate agents representing homebuyers practice *redlining*, defined as withholding from all customers houses in integrated neighborhoods. They found evidence to support this hypothesis in suburbs but not in central cities. Galster and Godfrey (2005) also used these data to provide evidence of racial steering of homebuyers. Zhao, Ondrich, and Yinger (2006) found that the scope of discrimination and the probability that it will be encountered by a buyer diminished sharply between 1989 and 2000. Note that performing a paired audit study—which inherently involves deception on the part of the auditors—is far easier and more feasible with homebuyers than with home sellers.

market characterized by free entry, we would expect real estate middlemen to pursue profitable opportunities wherever they occur. In equilibrium, agents and brokers would list and sell properties and be compensated for their services at prices that yielded the same return in low-income neighborhoods as in high-income neighborhoods and in ZIP Codes where house prices are low as in ZIP Codes where prices are high. Only the profit opportunities, and not the racial and ethnic characteristics of a neighborhood, would affect agents' and brokers' supply decisions.

Geographically proximate neighborhoods can differ markedly in per capita income and ethnic and racial composition. Average home prices can also differ significantly by neighborhood. The prevailing method of compensating real estate agents and brokers involved in a housing transaction is that the seller pays a fixed percentage commission on the selling price of the home. This structure limits how real estate agents and brokers are compensated for their services. Payment for services rendered may be more closely connected to the selling price of the product than to the costs incurred in facilitating the transaction.

Both the buying and selling sides of a real estate transaction have fixed and variable components of cost.[11] It is also the case that to a large degree costs are endogenous; that is, agents and brokers determine the level of effort and expense involved in listing and selling a particular house. The nature of costs combined with the fixed percentage commission structure means that the profitability of any transaction is likely to increase with the selling price of the house.[12] It is entirely plausible that real estate brokers and agents may be less likely to enter and serve neighborhoods where home prices are relatively low.

Given the relatively low homeownership rates among low-income and minority households, a natural question to ask is whether neighborhoods with higher proportions of low-income or minority households, where home prices may be relatively lower, are underserved by real estate middlemen. If brokers avoid neighborhoods, then a lack of competition among agents and brokers may lead to higher commissions and reduced services for residents of such neighborhoods.[13] Competitiveness in real estate brokerage has been a concern of the Antitrust Division of the U.S. Department of Justice (DOJ) and the Federal Trade Commission (FTC) for a long time. The two agencies issued a joint report on competitiveness in the real estate industry in 2007. They cited anecdotal evidence of high concentration levels in local real estate markets as cause for concern.[14]

[11] See the discussion in White (2006).

[12] Hsieh and Moretti (2003) analyzed the market for real estate in different cities and found that the supply of real estate agents is highly responsive to the average price of housing, which they attribute in no small part to the fixed commission-rate structure. Although this conventional wisdom about commission rates may be correct, very little direct evidence exists on full commission rates. One notable exception is Woodward (2008).

[13] One limitation of our study is that we are unable to determine whether the market segmentation we observe is the result of deliberate choices by individual large brokerages not to serve certain neighborhoods, which is the essence of redlining. Rather, we are able to examine availability of brokerage services at the market level.

[14] Motivated by that and other studies that analyzed one or a handful of markets, we collected data in 2007 and 2009 on the number of brokers and market shares for 90 small, medium, and large real estate markets around the country and computed HHIs. In medium- and large-sized markets we found no evidence of market concentration levels that might create problems for competition. In some of the small markets in our sample, we found HHIs in the range that would invite antitrust scrutiny under the FTC-DOJ Horizontal Merger Guidelines if two larger firms proposed to merge. We were also able to analyze the size distribution of firms in submarkets within a larger metropolitan area—Louisville, Kentucky—but were unable to look at submarkets stratified by income, house prices, or racial composition.

The general concern about competition in real estate brokerage alongside the differential rates of homeownership by income and race suggests an analysis of concentration levels by neighborhood. The structural question that we analyze is whether low-income, low house-price, or high fraction-minority neighborhoods face access issues by real estate brokers; that is, do brokers avoid low-income and low house-price neighborhoods because it is less profitable to do business there? If so, the lack of competition may lead to less market activity and relatively higher prices for real estate services. Similarly, do brokers as an industry discriminate against and avoid minority-dominated neighborhoods, possibly leading to lower levels of service and higher commissions for real estate services?

To answer these questions, we chose six large MSAs: the Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington, DC MSAs. We gathered data that enable us to analyze the number and market shares of real estate brokers serving each ZIP Code neighborhood. We combined these data with census data on income, house values, and racial composition, so that we can determine whether the supply of real estate brokerage services differs by income, house price, or racial composition in a neighborhood.

Data

We collected data from REALTOR.com in April 2011 for all ZIP Codes in the Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington DC MSAs. This website is maintained by the NAR and allows for users to search real estate listings throughout the country by city or ZIP Code. It provides a nationally consistent source of data on local real estate markets. According to GAO (2005), approximately 95 percent of all homes listed on MLSs around the country are contained on REALTOR.com. Because the brokerage firm listing the house is reported, we are able to record all the listings in each MSA at a point in time and thereby analyze local market structure. In the appendix, we provide a comprehensive analysis of the extent to which the NAR data appear to summarize the full housing market, because other options like for sale by owner or listing exclusively on the local MLS (but not REALTOR.com) are ignored in the subsequent analysis. The short answer is that the NAR data appear to summarize the vast majority of market activity, not only for each of the six MSAs but for individual neighborhoods as well.[15]

We gathered information on all single-family homes, townhomes, and condominiums within each ZIP Code, including the dwelling's address, city, lot size, bedrooms, bathrooms, listing broker, and unique URL link. Using a web-scraping program, we attempted to collect information from 2,984 ZIP Codes within these six MSAs; within those ZIP Codes our program collected more than 300,000 listings. Some ZIP Codes did not contain any listings, most often because they were post office boxes or unique ZIP Codes (for example, related to a government facility). Overall, 1,884

[15] In related research we have taken steps to verify the validity of the REALTOR.com data against other sources (see Beck, Scott, and Yelowitz, 2012). We compared REALTOR.com data with MLS data used by FTC and DOJ (2007) and also found a very close connection. For example, our analysis found Des Moines, Iowa, as a highly concentrated medium-sized market in 2007, consistent with discussion in the FTC and DOJ (2007). Note that we do not observe transactions, only listings.

ZIP Codes had at least one real estate listing. The amount of real estate activity in each MSA differed substantially. For example, the Atlanta MSA had 265 real estate listings per ZIP Code, more than three times higher than the Boston MSA's average of 85.[16]

We compiled a list of firms in each market from the core dataset of 314,232 real estate listings. This task was nontrivial, because real estate listings by the same office often have slightly different names. Consider, for example, Keller Williams Realty, Inc. (Keller Williams) franchisees in the Atlanta MSA. According to the Keller Williams website, the company has 32 offices in the Atlanta area.[17] One of the larger franchisee offices is "Keller Williams Realty Atlanta Partners." Various listings in the Atlanta MSA substitute the word "Ptnrs" or "Part" or "Part." or "Ptnr" for the word "Partners." Other listings substitute the word "Atl" or "Atl." for the word "Atlanta." Some other listings substitute "Rlty" or "Re" for the word "Realty." A few listings use the abbreviations "KW" or "Keller Wms" for "Keller Williams." Overall, the six MSAs contained 18,825 unique names for offices or firms, although clearly from this example, a particular real estate brokerage firm can have multiple unique names in the data.

To create the HHI for each MSA and for each ZIP Code, we had to perform the particularly time-intensive task of editing the firm names in defensible ways. Our first approach was to make extremely minor changes to office names, and then to treat each office as a unique firm. These minor changes included changing all lower case letters to upper case, removing extra spaces, dashes, periods, commas, slashes, explanation points, and converting obvious abbreviations (for example, "C 21" to "CENTURY 21"). After these minor changes were made, 16,264 firms existed across the six MSAs, varying from 1,767 in the Boston MSA to 5,855 in the Los Angeles MSA. To the extent that some of the individual offices identified by this process are parts of larger multilocation brokerage firms, then this "minor change" approach understates the HHI in the locality. Our second approach was to make "major edits," the most important of which is grouping all listings with a given franchise name and treating them as part of the same firm. For example, this approach would group the 32 Keller Williams offices in the Atlanta MSA into one firm.[18] As a consequence, this method likely overstates market concentration. The "major edit" approach leads to 14,922 firms across all areas, varying from 1,618 in the Boston MSA to 5,296 in the Los Angeles MSA. In this way, we are able to provide lower and upper bounds on the size distribution of firms in each given market.

From the initial 1,884 ZIP Codes with real estate listings in the MSAs, we created various geographies besides the MSA. In one specification, we restrict ZIP Codes to those that are officially in the central city according to the U.S. Postal Service (USPS).[19] These political jurisdictions yield many fewer ZIP Codes, as illustrated in exhibit 1. In another specification, we rely on agent-reported city names, even if the city name is inconsistent with the official name in the ZIP Code. This specification again yields many fewer ZIP Codes.

[16] See exhibit 1 for a complete description and breakdown of the construction of our sample.

[17] http://www.kw.com/kw/OfficeSearchSubmit.action?startRow=1&rows=50&city=Atlanta&stateProvId=GA.

[18] As is indicated in their Uniform Franchise Offering circulars, most real estate franchisors structure their franchise contracts so as to give legal autonomy to each franchisee, which would suggest that our first approach gives a better measure of the number of independent producers in a market than our second approach.

[19] See http://zip4.usps.com/zip4/citytown.jsp, where the central cities are Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington, D.C.

Exhibit 1

Data Extraction

	MSAs*						Total
	Atlanta	Boston	Chicago	Dallas	Los Angeles	Washington, DC	
Initial ZIP Codes scraped	345	327	510	436	662	704	2,984
ZIP Codes with at least one listing	254	234	419	279	375	323	1,884
Dwellings in these ZIP Codes (including duplicates)	86,663	20,267	86,461	34,933	52,619	33,289	314,232
Listings per ZIP Code (including duplicates)	341	87	206	125	140	103	
Dwellings in these ZIP Codes (no duplicates)	67,426	19,783	85,825	34,782	52,037	32,986	292,839
Percent unduplicated	78%	98%	99%	100%	99%	99%	93%
Listings per ZIP Code (no duplicates)	265	85	205	125	139	102	155
ZIP Codes within MSA	254	234	419	279	375	323	1,884
ZIP Codes within official city, according to USPS	50	26	62	46	63	25	272
ZIP Codes with agent-reported city name	71	27	61	50	87	22	318
ZIP Codes within MSA	254	234	419	279	375	323	1,884
ZIP Codes within MSA (50 or more listings)	177	158	327	185	314	200	1,361
ZIP Codes within MSA (50 or more listings, merged to American FactFinder)	172	157	310	176	308	198	1,321
Firms in MSA (unedited)	2,465	2,180	3,529	2,166	6,736	1,749	18,825
Firms in MSA (minor edits)	**2,028**	**1,767**	**3,179**	**1,935**	**5,855**	**1,500**	**16,264**
Firms in MSA (major edits)	**1,775**	**1,618**	**2,964**	**1,856**	**5,296**	**1,413**	**14,922**

MSA = metropolitan statistical area. USPS = U.S. Postal Service.

** The full MSA names are as follows: Atlanta MSA = Atlanta-Sandy Springs-Marietta, GA; Boston MSA = Boston-Cambridge-Quincy, MA-NH; Chicago MSA = Chicago-Naperville-Joliet, IL-IN-WI; Dallas MSA = Dallas-Fort Worth-Arlington, TX; Los Angeles MSA = Los Angeles-Long Beach-Santa Ana, CA; Washington, DC MSA = Washington-Arlington-Alexandria, DC-VA-MD-WV.*

Notes: Source of ZIP Codes within city is http://zip4.usps.com/zip4/citytown.jsp. Minor edits include changing lower case to upper case; removing extra spaces, dashes, periods, commas, slashes, exclamation points, or ampersands; converting RE MAX to REMAX, AND to &, C 21 to CENTURY 21, and so on; and treating each office as its own brokerage. Major edits include grouping all franchisees as one firm.

The MSA sample of ZIP Codes forms the starting point for much of our analysis on disparities in market structure by income, house value, or race. From the initial sample of 1,884 ZIP Codes, we restrict the sample to the 1,361 ZIP Codes with at least 50 or more real estate listings. By doing so, we believe that our computation of HHI will not be mechanically influenced by small sample sizes (for example, the HHI must be 10,000 if only one listing exists in a ZIP Code, and cannot be lower than 5,000 if two listings exist). We then append data from American FactFinder, drawing on the 2000 census.[20] Overall, approximately 97 percent of ZIP Codes—or 1,321 of 1,361—had information tabulated from the decennial census. We chose three critical characteristics at the ZIP Code level—median value of single-family owner-occupied homes, median family income, and percent White—from the FactFinder tool.

Empirical Results

Our goal in this article is to divide large markets (MSAs) into neighborhoods (ZIP Codes) where we can obtain demographic information on income, house values, population, and homeownership for 2000, merged with concentration levels from 2011, and use these data to investigate whether the market structure for real estate brokerage services is fundamentally different in low-income, low house-price, or high-minority neighborhoods. Exhibit 2 contains HHIs computed for each of the six cities at the MSA level, the city level where the listing real estate agent inputs the city, and at the city level as defined by the USPS ZIP Code. We include HHIs where all offices are considered separately, and where all offices of each franchisor are treated as part of one firm. At the MSA level, HHIs range from 36 to 341 when all offices are considered separately and from 302 to 678 when all offices of a franchisor are combined. HHIs are slightly higher when calculated at the city level, but not appreciably. All are clearly in the range considered unconcentrated by the DOJ and the FTC when evaluating horizontal mergers.[21]

This point is reinforced when we examine market shares of the top four brokerages in each MSA. Exhibit 3a contains this information when all offices are considered separately, and exhibit 3b does the same when all offices of a franchisor are combined. At the MSA level, even the largest real estate broker has less than a 5-percent market share in the Atlanta, Boston, Dallas, and Los Angeles MSAs when each office is considered as an independent firm. In the Chicago MSA, the largest broker has 7.8 percent of the market, and in the Washington, DC MSA, the largest broker has a 16.2-percent market share. When we treat all offices of a franchisor as one firm, a slightly different picture emerges. The larger franchisors in each MSA now have market shares in the teens, although none have as much as 20 percent of the market for real estate listings in the entire MSA.

These results confirm our previous research that indicated a lack of concentration in markets for real estate brokerage in larger urban areas.[22] Now we turn our attention to smaller submarkets

[20] See http://factfinder2.census.gov/. The ZIP Code data are derived from the census Summary Tape Files.

[21] Markets are classified according to HHI into three types under the 2010 Horizontal Merger Guidelines: unconcentrated (HHI < 1,500), moderately concentrated (1,500 < HHI < 2,500), and highly concentrated (HHI > 2,500). See http://www.justice.gov/atr/public/guidelines/hmg-2010.html.

[22] Beck, Scott, and Yelowitz (2012, Tables 2a and 2b).

Exhibit 2

HHIs by Different Geographic Levels and Brokerage Definitions

	MSAs					
	Atlanta[a]	Boston[b]	Chicago[c]	Dallas[d]	Los Angeles[e]	Washington, DC[f]
MSA level						
HHI—All offices considered separately	120	36	122	107	52	341
HHI—All franchise offices combined	512	418	677	622	302	678
Sample size	67,426	19,783	85,825	34,782	52,037	32,986
City level (realtor defined)						
HHI—All offices considered separately	233	142	249	184	46	562
HHI—All franchise offices combined	633	393	414	460	340	773
Sample size	13,441	2,269	18,531	6,494	5,363	2,878
City level (USPS ZIP Codes)						
HHI—All offices considered separately	224	144	228	259	46	560
HHI—All franchise offices combined	620	396	408	498	366	772
Sample size	15,142	2,255	19,850	6,113	6,126	2,881

HHI = Herfindahl-Hirschman Index. MSA = metropolitan statistical area. USPS = U.S. Postal Service.

[a] Atlanta-Sandy Springs-Marietta, GA MSA: the cities with the most listings were Atlanta, Marietta, Lawrenceville, Decatur, Cumming, Alpharetta, Smyrna, Kennesaw, Douglasville, and Acworth.

[b] Boston-Cambridge-Quincy, MA-NH MSA: the cities with the most listings were Boston, Plymouth, Newton, Quincy, Cambridge, Brockton, Lowell, Rochester, Manchester, and Haverhill.

[c] Chicago-Naperville-Joliet, IL-IN-WI MSA: the cities with the most listings were Chicago, Aurora, Naperville, Elgin, Joliet, Plainfield, Palatine, Des Plaines, Evanston, and Arlington Heights.

[d] Dallas-Fort Worth-Arlington, TX MSA: the cities with the most listings were Dallas, Fort Worth, Arlington, Plano, McKinney, Frisco, Garland, Irving, Carrollton, and Denton.

[e] Los Angeles-Long Beach-Santa Ana, CA MSA: the cities with the most listings were Los Angeles, Long Beach, Lancaster, Irvine, Palmdale, Santa Ana, Anaheim, Huntington Beach, Whittier, and Orange.

[f] Washington-Arlington-Alexandria, DC-VA-MD-WV MSA: the cities with the most listings were Washington, D.C., Alexandria, Silver Spring, Woodbridge, Fredericksburg, Arlington, Frederick, Hyattsville, Upper Marlboro, and Bowie.

Notes: Sample size refers to the number of multiple listing service listings used to compute the HHI. All data were obtained from http://www.REALTOR.com in April 2011. The ZIP Codes used to define MSAs come from http://www.census.gov/population/www/metroareas/metroarea.html. MSAs include both the central city and other cities that are part of the same labor market. The city-level definitions include only listings in the city proper, not in adjoining areas.

Exhibit 3

Top Four Brokerages by MSA* (1 of 2)

(a) HHI—All Offices Considered Separately

MSA	Firm Name	Market Share (%)
Atlanta	Harry Norman, Realtors®	4.5
	Prudential Georgia Realty	4.3
	Better Homes and Gardens Real Estate Metro Brokers	4.1
	Coldwell Banker Real Estate LLC	4.1
Boston	Keller Williams Realty, Inc.	2.5
	RE/MAX® Prestige	1.8
	William Raveis Real Estate, Mortgage & Insurance	1.7
	CENTURY 21 Commonwealth	1.2
Chicago	Coldwell Banker Real Estate LLC	7.8
	Baird & Warner Real Estate	3.7
	@properties®	2.6
	Koenig & Strey Real Living	2.5

Exhibit 3

Top Four Brokerages by MSA* (2 of 2)

(a) HHI—All Offices Considered Separately (continued)

MSA	Firm Name	Market Share (%)
Dallas	Keller Williams Realty, Inc.	4.9
	Ebby Halliday Realtors	4.7
	Coldwell Banker Real Estate LLC	3.5
	Coldwell Banker Apex Realtors	2.4
Los Angeles	Prudential California Realty	4.8
	First Team Real Estate	3.0
	Keller Williams Realty, Inc.	1.8
	Coldwell Banker Real Estate LLC	1.7
Washington, DC	Long & Foster Real Estate, Inc.	16.2
	Weichert, Realtors	4.5
	Coldwell Banker Real Estate LLC	3.1
	Keller Williams Realty, Inc.	3.1

(b) HHI—All Franchise Offices Combined

MSA	Firm Name	Market Share (%)
Atlanta	Keller Williams Realty, Inc.	15.0
	RE/MAX, LLC	11.8
	Coldwell Banker Real Estate LLC	7.0
	Prudential Real Estate	5.5
Boston	Coldwell Banker Real Estate LLC	12.7
	RE/MAX, LLC	10.9
	Century 21 Real Estate, LLC	7.4
	Keller Williams Realty, Inc.	5.6
Chicago	RE/MAX, LLC	18.8
	Coldwell Banker Real Estate, LLC	13.5
	Century 21 Real Estate, LLC	8.0
	Prudential	4.8
Dallas	Keller Williams Realty, Inc.	16.1
	RE/MAX, LLC	12.1
	Coldwell Banker Real Estate LLC	8.5
	Ebby Halliday Realtors	8.0
Los Angeles	Coldwell Banker Real Estate LLC	8.4
	Century 21 Real Estate, LLC	7.6
	RE/MAX, LLC	7.4
	Prudential	7.3
Washington, DC	Long & Foster Real Estate, Inc.	17.2
	RE/MAX, LLC	15.9
	Keller Williams Realty, Inc.	6.7
	Weichert, Realtors	4.6

HHI = Herfindahl-Hirschman Index. MSA = metropolitan statistical area.

** The full MSA names are as follows: Atlanta MSA = Atlanta-Sandy Springs-Marietta, GA; Boston MSA = Boston-Cambridge-Quincy, MA-NH; Chicago MSA = Chicago-Naperville-Joliet, IL-IN-WI; Dallas MSA = Dallas-Fort Worth-Arlington, TX; Los Angeles MSA = Los Angeles-Long Beach-Santa Ana, CA; Washington, DC MSA = Washington-Arlington-Alexandria, DC-VA-MD-WV.*

Note: Sample sizes are the same as for the MSA sample in exhibit 1.

within the larger MSAs. Exhibit 4 contains summary statistics at the ZIP Code level for each of the six MSAs in our sample. Average population per ZIP Code area varies from 20,300 in the Boston MSA to 38,009 in the Los Angeles MSA. The Boston MSA had the fewest housing units per ZIP Code, 8,097, and the Los Angeles MSA had the most, 13,024. Median income ranged from $58,400 in the Atlanta MSA to $77,200 in the Washington, DC MSA. Considerable variation exists across MSAs in median house value, with housing being the cheapest in the Dallas MSA (median = $124,900) and most expensive in the Los Angeles MSA (median = $286,700). The percentage of the population classified as White varies from 58.1 percent in the Los Angeles MSA to 87.1 percent in the Boston MSA. Finally, the level of housing market activity varies considerably as well. The Boston MSA contained only 113 MLS listings per ZIP Code, which is less than one-third of the level in the Atlanta MSA, which contained 380 MLS listings per ZIP Code.

Exhibit 4 also contains HHIs computed at the ZIP Code level and averaged across the entire urban area for each of the six MSAs. Again, we compute HHIs when all franchise offices are considered separately and when all offices of a franchisor are combined. Considering all franchise offices separately yields average HHIs that range from 355 in the Los Angeles MSA to 815 in the Washington, DC MSA. Combining all offices of each franchisor and treating them as one firm yields average HHIs that range from 642 in the Los Angeles MSA to 1,151 in the Chicago MSA. None of the six MSAs on average has market structures at the ZIP Code level that fall into the moderately concentrated level according to the 2010 Horizontal Merger Guidelines. These average HHIs also fall in the middle of the range of HHIs that we observed when we analyzed small markets (fewer than 1,000 listings) in our 2012 study.[23]

We are now ready to address the main topic of this article—are low-income, low house-price, or high-minority neighborhoods served differentially by the real estate brokerage industry? We have ranked ZIP Codes in each of the six MSAs by median income quartile, by median house value, and by percent of the population classified as White. Exhibit 5 contains the 25th, 50th, and 75th percentile cutoffs for median income, median house value, and fraction White in each of the six MSAs. Unsurprisingly, considerable variation exists. For example, in one-fourth of the 172 ZIP Codes in the Atlanta MSA, less than 57.5 percent of the population is White, and moving from the 25th to the 75th percentile of ZIP Code neighborhoods results in a 30-percentage-point increase in fraction White. A similar change in the Boston MSA results in a much smaller (13 percentage points) change. Moving from the 25th to the 75th percentile in median house value in the Atlanta MSA results in a $58,000 change in price, whereas a similar movement in the Los Angeles MSA results in a $168,000 change in price.

Now we examine the relationship between market concentration as measured by the HHI for real estate brokers and median income, median house price, and fraction White more rigorously. We regress HHI in each ZIP Code neighborhood on quartile categorical variables and a city identifier. Atlanta is the excluded MSA. These results are contained in columns A, B, and C of exhibit 6. As can be seen, market concentration increases with median income, median house price, and fraction White, and significant differences exist in concentration across MSAs.

[23] Beck, Scott, and Yelowitz (2012, Table 2c).

Exhibit 4

ZIP Code-Level Summary Statistics

	All MSAs	MSAs*					
		Atlanta	Boston	Chicago	Dallas	Los Angeles	Washington, DC
Population	28,216	25,369	20,300	28,959	25,395	38,009	23,077
	(18,429)	(14,334)	(12,472)	(21,962)	(15,018)	(19,525)	(13,478)
Housing units	10,570	9,853	8,097	11,023	10,013	13,024	9,119
	(6,496)	(5,398)	(5,113)	(8,316)	(5,996)	(5,613)	(5,456)
Median income ($1,000s)	65.9	58.4	71.4	67.6	60.7	61.4	77.2
	(25.6)	(21.3)	(24.3)	(25.2)	(22.8)	(27.6)	(25.3)
Median house value ($1,000s)	205.1	142.3	242.7	184.8	124.9	286.7	205.7
	(135.4)	(77.1)	(146.7)	(114.1)	(77.4)	(170.3)	(91.1)
Percent White (%)	70.4	67.6	87.1	76.1	75.2	58.1	66.0
	(24.4)	(26.3)	(14.8)	(25.3)	(18.0)	(21.8)	(25.3)
MLS listings	207	380	113	258	175	160	154
	(156)	(225)	(66)	(162)	(111)	(88)	(86)
HHI—All offices considered separately	597	473	794	668	593	355	815
	(417)	(347)	(443)	(440)	(352)	(234)	(465)
HHI—All franchise offices combined	971	824	1,138	1,151	1,062	642	1,115
	(481)	(360)	(528)	(477)	(417)	(312)	(515)
Sample size	1,321	172	157	310	176	308	198

HHI = Herfindahl-Hirschman Index. MLS = multiple listing service. MSA = metropolitan statistical area.

** The full MSA names are as follows: Atlanta MSA = Atlanta-Sandy Springs-Marietta, GA; Boston MSA = Boston-Cambridge-Quincy, MA-NH; Chicago MSA = Chicago-Naperville-Joliet, IL-IN-WI; Dallas MSA = Dallas-Fort Worth-Arlington, TX; Los Angeles MSA = Los Angeles-Long Beach-Santa Ana, CA; Washington, DC MSA = Washington-Arlington-Alexandria, DC-VA-MD-WV.*

Notes: ZIP Codes are restricted to those with 50 or more MLS listings on http://www.REALTOR.com and where the ZIP Code could be merged to American FactFinder data from 2000. MLS listings were gathered between April 11 and 13, 2011. Standard deviations are in parentheses. The HHI measures and listings were computed in 2011, and the population, housing, income, house value, and race statistics were computed from the 2000 census.

Exhibit 5

Descriptive Statistics (unit of observation is ZIP Code)

	MSAs*					
	Atlanta	Boston	Chicago	Dallas	Los Angeles	Washington, DC
25th percentile of MFI ($)	45,394	55,601	53,631	45,328	41,175	60,284
50th percentile of MFI ($)	54,829	67,004	64,631	56,980	55,994	74,539
75th percentile of MFI ($)	69,463	82,072	76,594	71,482	75,940	92,091
25th percentile of median house value ($)	97,550	162,400	124,100	77,600	174,650	143,200
50th percentile of median house value ($)	117,050	196,500	162,250	105,100	233,900	182,250
75th percentile of median house value ($)	155,650	262,400	208,400	152,650	343,250	234,300
25th percentile of fraction White (%)	57.5	83.8	67.3	66.9	42.0	52.9
50th percentile of fraction White (%)	76.5	93.6	86.2	80.4	59.6	73.0
75th percentile of fraction White (%)	87.1	96.9	93.8	88.8	76.8	84.5
Mean list price ($)	226,666	474,792	275,020	271,962	663,908	449,861
Median list price ($)	169,779	384,918	221,578	199,802	506,807	383,212
Sample size	172	157	310	176	308	198

MFI = Median Family Income. MSA = metropolitan statistical area.

** The full MSA names are as follows: Atlanta MSA = Atlanta-Sandy Springs-Marietta, GA; Boston MSA = Boston-Cambridge-Quincy, MA-NH; Chicago MSA = Chicago-Naperville-Joliet, IL-IN-WI; Dallas MSA = Dallas-Fort Worth-Arlington, TX; Los Angeles MSA = Los Angeles-Long Beach-Santa Ana, CA; Washington, DC MSA = Washington-Arlington-Alexandria, DC-VA-MD-WV.*

Notes: ZIP Codes are restricted to those with 50 or more multiple listing service listings on http://www.REALTOR.com and where the ZIP Code could be merged to American FactFinder data from 2000. Quartiles are within MSA.

Median income, median house price, and fraction White are obviously correlated, so we next regress ZIP Code-level HHI on all three variables along with a city identifier. These results are contained in column D of exhibit 6. House price and fraction White have significant effects on the degree of market concentration in local real estate brokerage markets. ZIP Codes in the fourth quartile of house prices are significantly more concentrated than ZIP Codes in the lower three quartiles. ZIP Codes in the first quartile of fraction White are significantly less concentrated than ZIP Codes in the higher three quartiles. Residents of neighborhoods with relatively lower house prices and with relatively more minorities face markets for real estate brokerage services that are less, not more, concentrated. These neighborhoods are served by more firms, each of which has a smaller market share.

To further enrich our analysis of the market structure of real estate brokerage, we consider the effect of local market heterogeneity on the size distribution of firms. If the housing stock in a neighborhood is relatively homogeneous, then brokerage firms may be able to take advantage of scale economies, leading to fewer and larger firms. If the housing stock in a neighborhood is heterogeneous, then brokerage firms may specialize and occupy one of the many niches in market space, leading to more and smaller firms. HHI is thus expected to be smaller the more heterogeneous the housing stock in a neighborhood.

To measure heterogeneity in the housing stock in a ZIP Code neighborhood we calculate the standard deviation of list prices of houses advertised for sale on REALTOR.com. Greater variation in list prices suggests greater variation in square footage, lot sizes, quality of construction, and various

Exhibit 6

Regression Results on HHI (unit of observation is ZIP Code)

	A	B	C	D	E	F
Second income quartile	85.5			– 30.9	– 30.2	– 44.0
	(32.3)			(37.1)	(36.2)	(36.2)
Third income quartile	151.6			– 29.8	– 29.6	– 45.9
	(32.3)			(42.8)	(41.8)	(41.9)
Fourth income quartile	353.9			57.6	13.6	– 19.6
	(32.3)			(49.9)	(49.1)	(49.4)
Second house-price quartile		31.6		– 19.6	– 39.9	– 49.9
		(32.5)		(35.8)	(35.0)	(34.8)
Third house-price quartile		128.8		3.6	– 32.5	– 46.4
		(32.5)		(40.0)	(39.4)	(39.1)
Fourth house-price quartile		311.2		137.3	15.0	– 8.0
		(32.5)		(45.9)	(47.2)	(47.5)
Second race quartile			221.3	208.4	205.4	199.7
			(31.6)	(34.1)	(33.3)	(33.0)
Third race quartile			343.2	302.8	301.1	293.6
			(31.5)	(36.0)	(35.1)	(34.8)
Fourth race quartile			414.5	368.7	327.3	318.8
			(31.6)	(35.7)	(35.3)	(35.0)
Boston MSA*	314.8	314.6	315.4	315.5	231.9	167.4
	(45.8)	(46.2)	(44.8)	(43.8)	(44.4)	(46.6)
Chicago MSA*	327.3	327.2	327.3	327.6	307.1	279.4
	(39.5)	(39.8)	(38.6)	(37.8)	(37.0)	(37.7)
Dallas MSA*	238.1	238.1	238.1	238.1	224.9	206.0
	(44.5)	(44.8)	(43.5)	(42.6)	(41.6)	(41.8)
Los Angeles MSA*	– 181.8	– 181.8	– 181.8	– 181.8	– 313.3	– 397.2
	(39.5)	(39.8)	(38.6)	(37.8)	(40.6)	(44.7)
Washington, DC MSA*	291.7	291.7	291.8	292.0	213.5	144.9
	(43.3)	(43.6)	(42.3)	(41.4)	(42.1)	(44.4)
SD of list price (/1,000)					– 0.1033	
					(0.0380)	
Mean list price (/1,000)					0.3825	
					(0.0621)	
90/10 ratio of list price						– 10.3
						(4.2)
Median list price (/1,000)						0.5556
						(0.0583)
Constant	676.5	706.3	579.5	574.7	578.9	649.2
	(37.3)	(37.6)	(36.5)	(38.6)	(37.6)	(47.5)

A = median income. B = median house price. C = fraction White. D = A, B, and C, with city identifier. E = list price. F = full set. HHI = Herfindahl-Hirschman Index. MSA = metropolitan statistical area. SD = standard deviation.

** The full MSA names are as follows: Atlanta MSA = Atlanta-Sandy Springs-Marietta, GA; Boston MSA = Boston-Cambridge-Quincy, MA-NH; Chicago MSA = Chicago-Naperville-Joliet, IL-IN-WI; Dallas MSA = Dallas-Fort Worth-Arlington, TX; Los Angeles MSA = Los Angeles-Long Beach-Santa Ana, CA; Washington, DC MSA = Washington-Arlington-Alexandria, DC-VA-MD-WV.*

Notes: Standard errors are in parentheses. ZIP Codes are restricted to those with 50 or more multiple listing service listings on http://www.REALTOR.com and where the ZIP Code could be merged to American FactFinder data from 2000. Quartiles are within each metropolitan statistical area. The sample size is 1,321 ZIP Codes in each regression.

other characteristics and amenities associated with each house in the neighborhood. We include the standard deviation of list price in our HHI regression model, and these results are contained in column E. We also include mean list price in the regression.

Greater heterogeneity in the housing stock, as measured by the standard deviation of list prices, is associated with less concentration on the supply side of real estate brokerage markets. Neighborhoods with greater variety among houses tend to have more brokers with smaller market shares than neighborhoods where the housing stock is more homogeneous. This relationship is statistically significant and robust to different specifications of the measure of heterogeneity.[24] Another interesting result of this regression is that the fraction White is still statistically significant. The estimated HHI is considerably smaller in the first quartile of fraction-White neighborhoods than in the three upper quartiles. Apparently, brokers with smaller market shares serve more neighborhoods with high-percentage minority populations than neighborhoods with relatively high-percentage White populations, which perhaps suggests some specialization of real estate brokers by race.

To further explore the supply of brokerage services in different neighborhoods, we identify the market leaders and their market shares in the bottom and top quartiles of income, house price, and fraction White in each of the six MSAs. These results are contained in exhibit 7, which lists the market shares of the top eight brokers in the first and fourth income, house-price, and fraction-White quartiles.

Market leaders in the bottom and top quartiles of income, house price, and fraction White, in general, are the same brokers. Some differences, however, do appear. For example, in the Atlanta MSA, Harry Norman, Realtors® was the third largest broker with a 10.0-percent market share in the top quartile of ZIP Codes ranked by house price, but was the seventh largest broker in the first house-price quartile with only a 1.9-percent market share. Better Homes and Gardens Real Estate Metro Brokers was a market leader in the first quartile of ZIP Codes ranked by house price with a market share of 5.7 percent, but they do not appear among the top eight brokers in the fourth house-price quartile.

Several of the larger brokers in the Boston MSA appear to specialize in submarkets. Coldwell Banker Real Estate LLC has a 25.2-percent market share in the fourth house-price quartile, but only a 6.9-percent market share in the first house-price quartile. When ZIP Codes are ranked by fraction White, Coldwell Banker has a 15.5-percent market share in the bottom quartile and a 7.4-percent market share in the top quartile. Whereas Coldwell Banker seems to specialize in high-income, high house-price, racially mixed neighborhoods in the Boston MSA, RE/MAX International seems to take the opposite approach. RE/MAX is the market leader in the first income and house-price quartile ZIP Codes and in the fourth quartile of fraction-White ZIP Codes. Hammond Residential Real Estate, LLC pursues a similar strategy. They are among the top eight in the fourth income and house-price and first fraction-White quartiles, but do not appear among the top eight in the first income and house-price and fourth fraction-White quartiles.[25]

[24] Column F of exhibit 6 regresses HHI on the ratio of the 90th percentile list price to the 10th percentile list price in the ZIP Code, along with median list price and the full set of other variables. As can be seen, the results are relatively unchanged from column E.

[25] The Boston MSA is the only one of the six MSAs where median house price and fraction White are negatively correlated.

Exhibit 7

Market Leaders by MSA—First Quartile Versus Fourth Quartile (1 of 6)

Atlanta-Sandy Springs-Marietta, GA Metropolitan Statistical Area (MSA)

Income	Firm Name	Market Share (%)
First quartile	Keller Williams Realty, Inc.	14.9
	RE/MAX, LLC	10.3
	Coldwell Banker Real Estate LLC	5.7
	Better Homes and Gardens Real Estate Metro Brokers	5.3
	Solid Source Realty GA	4.2
	Prudential Real Estate	3.0
	Harry Norman, Realtors® at CCOS	2.3
	Century 21 Real Estate, LLC	1.8
Fourth quartile	Keller Williams Realty, Inc.	16.8
	RE/MAX, LLC	11.3
	Harry Norman, Realtors® at CCOS	8.9
	Coldwell Banker Real Estate LLC	8.7
	Prudential Real Estate	7.5
	Solid Source Realty GA	3.1
	Better Homes and Gardens Real Estate Metro Brokers	2.7
	Duffy Realty of Atlanta	2.5
House Price	**Firm Name**	**Market Share (%)**
First quartile	Keller Williams Realty, Inc.	13.6
	RE/MAX, LLC	11.6
	Better Homes and Gardens Real Estate Metro Brokers	5.7
	Coldwell Banker Real Estate LLC	4.7
	Solid Source Realty GA	4.2
	Prudential Real Estate	2.8
	Harry Norman, Realtors® at CCOS	1.9
	Southern REO	1.7
Fourth quartile	Keller Williams Realty, Inc.	17.1
	RE/MAX, LLC	10.8
	Harry Norman, Realtors® at CCOS	10.0
	Coldwell Banker Real Estate LLC	9.4
	Prudential Real Estate	7.2
	Solid Source Realty GA	3.1
	Duffy Realty of Atlanta	2.5
	Sotheby's International Realty Affiliates LLC	2.5
Race (fraction White)	**Firm Name**	**Market Share (%)**
First quartile	Keller Williams Realty, Inc.	15.2
	RE/MAX, LLC	8.4
	Solid Source Realty GA	6.3
	Better Homes and Gardens Real Estate Metro Brokers	6.3
	Coldwell Banker Real Estate LLC	4.7
	Prudential Real Estate	2.9
	Harry Norman, Realtors® at CCOS	2.4
	Southern REO	1.8
Fourth quartile	Keller Williams Realty, Inc.	15.0
	RE/MAX, LLC	12.6
	Prudential Real Estate	7.2
	Coldwell Banker Real Estate LLC	6.1
	Harry Norman, Realtors® at CCOS	5.6
	Better Homes and Gardens Real Estate Metro Brokers	3.7
	Solid Source Realty GA	3.3
	Duffy Realty of Atlanta	2.0

Exhibit 7

Market Leaders by MSA—First Quartile Versus Fourth Quartile (2 of 6)

Boston-Cambridge-Quincy, MA-NH MSA

Income	Firm Name	Market Share (%)
First quartile	RE/MAX, LLC	10.7
	Coldwell Banker Real Estate LLC	9.3
	Century 21 Real Estate, LLC	7.4
	Keller Williams Realty, Inc.	6.4
	Prudential Real Estate	3.4
	Sotheby's International Realty Affiliates LLC	2.2
	Better Homes and Gardens Real Estate – The Masiello Group	1.7
	William Raveis Real Estate, Mortgage & Insurance	1.7
Fourth quartile	Coldwell Banker Real Estate LLC	23.8
	RE/MAX, LLC	7.8
	Century 21 Real Estate, LLC	5.8
	Prudential Real Estate	5.8
	Hammond Residential Real Estate	5.2
	Keller Williams Realty, Inc.	3.7
	William Raveis Real Estate, Mortgage & Insurance	3.6
	Sotheby's International Realty Affiliates LLC	3.3

House Price	Firm Name	Market Share (%)
First quartile	RE/MAX, LLC	13.8
	Keller Williams Realty, Inc.	7.0
	Coldwell Banker Real Estate LLC	6.9
	Century 21 Real Estate, LLC	6.8
	Prudential Real Estate	6.7
	Coco, Early & Associates The Olivares and Molina D's	4.0
	Better Homes and Gardens Real Estate - The Masiello Group	3.1
	Bean Group	1.5
Fourth quartile	Coldwell Banker Real Estate LLC	25.2
	RE/MAX, LLC	7.0
	Hammond Residential Real Estate	6.3
	Century 21 Real Estate, LLC	5.3
	Sotheby's International Realty Affiliates LLC	4.6
	Prudential Real Estate	4.3
	Keller Williams Realty, Inc.	4.3
	William Raveis Real Estate, Mortgage & Insurance	3.5

Race (fraction White)	Firm Name	Market Share (%)
First quartile	Coldwell Banker Real Estate LLC	15.5
	RE/MAX, LLC	7.2
	Century 21 Real Estate, LLC	7.1
	Keller Williams Realty, Inc.	5.2
	Hammond Residential Real Estate	4.4
	Sotheby's International Realty Affiliates LLC	3.6
	Prudential Real Estate	2.6
	William Raveis Real Estate, Mortgage & Insurance	1.7
Fourth quartile	RE/MAX, LLC	10.7
	Coldwell Banker Real Estate LLC	7.4
	Prudential Real Estate	6.3
	Keller Williams Realty, Inc.	6.2
	Century 21 Real Estate, LLC	4.4
	Coco, Early & Associates The Olivares and Molina D's	3.8
	Better Homes and Gardens Real Estate - The Masiello Group	3.5
	The Gove Group Real Estate, LLC	2.4

Exhibit 7

Market Leaders by MSA—First Quartile Versus Fourth Quartile (3 of 6)

Chicago-Naperville-Joliet, IL-IN-WI MSA

Income	Firm Name	Market Share (%)
First quartile	RE/MAX, LLC	12.7
	Coldwell Banker Real Estate LLC	9.7
	Century 21 Real Estate, LLC	7.9
	@properties®	5.0
	Prudential Real Estate	3.5
	Keller Williams Realty, Inc.	3.2
	Baird & Warner Real Estate	2.8
	McColly Real Estate Corporate	2.1
Fourth quartile	RE/MAX, LLC	18.8
	Coldwell Banker Real Estate LLC	17.1
	Baird & Warner Real Estate	7.5
	Prudential Real Estate	6.9
	Koenig & Strey Real Living	5.1
	Century 21 Real Estate, LLC	4.7
	Keller Williams Realty, Inc.	3.8
	@properties®	3.4
House Price	**Firm Name**	**Market Share (%)**
First quartile	RE/MAX, LLC	15.6
	Coldwell Banker Real Estate LLC	9.7
	Century 21 Real Estate, LLC	9.4
	McColly Real Estate Corporate	3.7
	Keller Williams Realty, Inc.	2.6
	Prudential Real Estate	2.4
	Baird & Warner Real Estate	2.0
	Realty Executives International	1.6
Fourth quartile	Coldwell Banker Real Estate LLC	16.5
	RE/MAX, LLC	14.8
	Baird & Warner Real Estate	7.5
	Prudential Real Estate	7.4
	Koenig & Strey Real Living	5.9
	@properties®	5.8
	Century 21 Real Estate, LLC	4.8
	Keller Williams Realty, Inc.	3.8
Race (fraction White)	**Firm Name**	**Market Share (%)**
First quartile	RE/MAX, LLC	12.2
	Coldwell Banker Real Estate LLC	11.1
	@properties®	6.1
	Century 21 Real Estate, LLC	6.0
	Prudential Real Estate	4.1
	Baird & Warner Real Estate	4.0
	Keller Williams Realty, Inc.	3.7
	Koenig & Strey Real Living	2.4
Fourth quartile	RE/MAX, LLC	19.0
	Coldwell Banker Real Estate LLC	15.1
	Century 21 Real Estate, LLC	12.3
	Prudential Real Estate	4.4
	McColly Real Estate	4.3
	Baird & Warner Real Estate	3.3
	Keller Williams Realty, Inc.	3.3
	Realty Executives International	2.4

Exhibit 7

Market Leaders by MSA—First Quartile Versus Fourth Quartile (4 of 6)

Dallas-Fort Worth-Arlington, TX MSA

Income	Firm Name	Market Share (%)
First quartile	Keller Williams Realty, Inc.	11.5
	Century 21 Real Estate, LLC	10.0
	RE/MAX, LLC	9.0
	Coldwell Banker Real Estate LLC	6.8
	Ebby Halliday Realtors	5.1
	Williams Trew Real Estate	3.2
	Virginia Cook, Realtors LLC	2.4
	Allie Beth Allman	2.4
Fourth quartile	Keller Williams Realty, Inc.	20.3
	RE/MAX, LLC	13.7
	Ebby Halliday Realtors	12.3
	Coldwell Banker Real Estate LLC	8.8
	Century 21 Real Estate, LLC	3.3
	Prudential Real Estate	2.2
	Allie Beth Allman	2.1
	Virginia Cook, Realtors LLC	1.9
House Price	**Firm Name**	**Market Share (%)**
First quartile	Century 21 Real Estate, LLC	14.3
	Keller Williams Realty, Inc.	11.5
	RE/MAX, LLC	10.5
	Coldwell Banker Real Estate LLC	8.5
	Ebby Halliday Realtors	3.5
	Johnson Monroe Realtors	1.7
	Prudential Real Estate	1.6
	Williams Trew Real Estate	1.4
Fourth quartile	Keller Williams Realty, Inc.	18.1
	RE/MAX, LLC	12.2
	Ebby Halliday Realtors	12.0
	Coldwell Banker Real Estate LLC	8.2
	Allie Beth Allman	3.8
	Century 21 Real Estate, LLC	3.2
	Dave Perry-Miller & Associates	2.7
	Virginia Cook, Realtors LLC	2.5
Race (fraction White)	**Firm Name**	**Market Share (%)**
First quartile	Keller Williams Realty, Inc.	12.0
	RE/MAX, LLC	10.6
	Century 21 Real Estate, LLC	8.9
	Coldwell Banker Real Estate LLC	7.1
	Ebby Halliday Realtors	6.6
	Allie Beth Allman	2.8
	Dave Perry-Miller & Associates	2.6
	Briggs Freeman Sotheby's International Realty	1.8
Fourth quartile	Keller Williams Realty, Inc.	16.9
	RE/MAX, LLC	11.1
	Coldwell Banker Real Estate LLC	9.4
	Century 21 Real Estate, LLC	7.8
	Ebby Halliday Realtors	6.9
	Prudential Real Estate	2.4
	Allie Beth Allman	1.7
	HomesUSA	1.5

Exhibit 7

Market Leaders by MSA—First Quartile Versus Fourth Quartile (5 of 6)

Los Angeles-Long Beach-Santa Ana, CA MSA

Income	Firm Name	Market Share (%)
First quartile	Century 21 Real Estate, LLC	10.3
	Keller Williams Realty, Inc.	6.8
	RE/MAX, LLC	6.0
	Prudential Real Estate	5.9
	Coldwell Banker Real Estate LLC	5.1
	Pinnacle Estate Properties Inc.	1.5
	First Team Real Estate	1.1
	Rodeo Realty, Inc.	0.9
Fourth quartile	Coldwell Banker Real Estate LLC	12.3
	Prudential Real Estate	9.8
	RE/MAX, LLC	8.1
	Keller Williams Realty, Inc.	5.8
	First Team Real Estate	5.7
	Century 21 Real Estate, LLC	3.9
	Sotheby's International Realty Affiliates LLC	2.4
	Realty Executives International	1.6
House Price	**Firm Name**	**Market Share (%)**
First quartile	Century 21 Real Estate, LLC	11.8
	Keller Williams Realty, Inc.	6.8
	RE/MAX, LLC	6.3
	Prudential Real Estate	5.7
	Coldwell Banker Real Estate LLC	5.0
	Pinnacle Estate Properties Inc.	1.5
	Realty Executives International	1.2
	First Team Real Estate	1.1
Fourth quartile	Coldwell Banker Real Estate LLC	15.2
	Prudential Real Estate	10.3
	Keller Williams Realty, Inc.	7.0
	RE/MAX, LLC	6.4
	First Team Real Estate	4.3
	Sotheby's International Realty Affiliates LLC	3.6
	Century 21 Real Estate, LLC	2.7
	Rodeo Realty, Inc.	2.3
Race (fraction White)	**Firm Name**	**Market Share (%)**
First quartile	Century 21 Real Estate, LLC	12.0
	RE/MAX, LLC	6.7
	Prudential Real Estate	5.7
	Coldwell Banker Real Estate LLC	5.2
	Keller Williams Realty, Inc.	4.9
	First Team Real Estate	1.5
	Realty Executives International	0.9
	ERA® Real Estate	0.8
Fourth quartile	Coldwell Banker Real Estate LLC	12.4
	Prudential Real Estate	10.6
	Keller Williams Realty, Inc.	6.9
	RE/MAX, LLC	6.6
	First Team Real Estate	5.1
	Century 21 Real Estate, LLC	3.7
	Sotheby's International Realty Affiliates LLC	2.7
	Rodeo Realty, Inc.	2.5

Exhibit 7

Market Leaders by MSA—First Quartile Versus Fourth Quartile (6 of 6)

Washington-Arlington-Alexandria, DC-VA-MD-WV MSA

Income	Firm Name	Market Share (%)
First quartile	Long & Foster Real Estate, Inc.	14.3
	RE/MAX, LLC	13.7
	Keller Williams Realty, Inc.	6.5
	Century 21 Real Estate, LLC	5.5
	Coldwell Banker Real Estate LLC	4.6
	Weichert, Realtors	3.7
	Fairfax Realty Inc.	3.7
	Exit Realty Corp. International	2.7
Fourth quartile	Long & Foster Real Estate, Inc.	24.4
	RE/MAX, LLC	14.6
	Keller Williams Realty, Inc.	6.7
	Weichert, Realtors	6.6
	Coldwell Banker Real Estate LLC	4.8
	Washington Fine Properties LLC	3.5
	McEnearney Associates Inc, REALTORS®	3.0
	Century 21 Real Estate, LLC	2.3
House Price	**Firm Name**	**Market Share (%)**
First quartile	RE/MAX, LLC	14.6
	Long & Foster Real Estate, Inc.	12.8
	Keller Williams Realty, Inc.	7.1
	Century 21 Real Estate, LLC	6.4
	Coldwell Banker Real Estate LLC	4.7
	Weichert, Realtors	3.6
	Fairfax Realty Inc.	3.5
	Exit Realty Corp. International	2.7
Fourth quartile	Long & Foster Real Estate, Inc.	25.1
	RE/MAX, LLC	12.7
	Keller Williams Realty, Inc.	6.2
	Weichert, Realtors	6.2
	Coldwell Banker Real Estate LLC	5.7
	Washington Fine Properties, LLC	4.1
	McEnearney Associates Inc, REALTORS®	3.6
	Sotheby's International Realty Affiliates LLC	3.1
Race (fraction White)	**Firm Name**	**Market Share (%)**
First quartile	Long & Foster Real Estate, Inc.	16.6
	RE/MAX, LLC	13.2
	Keller Williams Realty, Inc.	6.4
	Fairfax Realty Inc.	5.0
	Coldwell Banker Real Estate LLC	4.1
	Exit Realty Corp. International	4.0
	Weichert, Realtors	3.6
	Century 21 Real Estate LLC	3.6
Fourth quartile	RE/MAX, LLC	18.8
	Long & Foster Real Estate, Inc.	15.8
	Keller Williams Realty, Inc.	6.2
	Weichert, Realtors	6.0
	Century 21 Real Estate LLC	5.7
	Coldwell Banker Real Estate LLC	4.2
	ERA® Real Estate	1.9
	Real Estate Teams LLC	1.6

Note: Sample sizes are the same as for the MSA sample in exhibit 2.

Chicago market leader RE/MAX is relatively more specialized in high-income and high fraction-White ZIP Codes relative to low-income and low fraction-White ZIP Codes. RE/MAX has roughly the same market share, however, in ZIP Codes ranked according to house price. Second ranked Coldwell Banker also is relatively more specialized in high-income and high fraction-White ZIP Codes, but it is even more specialized in high house-price ZIP Codes relative to low house-price ZIP Codes. Several independent brokers have significant market shares in particular market niches. @properties® is the fourth largest broker in low-income ZIP Codes and the third largest broker in low fraction-White neighborhoods. Baird and Warner Real Estate is the third largest broker in ZIP Codes ranked by income and by house price.

An interesting pattern emerges from closer scrutiny of individual broker market shares in the Dallas MSA. Market leader Keller Williams and Ebby Halliday Realtors both specialize (relatively) in high-income and high house-price neighborhoods. Century 21 ranks first and second in low house-price and low-income neighborhoods, but is much lower ranked in high house-price and high-income neighborhoods. When neighborhoods are ranked by fraction White, however, no specialization patterns are evident.

The Los Angeles MSA is characterized by the highest correlation between fraction White, house price, and income among the six MSAs. Century 21 has the largest market share in low-income, low house-price, and low fraction-White ZIP Codes, but it is sixth, seventh, and sixth, respectively, in high-income, high house-price, and high fraction-White ZIP Codes. Coldwell Banker exhibits the reverse of that pattern, with the leading market share in high-income, high house-price, and high fraction-White ZIP Codes. RE/MAX is the third ranked broker citywide by overall market share. Its market presence, however, is evenly spread across ZIP Codes as ranked by income, house price, and fraction White.

In the Washington, DC MSA, the two overall market leaders are Long & Foster Real Estate, Inc., (Long & Foster) and RE/MAX. Long & Foster seems to specialize in high-income and high house-price ZIP Codes, but RE/MAX shows no such tendency. Weichert, Realtors is fourth ranked overall in the D.C. market. It has roughly double the market representation in high-income, high house-price, and high fraction-White ZIP Codes as in low-income, low house-price, and low fraction-White ZIP Codes. Third ranked Keller Williams is spread evenly across the MSA when ZIP Codes are sorted by income, house price, and fraction White.

In summary, the analysis of exhibit 7 certainly suggests that firms specialize in different parts of the housing market; nonetheless, no evidence suggests that this specialization leads to differential availability of brokerage services. It may be that the services offered by brokers serving low-income, low house-price, or low fraction-White neighborhoods fall short of those offered by brokers in other neighborhoods, but such differences would arise naturally if different clients demand different types and levels of services.

Summary and Conclusions

Real estate brokers often specialize in local submarkets within larger urban markets, especially because geographically proximate neighborhoods can differ nontrivially by income levels, house prices, racial composition, and other attributes. Real estate agents and brokers are typically compensated based on the selling price of the home. The nature of agents' and brokers' costs is such that the profitability of any real estate transaction is likely to increase with the selling price of the house.

The question naturally arises whether low-income neighborhoods or neighborhoods where house prices are low are as well served by real estate professionals as higher income or higher price neighborhoods. If not, the discrepancy might partially explain the income gap in homeownership. A related question is whether neighborhoods with high minority populations are served differentially by brokers, which might partially explain the racial gap in homeownership. Poor service by real estate professionals might also affect property appreciation in minority neighborhoods, which in turn could have important implications for the wealth gap by race.[26]

To answer these questions we gathered data for six large metropolitan areas: the Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington, DC MSAs. We collected information on income, house values, racial composition, and homeownership at the ZIP Code level from the 2000 census. We combined these data with information that we collected from REALTOR.com in 2011 on real estate listings by broker for each ZIP Code neighborhood, which we used to calculate HHIs and market shares for individual real estate brokers.

To understand the relationship between market concentration and income, house price, and fraction White, we regress HHI on median income, median house price, and fraction White in each ZIP Code neighborhood. We also include in the regression analysis a measure of the heterogeneity in the housing stock in each ZIP Code, the standard deviation in list prices, and mean list price. We find that neighborhoods with greater variety among houses tend to have more brokers with smaller market shares than neighborhoods where the housing stock is more homogeneous. Estimated HHI is considerably smaller in the first quartile of fraction-White neighborhoods than in the upper three quartiles. More brokers with smaller market shares apparently serve more neighborhoods with high minority populations than neighborhoods with relatively higher White populations. Market concentration also increases with average list price, indicating that high house-price neighborhoods tend to be served by fewer but larger real estate brokers.

Finally, we analyzed market shares of individual brokers in each MSA in the first and fourth quartiles of ZIP Code neighborhoods ranked by median income, median house price, and fraction White. The general pattern is that market leaders in one segment tend to be market leaders in other segments, but numerous examples of brokers specializing in particular market segments exist.

Note that our investigation of access to real estate brokerage across neighborhoods only scratches the surface of what is surely a more complicated picture. D'Rozario and Williams (2005) noted that

[26] Herbert and Belsky (2008) argued that the literature on differential housing appreciation rates is thin and that it is difficult to draw general conclusions. One study—Kim (2000)—did find lower appreciation rates for minorities in Milwaukee, Wisconsin neighborhoods.

retail redlining can fall into eight categories, only one of which is refusing service to all customers in certain areas. We cannot observe the quality of brokerage services, and it is possible that smaller firms serving the minority, low-price, and low-income neighborhoods provide lower quality service than some of the market leaders who do not have a presence in these neighborhoods. We also do not analyze the commission rate structure across neighborhoods. Getting full commission rates (that is, of both the listing and selling agent) is very difficult because, as Zumpano and Hooks (1988) pointed out, in 1980 the NAR adopted policies to prohibit publishing the total commission on MLS listings. Although Hsieh and Moretti (2003) presented full commission rates for several cities, the commissions were drawn from the late 1970s, before the NAR policy was in effect. With the notable exception of Woodward (2008), no recent study has presented the distribution of full commission rates. Given the difficulties in measuring quality and commission rates, our data scraping method, which enables us to learn about access to real estate brokerage, is an appropriate first step. Future studies that measure either of these two dimensions will enhance the understanding of redlining in real estate brokerage.

Appendix. Do the NAR Data Provide a Complete Picture of the Housing Market?

One important concern is the extent to which scraping data from http://www.REALTOR.com provides a full characterization of local housing market conditions. The two key concerns are that for-sale-by-owner (FSBO) listings could serve as an important and cheaper alternative to listing with a broker and that some brokers may put their listings on a local multiple listing service (MLS) but not on the National Association of REALTORS® (NAR) website.

We are aware of three recent studies that have analyzed FSBO activity. First, the NAR (2011) found that FSBO activity ranged from 9 to 14 percent during the past decade, with a dramatic reduction in FSBO activity during the latter one-half of the decade. For example, they report that FSBO activity in 2011—the period when our sample was collected—was 10 percent. Their study also shows that in 37 percent of these FSBO transactions, the seller knew the buyer (NAR, 2011, exhibit 6-26). Second, Woodward (2008) analyzed HUD-1 statements from 2001 and found a higher percentage of homes sold by FSBO than did the NAR study, even for the same period. 18.5 percent of the home transactions in her sample had no line items related to brokerage commissions, and it is unlikely that these brokerage fees would have been hidden in another line item.[27] She noted that this percentage compares with a rate of 13 percent for 2001 from the NAR, and she attributed the difference to the composition of the sample. She used Federal Housing Administration (FHA) data that focus on less valuable homes, which are more likely to be sold by their owners without assistance from a real estate agent. The data used in her analysis drew approximately equal numbers of loans from each state, and the 18.5 percent figure is not weighted for differences in the underlying availability of homes in each state. Thus, it is difficult to compare her figure with the NAR's. Finally, Hendel, Nevo, and Ortalo-Magné (2009) examined FSBO activity in Madison, Wisconsin. They found that the share of listings that are FSBO is roughly 21 percent.

[27] Woodward (2012).

Overall, none of these studies sheds much light on our sample. First, the overall FSBO percentages from the NAR are much higher in the beginning of the decade, when the housing market was healthier. They are also national numbers and include both FSBO sales that are between related parties and those between unrelated parties. Because virtually all MLS transactions will be between unrelated parties, the NAR statistics will overstate the importance of FSBO activity on arm's-length transactions. Second, the fact that Woodward's (2008) analysis also focused on the early part of the decade and on a narrow segment of transactions (FHA loans, rather than conventional or jumbo loans) also calls into question the ability to extrapolate the findings to our sample. Finally, in a longer working paper that preceded the publication of Hendel, Nevo, and Ortalo-Magné (2009), the authors clearly acknowledged that their data come from a single city, and they do not know how representative their results are of other markets.[28] They noted that Madison is unique in many respects (being a college town and a state capital), and that it is a midsized city, which is clearly different from the six large cities in our study.

To further analyze the importance of FSBOs, we have investigated the FSBO market extensively to see what percentage of residential real estate transactions do not involve a real estate professional and thus fall outside the coverage of our REALTOR.com data. We discuss the steps extensively in the following section, and conclude that, at most, FSBO transactions account for slightly more than 10 percent of housing transactions.

First, note that NAR (2011) found that only 10 percent of transactions were FSBO in 2011, but in many of those transactions, the seller knew the buyer before the purchase. Even so, national statistics could mask substantial variation across cities or across neighborhoods. Conceptually, it is much more difficult to collect FSBO data than NAR data. FSBO sales are far more likely to be between parties that know each other and, therefore, are less likely to show up in the public domain until the transaction is complete. Even for FSBOs that are arm's-length transactions, the intensity of marketing varies. NAR (2011, exhibits 7-8 and 8-11) reported that 38 percent of FSBOs did not actively market their home at all, and only 33 percent of FSBOs put the listing on the internet (versus 92 percent of agent listings). Thus, many FSBO listings may not represent serious selling efforts.

Unlike REALTOR.com, a sole aggregator of FSBO listings does not exist (although some—like http://www.FSBOMadison.com—do an excellent job for a local market). Because it is impossible to account for the number of FSBO yard signs in a given market or neighborhood, our analysis requires that a FSBO seller has taken the larger step of listing the home on line. We rely on two well-known websites—http://www.Zillow.com and http://www.ForSaleByOwner.com. According to Zillow's website, their real estate network (partnering with Yahoo! Inc.) is the largest, with more than 25 million unique visitors each month. ForSaleByOwner.com advertises aggressively on http://Google.com and currently ranks first in organic search for the term "FSBO."[29] At the time we accessed the Zillow data, the cost for a person to put a home on the FSBO listing was $1, and it is currently free. Assuming a FSBO owner was aware of Zillow's price, it seems likely they would list

[28] Hendel, Nevo, and Ortalo-Magné (2007).

[29] As of August 30, 2012.

their home on Zillow, in addition to any other methods they were using to market their home. The cost to list on ForSaleByOwner.com is much higher, but the site offers better targeting to buyers who are open to FSBOs. As of August 2012, the price to list on this website is $80.95 per month, a one-time fee of $184 until sold, or a higher price for upgraded packages that include videos and wider reach.[30]

In March 2012, we compared the number of listings on REALTOR.com with each of these websites for the six large cities in our sample. The results are shown in exhibit A-1. The first five columns of data come from Zillow, the sixth column from REALTOR.com, and the final column from ForSaleByOwner.com. Of the three websites, Zillow in some sense provides the fullest characterization of the housing market because it provides by city or ZIP Code the number of agent listings, FSBO listings, and so forth. As the fifth column shows, the fraction of FSBO listings on Zillow is miniscule—less than 2 percent in all cities. Although the count is usually higher with the alternative website ForSaleByOwner.com, the fraction of listings that are FSBO is perhaps 5 percent for a city as a whole.

Exhibit A-1

Homes for Sale, by Type

City	By Agent	By Owner	New Homes	Fore-closures	*FSBO / (FSBO+AGENT)*	REALTOR.com	ForSale ByOwner.com
Atlanta	4,632	80	24	823	1.70%	8,757	209
Boston	2,106	27	2	311	1.27%	1,577	66
Chicago	13,000	166	0	11,000	1.26%	16,119	491
Dallas	5,559	73	57	417	1.30%	4,622	162
Los Angeles	10,000	89	38	6,746	0.88%	5,286	37
Washington, D.C.	2,270	32	14	297	1.39%	2,149	140

FSBO = for sale by owner.

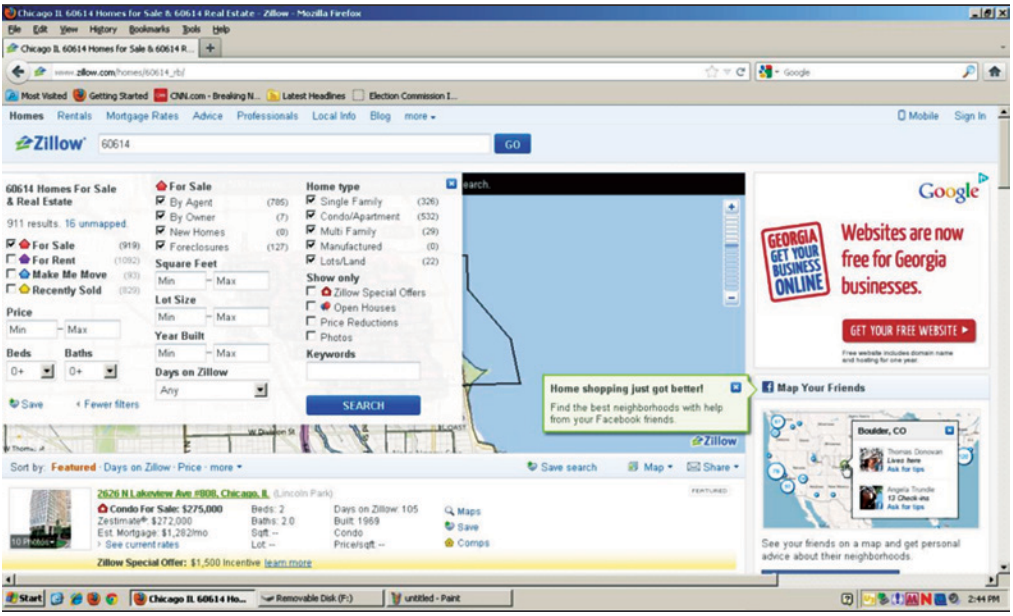
Sources: http://www.Zillow.com; http://www.Realtor.com; http://www.ForSaleByOwner.com (accessed March 13, 2012)

Although the absolute level of FSBO activity is low for all six cities, it could be the case that such activity varies within city, which in turn could have a meaningful effect on our Herfindahl-Hirschman Index (HHI) measures. Thus, we examined the Zillow data by ZIP Code, which directly addresses the concern that FSBO listings might vary from one neighborhood to another in a way that affects the HHI computations. We collected data for 723 ZIP Codes in the six cities; of these ZIP Codes, 203 had at least 50 observations on agent listings and/or FSBO listings. One such illustration is provided in exhibit A-2, which is a screenshot from the ZIP Code 60614 in Chicago, which had 785 for-sale-by-agent listings and 7 FSBO listings. For each of these 203 ZIP Codes, we computed the percentage of listings that were FSBO listings (that is, $\frac{FSBO}{FSBO + AGENT}$). On average, the fraction of listings that were FSBO was 1.25 percent, and 99 percent of the ZIP Codes had fewer than 4.3 percent of listings as FSBO. As a consequence, it appears that FSBOs play a fairly minor role in the housing market, and the incidence of FSBO listings does not vary tremendously across neighborhoods (at least in the large cities and time period we examine).

[30] See http://www.forsalebyowner.com/listing/new/package.

Exhibit A-2

Zillow Screenshot From Chicago



Source: Screenshot taken from http://www.zillow.com in March of 2012.

Finally, it is also a challenging task to compare REALTOR.com data with local MLS data, because many local MLSs require membership to gain access. We were able to examine, however, the count of listings for some large ZIP Codes in the Dallas MSA on REALTOR.com and the MLS site http://www.TexasRealEstate.com. We found a tight correspondence between the listings on the two sites for nine large ZIP Codes (correlation = 0.88).

In summary, this analysis suggests that our approach of using data from REALTOR.com is the best and most comprehensive approach to measuring market activity, and captures the overwhelming share of all listing activity in the market. Both the use of FSBOs and ignoring the NAR site are relatively small issues, and don't appear to vary dramatically by neighborhood.

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Data Shop

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Psychometrics of Housing Quality Measurement in the American Housing Survey

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Abstract

This article assesses the test-retest reliability, internal consistency, and convergent and predictive validity of the American Housing Survey inadequacy index. We find that the index does not appear to tap a single underlying construct of housing quality and does not differentiate among the worst quality units. We conclude that it may be time to reconceptualize the elusive construct of housing quality.

Introduction

As the most comprehensive source of data on the U.S. housing stock, the American Housing Survey (AHS) is relied on by policymakers, practitioners, and researchers seeking answers to questions about the conditions, costs, and myriad other attributes of the nation's housing. For those developing their own surveys, the AHS is also a source of housing questions. Some of the most prominent social science studies of the past two decades, including the Moving to Opportunity for Fair Housing Demonstration (Shroder, 2001), Welfare, Children, & Families, A Three-City Study (Winston et al., 1999), and the Fragile Families and Child Well-Being Study (Reichman et al., 2001), include questions that are strikingly similar if not identical to the AHS items on housing characteristics and conditions.

Of particular interest to many users is the AHS composite measure of housing inadequacy available on the public use database. This measure combines 15 individual questionnaire items on housing conditions into an index, setting numerical thresholds for the presence or absence of physical deficiencies in the dwelling to distinguish among "adequate," "moderately inadequate," and "severely inadequate" units. Both the AHS and data users refer to this composite as AHS's "housing quality" measure.[1] Numerous published articles include the AHS measure in their analyses (for example, Carter, 2011; Friedman and Rosenbaum, 2004; Khadduri, 2007; Ross, Shlay, and Picon, 2012), the measure plays a prominent role in the U.S. Department of Housing and Urban Development's *Worst Case Needs* reports (for example, HUD, 2011b), and it is also included in the frequently cited Joint Center for Housing Studies' *State of the Nation's Housing* reports (for example, JCHS, 2010) and by the Millenial Housing Commission (2002).

Despite widespread reliance on the AHS inadequacy index by a broad audience of users, little is known about its reliability, internal consistency, and validity. These attributes are typically referred to as *psychometric* features, because these tests were originally developed to assess indicators within the purview of psychologists, such as cognitive achievement, attitudes, and personality (Nunnaly, 1978).

Our goal in this article is to shed light on each of these psychometric properties of the AHS inadequacy index. This information will enable users to assess, for example, (1) if the inadequacy index differentiates among dwellings of different housing quality, (2) if respondents can reliably answer the questions used to create the 15-item index, and (3) if we can be reasonably confident that the index is a valid representation of housing quality. The next section presents the composite index and its distribution. The subsequent sections present results on reliability and validity. We summarize and discuss the implications of this review in the final section.

The AHS Inadequacy Index

The AHS inadequacy index is shown in exhibit 1. A dwelling unit is deemed severely inadequate in one of four ways: (1) the existence of a single inadequacy (for example, electricity is not used); (2) the combination of two inadequacies (for example, the unit has fewer than two full bathrooms and does not have a bathtub or shower); (3) the combination of three inadequacies (exposed wiring, lack of working electrical plugs in all rooms, and fuses blown more than twice in the past 3 months); or (4) the combination of five inadequacies (including leaks, floor holes, cracks, peeling paint, and rats). Units are deemed moderately inadequate if they do not meet the criteria for severe inadequacy but have three or four (instead of five) of the problems listed under (4) or have one of three

[1] The AHS codebook notes: "This three-scale index, in which one is adequate and three is severely inadequate, is a summary measure of housing quality" (HUD, 2011a: 212). The composite measure is also listed in the AHS documentation under the category "Unit Quality."

Exhibit 1

AHS Housing Inadequacy Index

A unit is considered severely inadequate if it meets one of the following conditions:

1. Unit has less than 2 full bathrooms and the unit has at least one of the following (incomplete plumbing).
   a. Unit does not have hot and cold running water.
   b. Unit does not have a bathtub or shower.
   c. Unit does not have a flush toilet.
   d. Unit shares plumbing facilities.
2. Unit was cold for 24 hours or more and there have been more than 2 breakdowns of the heating equipment that lasted longer than 6 hours.
3. Electricity is not used.
4. Unit has exposed wiring and not every room has working electrical plugs, and the fuses have blown more than twice.
5. If the unit meets five or six of the following:
   a. Unit has had outside water leaks in the last 12 months.
   b. Unit has had inside water leaks in the last 12 months.
   c. Unit has holes in the floor.
   d. Unit has open cracks wider than a dime.
   e. Unit has an area of peeling paint larger than 8 x 11.
   f. Rats have been seen recently in the unit.

A unit is considered moderately inadequate if it is not severely inadequate and meets one of the following conditions:

1. Three or four of the conditions listed in item (5) above.
2. There have been more than 2 breakdowns of the toilet that lasted longer than 6 hours.
3. The main heating equipment is unvented room heaters burning kerosene, gas, or oil.
4. The unit is lacking complete kitchen facilities.

AHS = American Housing Survey.
Source: HUD (2011a)

additional problems (for example, unvented heating equipment). The complexity of the index suggests it is based on considerable statistical analysis, but no documentation of which we are aware reveals the nature of this analysis or, alternatively, the basis for selecting the 15 measures in the composite and the decision rules for identifying severe and moderate inadequacy.

Exhibit 2 shows the distribution of the components of the index and its three aggregate categories for the full sample, for rental units, and for owned units, using data from the 2007 national AHS.[2] Less than 4 percent of the housing stock is rated moderately inadequate and less than 2 percent is rated severely inadequate. The inadequacy rate is less for owned units (roughly 3 percent) and more for rentals (nearly 10 percent). Of the 15 measures, only 3 characterize more than 3 percent of all dwelling units: exterior water leak, interior water leak, and cracks in walls. By identifying the small share of dwelling units that have multiple physical inadequacies, the index characterizes what it considers the lowest quality units. On the other hand, it does not characterize units without these multiple inadequacies other than to deem them adequate. Therefore, it does not produce a distribution of units along a continuum ranging from best to worst quality.

[2] We use 2007 data because our predictive validity analyses rely on 2009 data for outcomes. These data are the latest available at the time of this writing.

Exhibit 2

Prevalence of 2007 AHS Inadequacy Index Components and Individual Items

	Full Sample (%)	Renters (%)	Homeowners (%)
Adequate	94.96	90.10	96.97
Moderately inadequate	3.48	6.84	2.08
Severely inadequate	1.56	3.06	0.94
Incomplete plumbing	1.08	1.88	0.73
Incomplete kitchen	1.39	4.03	0.35
Exterior water leak	10.74	9.62	11.12
Interior water leak	8.16	11.50	6.83
Cracks in walls	4.72	7.22	3.66
Holes in floor	0.91	1.63	0.60
Peeling paint or plaster	1.95	3.23	1.40
Rats in unit	0.72	1.08	0.55
Unvented room heaters	1.07	1.14	1.00
Frequent toilet breakdowns	0.20	0.41	0.11
Frequent heating breakdowns	0.45	1.04	0.20
Not all rooms have outlets	1.20	1.70	1.00
Frequent blown fuses	2.05	2.60	1.83
Exposed wiring	0.95	1.38	0.79
No electricity	0.00	0.00	0.00
N	35,128	9,721	24,781
Weighted N	99,090,591	27,151,173	70,129,019

AHS = American Housing Survey.

Notes: Values shown denote the existence of inadequacy (some items have been reverse coded). Weighted data. Listwise deletion of missing data.

Source: 2007 AHS

Reliability

A reliable index should score identical units in identical ways across different time points and survey modalities (Carmines and Zeller, 1979). For this condition to be met, the individual items need to be sufficiently clear to produce consistent responses, and the overall index should measure a single characteristic of the unit—in our case, housing quality.

Test-Retest Reliability

The most straightforward way to test the reliability of survey questions is to ask the same respondents the same questions again, either later in the survey or shortly thereafter, and to calculate the correlation between the two responses. In the case of housing conditions, asked about at a second point in time, the reasonable expectation is that they are unlikely to change during the brief hiatus between the initial survey and the followup (for example, the house has a basement in the initial survey but not in the second).

Although the Census Bureau routinely follows up with a subsample of AHS households, this followup is part of the quality assessment of field operations, not the survey instrument. The purpose is to determine whether particular questions were asked (for example, a question about income), not to re-ask these questions (Cole, 2011). From the inception of the AHS in 1973 through 1981, however, the Census Bureau conducted reinterviews with roughly 20,000 households (Chakrabarty, 1996). The reinterview data files are not publicly available, but an analysis of the test-retest data is presented in a 1996 Census Bureau report (Chakrabarty, 1996). Exhibit 3 reproduces the report's results for 11 of the 15 items in the AHS inadequacy index. Starting from the first results column, the exhibit shows the percentage of responses that changed between the original survey and the reinterview survey; the fraction of "yes" responses to the original survey that changed to "no" in the retest; the fraction of "no" responses to the original survey that changed to "yes" in the retest; and, when applicable, the fraction of responses that were "don't know" in the initial survey that changed to a "yes" or "no" in the reinterview.[3]

Although a relatively small proportion of responses changed between the test and retest, the low prevalence of inadequate housing conditions in the initial AHS interview, as described in the previous section, means that even modest test-retest differences are meaningful for some analyses. The overall pattern suggests a greater tendency to report that a condition exists in the original AHS interview but that it does not exist in the reinterview than vice versa. In the 1974 AHS, for example,

Exhibit 3

Test-Retest Reliability: AHS Inadequacy Index Items, 1973–1981

Binary Response Variables

Item	All (%)	Yes (%)	No (%)	Don't Know (%)	Survey Year
Heating breakdown	6	54	4	NA	1977
Heating breakdown	5	40	2	NA	1976
Interior open cracks/holes	5	49	2	NA	1977
Interior open cracks/holes	5	51	3	NA	1976
Holes in floors	2	35	1	NA	1977
Holes in floors	2	58	1	NA	1976
Seen mice or rats	9	40	4	NA	1976
Basement leak	15	27	10	38	1976
Electric plug in every room	3	2	49	NA	1976
All wiring concealed	3	2	75	NA	1976
Blown fuses	10	51	5	100	1976
Roof leaked in last 3 months	5	29	2	42	1974
Roof leaked in last 3 months	5	28	2	51	1973

Nominal Response Variables (complete kitchen and plumbing)

	All (%)	Exclusive Use (%)	Shared (%)	No (%)	Survey Year
Complete kitchen	1	0.3	88	14	1978
Complete kitchen	1	0.2	NA	26	1977
Complete kitchen	1	0.3	89	11	1975
Complete plumbing	1	0.2	33	19	1977
Complete plumbing	1	1.0	46	23	1974

AHS = American Housing Survey. NA = insufficient responses in original survey.

Source: Adapted from Chakrabarty (1996)

[3] For complete plumbing and kitchen, the exhibit shows further detail on shared versus exclusive use.

5 percent of responses about roof leaks in the past 3 months were inconsistent between the initial interview and the followup, but a greater percentage of initial reports of a leaking roof changed to no leak (29 percent) than the opposite (2 percent). The test-retest results suggest that one-fourth or more of dwelling units classified as inadequate in the AHS may not be. Two caveats about these estimates are in order. First, although Census Bureau interviewers attempted to reinterview the same respondent as the initial interview, they did not always succeed, although the share of the same versus different respondents is not known (Cole, 2011). In addition, the 4-week time lag between the initial interview and the followup could be sufficient for some conditions to be resolved (and other conditions to emerge). Although less precise than would be ideal, the test-retest results are a cautionary note for analysts, particularly those focusing on inadequate housing.

Internal Consistency

Another test of the reliability of the AHS inadequacy index as a measure of housing quality is its internal consistency—the degree to which the individual items in the index are intercorrelated and, therefore, more likely to all be indicators of the same latent characteristic. The most frequent statistical test of internal consistency is Cronbach's alpha, which is the ratio of the sum of each item's variance to the variance of the entire scale (Bland and Altman, 1997; Cronbach, 1951):

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum s_i^2}{s_T^2}\right), \tag{1}$$

where k is the total number of measures, s^2_i is the variance of each individual measure, and s^2_T is the variance of the overall index (the sum of the individual measures). Like a bivariate Pearson correlation coefficient, Cronbach's alpha ranges between 0 and 1. Higher alphas represent better internal consistency, and an alpha of 0.70 or higher is generally considered acceptable (Spector, 1991).

The Cronbach's alpha for the AHS inadequacy index is 0.37 for the total housing stock, 0.44 for rental units, and 0.30 for owned units, falling well short of the 0.70 threshold. Even restricting the sample to a homogenous subgroup of dwelling units (central city, attached single-family—typically a rowhouse—two-bedroom rentals occupied by households with incomes less than the median) produces an alpha of 0.58, still less than the acceptable level. These results suggest that all the items in the index are not tapping the single construct of housing quality.

Latent Trait Analysis

Another test of internal consistency shifts the emphasis from the degree to which the items in the index "hang together," which is the focus of Chronbach's alpha, to the properties of each item in the index and the contribution it makes to the underlying construct. Latent Trait Analysis (LTA) assumes that each item is a measure of the underlying variable, in this case, housing quality, and that lower quality houses are more likely to have each inadequacy included in the index. LTA estimates two parameters for each item in the index: its difficulty and its discrimination. *Difficulty* in this context means how deteriorated or inadequate the dwelling needs to be before any particular item in the index is present.[4] More difficult items (that is, those denoting serious inadequacy

[4] LTA was originally developed to evaluate standardized educational tests, which explains why the word "difficulty" is used.

problems) are likely to be found only in the worst quality units. A measure's *discrimination* is its ability to distinguish among types of units. For example, the index might include two items of equal difficulty, such as a collapsed wall and a bat infestation, and both inadequacies might characterize less than 1 percent of the housing stock. The collapsed wall may be more discriminating, however, because it does a better job distinguishing units in terms of their housing quality. By contrast, because bat infestations most often arise in particular geographic locations, special environmental conditions, and even in high-quality dwelling units, they do not constitute a strong predictor of housing quality. If the AHS index reflects the full range of housing quality from best to worst, LTA difficulty values should range from negative to positive. If the index ranks highly on its discrimination ability, LTA discrimination values should be large.

Using a logit/normal response function, LTA models the probability (*P*) of having a particular inadequacy item (*i*) by the following:

$$P_i(\theta_n) = \frac{e^{\lambda_i(\theta_n - \delta_i)}}{1 + e^{\lambda_i(\theta_n - \delta_i)}}, \qquad (2)$$

where λ_i is the discrimination of an item and δ_i its difficulty. To estimate these parameters for each measure, this article uses a Birnbaum 2-parameter model in STATA's GLLAMM package, using maximum likelihood estimation (Zheng and Rabe-Hesketh, 2007).

Exhibit 4 presents results for the full AHS sample, for rental units, and for owned units, and exhibit 5 displays the characteristic curves for each item in the index for the full sample. In the graph, an item's difficulty is indicated by its position along the latent variable axis and its discrimination is measured by its slope at the inflection point. As shown in exhibit 4, the measures follow mostly the same pattern in each sample.[5] The difficulty of all items exceeds 2.00, indicating that they are limited to housing units with a level of disrepair that is more than two standard deviations greater than the mean. The least difficult items are signs of minor disrepair such as peeling paint, cracks in walls, and leaks, and the most difficult items are the presence of unvented room heaters, incomplete kitchens, and incomplete plumbing. As their steep slopes indicate, the most discriminating measures are cracks in walls, holes in floors, and peeling paint, followed by frequent toilet and heating breakdowns. By and large, the remaining 10 items are not discriminating. This is particularly the case for incomplete plumbing, incomplete kitchen, and unvented room heaters.

Consistent with the prevalence of each inadequacy shown in exhibit 1, the LTA results suggest that the AHS inadequacy items differentiate a small fraction of units with multiple physical inadequacies. LTA provides the additional insight that the items do not differentiate among the most inadequate units, because the high-difficulty items are also nondiscriminating. The results further confirm that none of the individual items distinguishes among units categorized as "adequate," which constitute most of the housing stock. In LTA parlance, the items in the inadequacy index are too difficult to discriminate among most units.

[5] Some distinctions from the overall pattern include the greater likelihood that measures of severe inadequacy (for example, incomplete plumbing) characterize rented units and that measures of moderate inadequacy (for example, peeling paint) characterize owned units.

Exhibit 4

Latent Trait Analysis: "Difficulty" and "Discrimination" of AHS Inadequacy Index Items

	Full Sample		Rental Units		Owned Units	
	Difficulty	Discrimination	Difficulty	Discrimination	Difficulty	Discrimination
Incomplete plumbing	7.71	0.62	11.28	0.36	7.44	0.70
Incomplete kitchen	10.41	0.42	24.76	0.13	9.49	0.62
Exterior leak	2.95	0.82	2.66	1.03	2.95	0.80
Interior leak	3.31	0.84	2.50	1.00	4.28	0.67
Cracks in walls	2.49	1.77	2.13	1.86	2.76	1.64
Holes in floor	3.16	2.34	2.98	2.12	3.20	2.69
Peeling paint or plaster	2.81	2.22	1.83	3.00	3.05	2.12
Rats in unit	5.30	1.06	4.66	1.13	6.59	0.86
Unvented room heaters	10.34	0.45	12.32	0.37	10.98	0.43
Frequent toilet breakdowns	5.30	1.39	5.23	1.23	5.54	1.46
Frequent heating breakdowns	4.06	1.15	4.61	1.00	4.02	1.17
Not all rooms have outlets	5.35	0.91	5.13	0.87	5.43	0.93
Frequent blown fuses	5.17	0.82	4.53	0.91	5.87	0.73
Exposed wiring	6.75	0.74	7.27	0.63	6.68	0.77

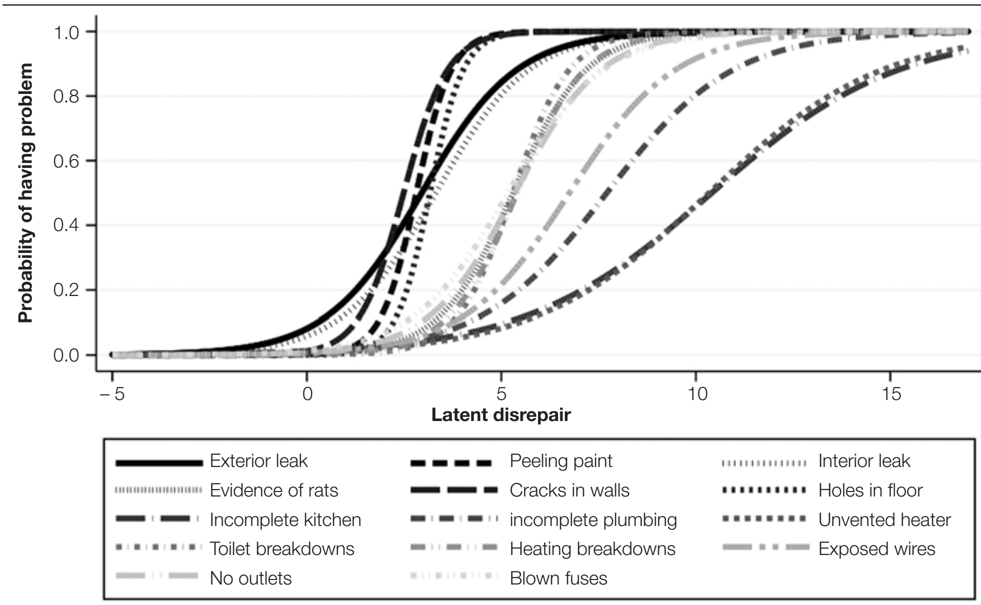
AHS = American Housing Survey.

Notes: All values are statistically significant. The "no electricity" item is excluded because of its incredibly low prevalence. Listwise deletion of missing data.

Source: 2007 AHS

Exhibit 5

Latent Trait Analysis: Item Characteristic Curves



Validity

A valid index is one that accurately measures the latent construct, housing quality, and not some other feature of the unit. To this end, it should correlate with measures typically associated with housing quality and predict outcomes known to be affected by unit quality (Carmines and Zeller, 1979).

Convergent Validity

If the AHS inadequacy index is a valid measure of the underlying construct of interest, housing quality, then it should correlate highly with other measures that also purport to tap this underlying construct. Indicators that should yield strong correlations include housing cost (for example, Emrath and Taylor, 2012; Kain and Quigley, 1970; Thibodeau, 1995), age of structure (for example, Malpezzi, Ozanne, and Thibodeau, 1987; Rubin, 1993), the tenant's satisfaction with the housing unit, and residential mobility (Lu, 1999; Newman and Duncan, 1979; Speare, 1974).[6] We measure housing cost as the log of house value reported by owners and the log of gross rent reported by renters. "Age of structure" is the estimated age reported by the respondent. "Satisfaction with the housing unit" is the respondent's rating on a 10-point scale (10 is "best" and 1 is "worst"). "Residential mobility" reflects whether a different household occupied the unit in the 2009 AHS than in the 2007 AHS.

Exhibit 6 lists the Pearson *r* correlations between each of the three points on the inadequacy index and each of the five measures theoretically associated with physical inadequacies in the dwelling. The correlations have the expected signs but are small, indicating little convergent validity. The greatest correlations are between adequacy and house value (0.10), structure age (-0.10), and housing satisfaction (0.15).

Predictive Validity

Another test of the extent to which the AHS inadequacy index is tapping the housing quality construct is to determine whether the index predicts outcomes to which it is theoretically associated. Four of the five measures used to estimate convergent validity meet this criterion: house value, rent, satisfaction, and residential mobility. To predict value and rent, we use a hedonic framework. Because hedonic models are highly sensitive to specification, we replicate, to the extent possible, models developed by two well-regarded housing economists (Coulson and Li, 2011; Thibodeau, 1995). We model housing satisfaction using an ordered logit and model the likelihood that the household moved between 2007 and 2009 using a logistic function.[7]

Exhibit 7 presents the results. Although the Coulson and Li (2011) and Thibodeau (1995) specifications are somewhat different, our replication using 2007 data produces nearly identical coefficients for the inadequacy index. For owners, the coefficient on "moderately inadequate" is negative and

[6] The predominant reasons AHS respondents give for moving focus on attributes of the housing unit (for example, Holupka and Newman, 2011).

[7] Models using contract rent and gross rent produce similar estimates. We report estimates from gross rent models in the exhibit.

Exhibit 6

Correlations Between AHS Inadequacy Index Components and Items With Housing Cost, Age, Satisfaction, and Moves

	Log Rent (renters)	Log Value (owners)	Age (all)	Satisfaction (all)	Move (all)
Adequate	0.05*	0.10*	– 0.10*	0.15*	– 0.07*
Moderately inadequate	– 0.05*	– 0.09*	0.09*	– 0.12*	0.05*
Severely inadequate	– 0.02**	– 0.03*	0.05*	– 0.09*	0.04*
Incomplete plumbing	– 0.01	– 0.03*	0.04*	– 0.05*	0.02*
Incomplete kitchen	– 0.04*	– 0.01	0.03*	– 0.05*	0.06*
Exterior water leak	0.02	– 0.03*	0.13*	– 0.09*	– 0.01*
Interior leak	0.00	– 0.01*	0.03*	– 0.12*	0.04*
Cracks in walls	– 0.03*	– 0.07*	0.10*	– 0.18*	0.05*
Holes in floor	– 0.01	– 0.08*	0.04*	– 0.11*	0.02*
Peeling paint or plaster	– 0.02	– 0.05*	0.09*	– 0.13*	0.03*
Rats in unit	– 0.01	– 0.01**	0.04	– 0.07*	0.01
Unvented room heaters	– 0.05*	– 0.10*	0.06*	– 0.04*	0.01
Frequent toilet breakdowns	– 0.02**	– 0.02*	0.01**	– 0.05*	0.02*
Frequent heating breakdowns	– 0.01	0.00	0.04*	– 0.07*	0.02*
Not all rooms have outlets	– 0.01	– 0.01	0.03*	– 0.05*	0.02*
Frequent blown fuses	0.03*	0.01	0.03*	– 0.09	0.03*
Exposed wiring	– 0.02**	0.01	0.01*	– 0.01	0.02*
No electricity	NA	0.00	0.00	0.00	0.00

AHS = American Housing Survey. NA = insufficient responses in original survey.

**p < 0.05. **p < 0.10.*

Notes: Weighted data. Listwise deletion of missing data.

Sources: 2007 and 2009 AHS

statistically significant. It suggests that moving from an adequate to a moderately inadequate unit is associated with a 20- to 22-percent decline in housing value.[8] None of the other coefficients reach statistical significance at the 0.10 level, and all are very small. The lack of significance of the severe inadequacy variable confirms the lack of discrimination at the extreme end of poor housing quality. Emrath and Taylor's (2012) recent *Cityscape* article also tested several different hedonic specifications that included the AHS inadequacy index. They report statistically insignificant coefficients on both the moderately and severely inadequate variables in predictions of both house value and rent.

The results for housing satisfaction are decidedly different. The coefficients on both moderate and severe inadequacy are large, of similar size, and statistically significant in all models. For example, moving from an adequate to a moderately inadequate unit reduces by 19 percentage points the likelihood that respondents ranked their housing satisfaction a 9 or 10. By contrast, moderate or severe inadequacy in the dwelling does not appear to be closely associated with making a residential move. Living in a severely inadequate unit, for example, increases the likelihood of a household moving by 2 percentage points. The only result that reaches significance ($p < 0.10$) occurs for homeowners, but even here, the size of the effect is small, increasing the probability of moving by about 3 percentage points.

[8] These marginal effects are calculated by exponentiating the coefficients.

Exhibit 7

Multivariate Analysis of AHS Inadequacy Index

		AHS (moderately inadequate)	AHS (severely inadequate)
Coulson and Li (2011) hedonic[a]	Renters (log rent)	– 0.01	0.03
		(0.02)	(0.04)
	Owners (log value)	– 0.25*	0.01
		(0.05)	(0.07)
Thibodeau (1995) hedonic[b]	Renters (log rent)	0.00	0.03
		(0.02)	(0.03)
	Owners (log value)	– 0.22*	0.01
		(0.04)	(0.06)
Housing satisfaction[c]	All	– 0.79*	– 0.87*
		(0.06)	(0.08)
	Renters	– 0.68*	– 0.82*
		(0.08)	(0.11)
	Owners	– 0.88*	– 0.87*
		(0.09)	(0.13)
Moving in 2 years[c]	All	0.12	0.16
		(0.07)	(0.10)
	Renters	0.10	0.14
		(0.09)	(0.13)
	Owners	0.10	0.32**
		(0.14)	(0.19)

AHS = American Housing Survey.

$^*p < 0.05$. $^{**}p < 0.10$.

[a] Includes household income, race, school adequacy, shopping adequacy, the presence of public transportation, the number of bathrooms, the age of the housing unit, the presence of a garage, the presence of central air conditioning, the type of heat, region, whether the unit was in a central city, the lot square footage, and the interior square footage.

[b] Includes slightly different specifications for renters and owners and controls for number of bathrooms, number of bedrooms, number of other rooms, structure type, age of property, garage, basement, heating system, air conditioning system, assessment of neighborhood, abandoned properties nearby, litter in neighborhood, neighborhood crime, neighborhood noise, head of household Black, head of household Hispanic, people per room, lot size, head of household moved before 1949, and utility inclusion in rent.

[c] Include log household income, head of household race, head of household education, head of household gender, head of household age, urban/suburban, and region.

Notes: Standard errors in parentheses. Hedonic models are estimated using ordinary least squares. Housing satisfaction, measured on a scale of 1 to 10 (10 being best), is estimated using an ordered logit linking function. Moving, measured by a change in household between the 2007 and 2009 surveys, is estimated using a logit linking function. Coefficients (log odds) are reported. Listwise deletion of missing data.

Sources: 2007 and 2009 AHS

Conclusions

The AHS inadequacy index identifies a small share of dwelling units with multiple inadequacies. Whether a dwelling unit is consistently characterized by the same inadequacies when the initial survey is administered again within 1 month is indeterminate with the available data, but evidence at least suggests that data users should exercise caution, particularly when focusing on units categorized as inadequate by the index. Although we could not find any documentation about how the

AHS inadequacy index was formed, the AHS (and users) view it as a measure of housing quality. Tests of internal consistency suggest that the 15 items in the index do not tap the same underlying construct of housing quality, and that no differentiation is made among the items that characterize the worst quality units. Tests of convergent and predictive validity also raise questions about whether the index taps the housing quality construct.

These results are reminiscent of the many past failed efforts, primarily in the 1970s, to develop a single measure of housing quality (for example, Goedert and Goodman, 1976; Goodman, 1978; Kain and Quigley, 1970). With increased interdisciplinary interest in housing and greater analytic sophistication, now may be the time to revisit the conceptualization and measurement of the elusive concept of housing quality.

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Graphic Detail

Geographic Information Systems (GIS) organize and clarify the patterns of human activities on the Earth's surface and their interaction with each other. GIS data, in the form of maps, can quickly and powerfully convey relationships to policymakers and the public. This department of Cityscape *includes maps that convey important housing or community development policy issues or solutions. If you have made such a map and are willing to share it in a future issue of* Cityscape*, please contact ronald.e.wilson@hud.gov.*

Race and Refinancing During the Bubble in the Baltimore and Washington Metropolitan Region

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The views expressed in this article are those of the author and do not represent the official positions or policies of the Office of Policy Development and Research or the U.S. Department of Housing and Urban Development.

The map in exhibit 1 depicts geographic differences in the ratio of house-purchase loans to home-refinance loans in 2006,[1] during the height of the housing bubble. Purchases and refinances serve different purposes. New house purchases suggest mobility and home refinances suggest stability. The map contrasts these patterns with the geographic distribution of the African-American and White populations at the census tract level[2] in the Baltimore and Washington, DC region.

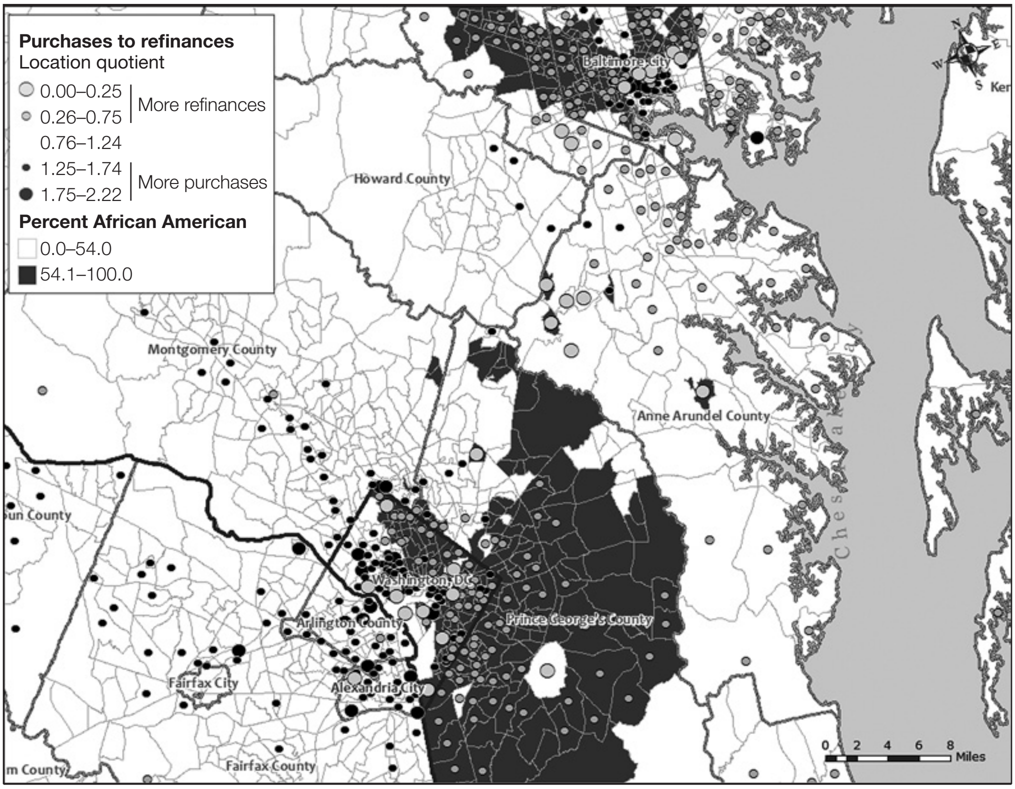
I used location quotients (LQs) in this analysis to measure the relative differences between purchase and refinance loans of a tract in relation to the two subregions overall. If a tract's LQ is 1, it has the same purchase-to-refinance ratio as the two subregions. If the LQ is greater than 1, the tract has more purchases relative to refinances. If the LQ is less than 1, the tract has more refinances relative to purchases—or fewer purchases relative to refinances.

[1] Mortgage loan originations peaked in 2005 and have since declined significantly in all markets across the United States (Harvey, 2009). Loans obtained by minorities in the top 100 metropolitan areas, however, expanded through 2006 (Pettit and Rueben, 2009).

[2] Based on 2005 to 2009 American Community Survey 5-year estimate data, which estimate the population for 2007.

Exhibit 1

Tract Shares of House-Purchase to Home-Refinance Loans Against Concentrations of the African-American Population



Note: Manual classification of location quotient breaks and percent African American.
Source: 2006 Home Mortgage Disclosure Act

The background shading of the map in exhibit 1 shows the geographic patterns of the relative concentration of the African-American population, in which shading indicates that African Americans make up at least 54 percent of the residents in a tract.[3] Two different subregional patterns of African-American concentration are apparent. In Baltimore, the concentration is primarily in the city with a small extension radiating northwest into Baltimore County. Around Washington, D.C., the concentration is primarily east of the city and covers most of the suburbs in Prince George's County, Maryland.[4]

[3] This class break is based on the upper quartile of 0.75 (54 percent) African-American population within a tract.

[4] The tract in the center of Prince George's County that does not contain a concentration of African Americans contains Andrews Air Force Base and is populated mostly by military personnel.

The LQ patterns show a strong geographic relationship of the purchases to refinances with the distribution of the African-American and White populations.[5] Light gray circles indicate relatively more (one-fourth to three-fourths as many) refinances and dark gray circles indicate relatively more (one-fourth to one and one-fourth as many) purchases than the region. The absence of a circle indicates that a tract has a fairly typical ratio of purchases to refinances across the two subregions.

More refinances occurred in areas where the African-American population was concentrated, and more purchases were made in non-African-American areas. Maps similar to this one can be the starting point for further investigating the causes of these differential uses of credit.

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[5] A bivariate spatial autocorrelation analysis with the Moran's I statistic supports the geographic pattern in exhibit 1. The Moran's I statistic for LQs and the African-American population in the two subregions is -0.25 ($p \geq 0.001$) and indicates that tracts with home-refinance loans have a moderate spatial correlation with high percentages of African-American population in adjacent tracts.

Industrial Revolution

Every home makes compromises among different and often competing goals: comfort, convenience, durability, energy consumption, maintenance, construction costs, appearance, strength, community acceptance, and resale value. Often consumers and developers making the tradeoffs among these goals do so with incomplete information, increasing the risks and slowing the adoption of innovative products and processes. This slow diffusion negatively affects productivity, quality, performance, and value. This department of Cityscape *presents, in graphic form, a few promising technological improvements to the U.S. housing stock. If you have an idea for a future department feature, please send your diagram or photograph, along with a few, well-chosen words, to dana.b.bres@hud.gov.*

Reducing Appliance Backdrafting Risks With HVAC-Integrated Makeup Air Systems

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Abstract

Kitchens are often a significant source of indoor air pollution, and cooking byproducts should be vented to the outside, but range hoods should not be installed without taking certain precautions. Exhaust equipment, such as range hoods, may create negative pressure inside a house, resulting in backdrafting of combustion appliances. This scenario is particularly true because of modern construction practices that yield tight building enclosures and because of consumer demand for large range hoods. A properly sized and installed heating-, ventilation-, and air-conditioning-integrated makeup air system will alleviate building pressures and reduce the risk of backdrafting appliances.

With Americans spending roughly 90 percent of their time indoors, the quality of the indoor environment can have a profound effect on occupants' health. Cooking, particularly with unvented gas ranges, is the source of a variety of indoor air pollutants. Products of natural gas combustion include carbon monoxide, nitrogen dioxide, formaldehyde, and particulates. Nitrogen dioxide may cause eye, nose, and throat irritation and impaired lung function (EPA, 2012), and carbon monoxide may produce symptoms associated with oxygen deprivation. The food itself may also be a significant source of indoor air pollution, particularly in the form of cooking oil fumes (Wallace, Emmerich, and Howard-Reed, 2004).

In addition to the release of these pollutants, moisture released into the air from burning gas and boiling water may indirectly affect human health, because high indoor humidity levels facilitate mold growth. The Environmental Protection Agency recommends that homeowners maintain their dwellings at between 30 and 60 percent relative humidity to reduce the risk of mold growth. If moist conditions exist, mold growth may begin to occur within 24 to 48 hours, possibly resulting in health effects and symptoms including allergic reactions, asthma, and respiratory complaints (EPA, 2010).

Yik, Sat, and Niu (2004) reported amounts of moisture released from cooking various dishes, ranging from 0.055 pounds for noodles to more than 2.000 pounds for boiling soup. These numbers do not include the moisture released from the combustion of natural gas, which adds about 1.000 pound per hour for a 10,000 British thermal unit (Btu) burner set on high (TenWolde and Pilon, 2007). Cooking may not be the greatest overall source of moisture in a house, but it may contribute to high indoor humidity levels when combined with human and pet respiration, plant transpiration, showering, and wet foundations. In addition to affecting health, moisture may also affect the building negatively in terms of condensation on windows and the decay of wood-based building materials. Modern construction practices, which feature relatively airtight building enclosures for the purpose of energy conservation, may exacerbate concentrations of these pollutants.

To remove cooking-related air pollutants, builders, remodelers, and mechanical contractors generally install some type of range hood device. These devices frequently consist only of a circulating fan and a filter with no actual exhaust of indoor air to the outdoors. These filters remove some odors, but they have a limited ability to remove pollutants and do not remove heat or moisture from the living space. Other range hoods exhaust air, pollutants, and moisture to the outdoors. The industry-recommended ventilation rate is 250 cubic feet per minute (cfm) for a standard 30-inch range (HVI, 2013), but the installation of range hoods with exhaust rates in the range of 400 to 1,500 cfm is common.

Although a high-rate exhaust system might seem like an excellent solution for removing cooking-related indoor air pollutants, the system may create unhealthy or hazardous conditions by *back-drafting* appliances. In some instances, the negative house pressure induced by the exhaust system may be great enough to reverse the draft of combustion appliances, causing dangerous combustion products to spill into the living space. This spillage may result in unhealthy or dangerous levels of nitrogen dioxide and carbon monoxide and result in large amounts of moisture entering the house (about 1 pound per 10,000 Btu/hour).

The risk of backdrafting appliances is a function of the total building exhaust rate and house tightness. The total building exhaust rate is the exhaust rate of the kitchen exhaust system combined with the exhaust rates of other appliances that might be running simultaneously; for example, dryers, bath fans, and heating, ventilating, and air-conditioning (HVAC) duct leakage. These exhaust appliances will combine to induce a negative pressure in the house with respect to the outdoors. The degree to which the house will experience negative pressure also depends on the level of air tightness of the building enclosure. The tighter the house, the greater the resulting negative pressure from an equivalent rate of exhaust.

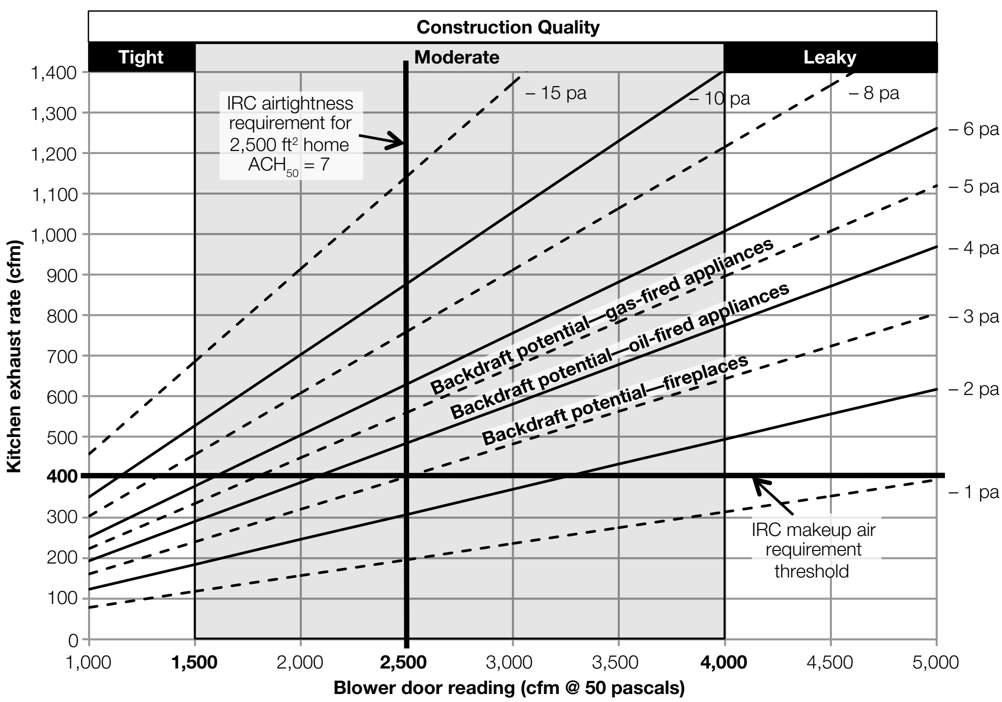
Exhibit 1 provides a reference for assessing the risk of backdrafting various combustion appliances under varying levels of house tightness and exhaust rates. The 2009 International Residential Code requires makeup air for range hoods with exhaust rates in excess of 400 cfm. At this exhaust rate, there is a risk of backdrafting a masonry fireplace in a house built to current construction standards. Even modest levels of exhaust can create risks in tight houses that contain combustion appliances. Similarly, very high exhaust rates may create risks even in relatively leaky houses.

If an installer determines that the operation of a kitchen exhaust system creates a backdrafting risk, the next step is to determine an appropriate means of providing makeup air. *Makeup air* refers to outside air that is brought into the house at a rate roughly equal to the exhaust rate. Properly installed makeup air systems will equalize the pressure inside the house and thereby alleviate the risk of backdrafting.

Makeup air systems fall into two main categories: engineered openings and HVAC-integrated systems. Engineered openings are simply glorified holes in the wall—when a damper in the opening

Exhibit 1

Induced House Pressures Under Various Exhaust Rates and House Tightness



ACH = air changes per hour. cfm= cubic feet per minute. ft² = square feet. IRC = International Residential Code. pa = pascals.
Source: Jellen, Wolfgang, and Turns (2012a)

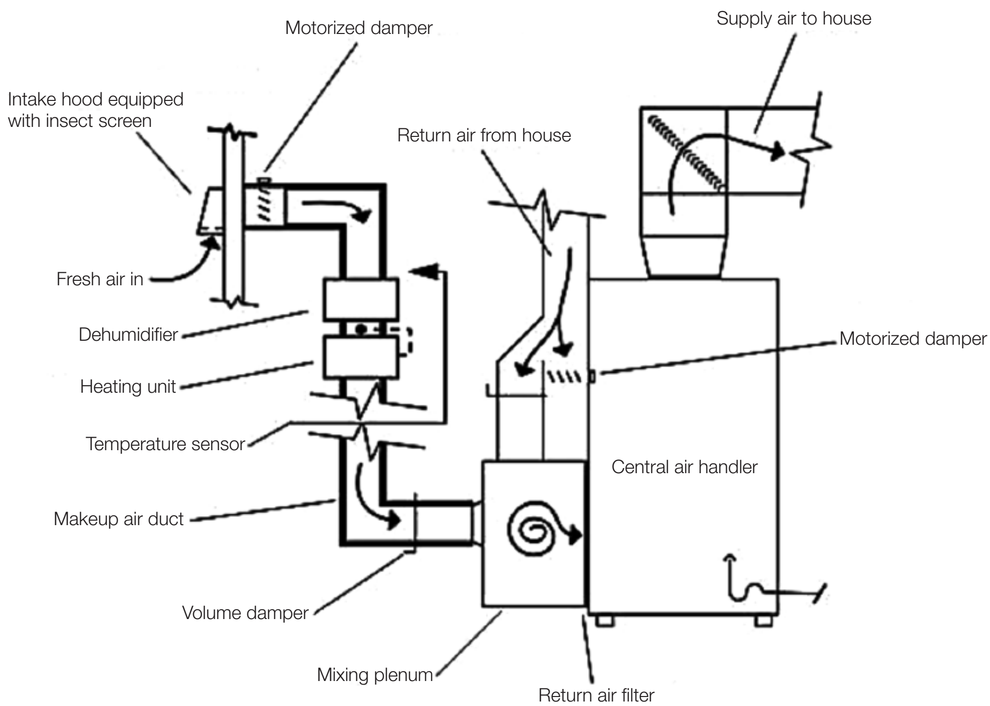
is put under pressure, it opens passively to let air in. Although appealing in their simplicity, engineered openings are effective only at relatively low pressures, and thus relatively low kitchen exhaust rates. With exhaust rates of about 150 cfm or greater and a 10-square-inch opening, the pressure required to let in a roughly equivalent amount of air is already greater than the pressure that could backdraft a masonry fireplace. In addition, there is no opportunity to heat or cool the incoming air, which can lead to occupant discomfort.

HVAC-integrated systems (exhibit 2) solve this problem by locating the air intake remotely from the kitchen and near the air handler. In this configuration, the air-intake damper is in a duct that connects an opening to the outside with the return air plenum of the HVAC system. The damper is electronically linked to the on/off switch for the kitchen exhaust system, thus opening automatically when the range hood is operating. HVAC-integrated makeup air systems allow for much higher rates of air intake and provide the ability to temper incoming air via the HVAC unit (when it is operating) or via a standalone duct heater or dehumidifier.

Another solution is to remove or not install any combustion equipment other than direct-vent equipment and ensure the living space is well-sealed from the garage or other potential sources of pollution. *Direct-vent*, or sealed combustion, equipment brings air into the system, burns the fuel,

Exhibit 2

Typical HVAC-Integrated Makeup Air System With Optional Heating Unit and Dehumidifier



HVAC = heating, ventilating, and air-conditioning.

Source: Jellen, Wolfgang, and Turns (2012b) and exhausts air back out with no communication with the indoor air. This equipment is not new, but most houses that use gas or propane as a fuel source have at least one piece of open combustion equipment.

This article highlights one of the challenges of designing a structure to achieve multiple goals. Achieving the goal of a more energy-efficient housing stock means building tighter homes, and building tighter homes means greater risks of indoor air-quality problems. Furthermore, the measures used to remove pollutants may create new risks such as backdrafting combustion appliances. This problem requires an integrated solution that considers a variety of factors, including house tightness, exhaust rates, building pressures, energy consumption, and occupant comfort, health, and safety.

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Additional Resources

Air Conditioning Contractors of America (http://www.acca.org).

Building Performance Institute, Inc. (http://www.bpi.org).

Green Building Advisor (http://www.greenbuildingadvisor.com).

Home Ventilating Institute (http://www.hvi.org).

Lawrence Berkeley National Laboratory (http://www.lbl.gov).

The Pennsylvania Housing Research Center (http://www.engr.psu.edu/phrc).

Policy Briefs

The Policy Briefs department summarizes a change or trend in national policy that may have escaped the attention of researchers. The purpose is to stimulate the analysis of policy in the field while the policy is being implemented and thereafter.

The HEARTH Act

Steve Berg
National Alliance to End Homelessness

Abstract

This article describes the Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act, which was enacted in 2009 to overhaul the U.S. Department of Housing and Urban Development's (HUD's) homelessness assistance programs. The article provides an overview of changes in HUD's programs and in the practices of communities leading up to the HEARTH Act. It provides a summary of the most important changes made by the act and some of the effects it will likely have on communities. Finally, it suggests important topics for future research.

Introduction

In 2009, the Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act was included in a larger piece of legislation, passed by Congress, and signed by President Obama. The HEARTH Act accomplished the first comprehensive overhaul of the U.S. Department of Housing and Urban Development's (HUD's) homelessness programs in 15 years. During that time, HUD had changed the process for distribution of funds from its homelessness programs, and the homeless assistance field had grown and advanced, with a new focus on reducing the incidence of homelessness and even ending it.

This article briefly traces that history, describing how the HEARTH Act brought the underlying statutory framework into alignment with actual practice and prepared for future development. Achievement of the HEARTH Act's ambitious goals will require a research agenda that is challenging and important, and that research agenda is discussed at the end.

The Law and Practice Before HEARTH

Before the HEARTH Act passed, Title IV of the McKinney-Vento Homeless Assistance Act included authorization for a number of different competitive grant programs, with similar purposes and serving similar clienteles. Differences included the kinds of entities that could be funded, program designs, length of initial grants, and whether capital costs could be covered. The plain statutory language contemplated program operators applying to HUD for funding and HUD making decisions based on the strength of the applications. This process is indeed how the programs worked in the early years of McKinney-Vento.

In addition to awarding these competitive grants, HUD distributed the Emergency Shelter Grant (ESG) by formula to state and local governments, mostly to pay for emergency shelters.

Beginning in the mid-1990s, HUD and Congress began to make changes in the way these programs were administered, although without any major changes to the underlying statute. The most important change was the consolidation of the application process and funding for the competitive grants, using the following elements of the continuum-of-care approach.

- Instead of individual programs competing, entire communities competed against each other.
- The need for homelessness assistance and the quality of the continuum of care were the criteria used in the competition.
- Need was determined through a formula that was in most aspects the same as the ESG formula.
- Within communities, local decisionmakers rated individual projects by priority. Communities had broad discretion over their decisionmaking process and the substantive criteria employed. Based on the amount of money available from appropriations and the community's score in the competition, HUD would fund programs beginning at the top of the community's priority list and continuing down the list as far as that community's funding extended.
- The scoring system gave some preference to each community's renewal amount—the amount necessary to fund existing projects at their current level.

Congress also made changes to the system.

- It set a minimum amount (in general, 30 percent) that was to be used for permanent housing.
- It regularly increased funding, even in years such as the early-to-mid 2000s, when many HUD and other domestic programs were having their funding reduced.
- It pushed for better quantification of the issue. Congress funded local homeless management information systems that enable communities to track movement through their homeless systems. HUD required communities to count homeless people on a specific date every 2 years; many communities, seeing the benefits, made it an annual event.

Outside of these specific policy changes, other developments, including the following, changed the way people were looking at and responding to homelessness.

- Research on homelessness by Dennis Culhane and others confirmed two key points. The first is that homeless people are not all the same but are instead a diverse group and particularly have different experiences of homelessness. Most remain homeless for only a few weeks or months, but a distinct group remains homeless for much longer periods of time. The second is that, for people with severe disabilities, a model based on permanent supportive housing can end their homelessness for little net cost to taxpayers (Culhane, Metraux, and Hadley, 2002; Kuhn and Culhane, 1998).
- Other research and the experience of a few leading communities showed the efficacy of a *rapid rehousing approach*, particularly for homeless families. That approach is to use small amounts of money to pay move-in expenses and a few months' rent to get people out of shelters, then work intensively on employment-related services to get them in a position to afford rent on their own at the end of that period. This model was the key to large reductions in family homelessness in communities that implemented it (NAEH, 2012, 2006a, 2006b).
- In February 2002, the Bush Administration announced the goal of ending chronic homelessness (defined as unaccompanied individuals with disabling conditions living in shelters or on the streets for 1 year or more or repeatedly)(GP0, 2003). As part of this initiative, the Administration revitalized the United States Interagency Council on Homelessness, and the council's staff worked to promote the idea that local communities should adopt plans to end homelessness in 10 years, using the timeframe first set out by the National Alliance to End Homelessness in 2000 (NAEH, 2000). Hundreds of communities adopted such plans.
- Leading communities began to focus specifically on the number of homeless people and to adopt proven strategies for reducing this number. Because of the adoption of more effective practices at the local level and a positive economic situation, homelessness declined in the United States by 70,000 to 80,000 people from the first official point-in-time count in January 2005 through the second biennial national count in January 2007 (HUD, 2007, 2005; NAEH, 2009).

The HEARTH Act

The new bill emerged in this context. An early version was introduced by Senator Jack Reed in 2001. Other versions were introduced in the next three Congresses by Senator Reed and his cosponsors and in the House by the late Representative Julia Carson and her cosponsors. After several years and extensive negotiation to resolve a range of issues, the final version of the HEARTH Act was attached to a larger housing bill and passed Congress in early 2009.

For the most part, the HEARTH Act codifies the continuum of care as it had evolved over the previous decade. HUD's homelessness programs were widely regarded as well run and accomplishing a good purpose, and no push was made for any kind of fundamental alteration. The act, however, did make some changes, summarized as making the programs more about the goal of ending homelessness, not merely managing the problem.

The following changes were the most important in the act.

- **ESG changes.** The ESG formula grant was renamed the Emergency Solutions Grant, and eligible activities were expanded to include funding of activities for rapid rehousing and emergency homelessness prevention. A minimum of 20 percent of appropriated funds was set aside for ESG (unless Congress appropriated insufficient funds to both set aside 20 percent and fund existing projects at their current levels), and the amount that could be used for shelters was essentially capped at the pre-HEARTH amount, requiring that additional funds be used for the new ESG activities.

- **Using the competition to incentivize behavior.** The bill included great detail about selection criteria for the competitive continuum-of-care grants. These criteria were largely designed to reward communities that achieve better outcomes, so they included the number of people who become homeless, how long they stay homeless, and operational details such as the amount of matching funds brought in, coordination with other antipoverty programs, and the quality of the communities' planning to end homelessness and methodology for making priority decisions.

- **Bonuses for effective practices.** The act provided HUD with statutory authority to provide bonuses to communities that wish to implement practices that have proven effective. This authority replicates and somewhat expands HUD's previous practice of providing bonuses for new permanent supportive housing projects. The act allows for bonuses for permanent supportive housing for chronically homeless people, rapid rehousing for families with children, and other program models that research may demonstrate to be effective.

- **Protecting teenage family members.** The act prohibits programs that serve families with children from excluding children younger than 18 based on their age or gender.

- **Matching funding.** The act eliminates the previous complicated array of different matching requirements and substitutes a single, 25-percent matching requirement for all activities, with the single exception that funds used for leasing do not need to be matched. (No matching requirement existed for leasing under previous law.) The act also enables HUD to apply the 25-percent matching requirement to the entire continuum of care, rather than to each individual project within the continuum. Match amounts may include those funded by federal programs other than HUD's homelessness programs, and they may be in cash or in kind, although in-kind matches must be backed up by a memorandum of understanding providing that the services will be available.

- **Continuumwide administrative funding.** The act generally increases allowable funding for administration and for the first time funds administration of the entire continuum of care, not only individual projects.

- **Unified funding agencies.** The act provides additional administrative funds for communities where one entity receives a single grant from HUD and distributes the funding to other programs in the community.

- **Some expanded eligibility.** The act somewhat expands the ability of communities to use continuum-of-care funding for people who are living in houses or apartments but whose housing situation is not stable. The most significant change in this regard was to make more ESG funding available for prevention, including for people who are not homeless. Under certain circumstances, some continuum-of-care funds can be used for children and families who are not homeless as defined by the HEARTH Act, but who are homeless as defined by other federal programs, including families that are living in the home of another because of economic hardship or loss of housing.

- **More expanded eligibility if certain touchstones are accomplished.** In a number of circumstances, the HEARTH Act allows for continuum-of-care funding to serve people who are not homeless but who are at risk of homelessness. These circumstances include when the community meets certain performance measures that qualify it as a high-performing community. In addition, if a community's rate of homelessness is less than one-tenth of 1 percent, then all continuum-of-care funds can be used for people who are at risk of homelessness. Finally, if HUD offers the previously referenced bonus for an effective practice, and if a community has already implemented that practice for everyone in the group for whom it is targeted, then the community may receive the bonus but use it for any eligible activity, including prevention.
- **Authorized amount of funding.** The act authorizes substantially increased funding of $2.2 billion for fiscal year 2010, although the amount of funding was to be determined by the appropriations process. To date, Congress has not increased funding to more than approximately $1.9 billion, thus making it unlikely that some other parts of the HEARTH Act, such as a new variant of the continuum of care specifically for rural areas, will be implemented soon.

These details add up to a change in approach that can be summarized by four shifts in what is funded and encouraged.

- **Programs to systems.** The act continues the move begun with the continuum of care, to go beyond funding and evaluating a collection of programs in a community and instead to adopt a systems approach. This approach is evident in the way administrative costs are funded, in the way the match requirement is organized, and in the way homeless assistance is evaluated.
- **Activities to outcomes.** The act streamlines funding, eliminates several requirements, and shifts the emphasis from activities and compliance to achieving outcomes, particularly moving people quickly out of homelessness and into housing. Outcomes are rewarded through the competitive process.
- **Shelter to prevention.** The act concentrates on housing for people who are homeless, but it also gives communities more opportunity to operate programs that prevent future homelessness. This opportunity is particularly evident in provisions that allow for the use of the expanded ESG program for prevention activities and is carried further by provisions allowing for continuum-of-care resources to be used for prevention in communities that have made the most progress toward rehousing homeless people.
- **Gradual rehousing to rapid rehousing.** Instead of helping people slowly transition out of homelessness by fixing other problems, the act places more emphasis on rapid rehousing. The phrase "housing first" is appropriate for describing the HEARTH Act's approach to homelessness.

Other Developments

Late in the process of the HEARTH Act's movement through Congress, the recession hit, and the federal government's response included the Homelessness Prevention and Rapid Re-Housing Program (HPRP), one-time money to state and local government that used the exact language that had appeared in early versions of what became the HEARTH Act. The HPRP program meant that these models of rapid rehousing and homelessness prevention were tested and used in virtually every community in the country.

The interim rule provided helpful clarification on a vast range of difficult technical issues. The rule generally promotes the large policy changes in the HEARTH Act. A key example is how it fleshes out the requirement that communities develop a system of coordinated assessment.

Issues for Research

Looking forward, the HEARTH Act gives rise to a number of key questions for researchers. Answers to these questions will help HUD, Congress, and local communities implement the act most effectively and move closer to the goal that the act contemplates—an end to homelessness in the United States.

- **Are the numbers going down?** The regular reporting of the number of homeless people by locality and state has helped policymakers understand the effects of these programs.
- **Are they going down more in places that are enacting certain approaches?** An important task for researchers is to operationalize the adoption of program models in communities, and then compare the effects on homelessness when communities adopt various arrays of interventions.
- **What are the right interventions for whom?** A better understanding is needed of what it takes to end homelessness for people with different characteristics. The goal is to provide precisely the right amount of help to each person to allow that person to be securely housed and no longer homeless—no less, but also no more. That is the way to house the greatest number of people with limited financial resources. To achieve this goal will require different levels of intensity of assistance for people with different levels of disability, barriers to work, and other difficulties.
- **For whom does prevention work?** Experience with homelessness prevention funded by HPRP indicates that, as with other efforts to prevent some problem, a certain amount of *overshot* will persist in homeless prevention programs: services provided to people who would have found some way to avoid homelessness had they not received the help. Cost-effective homelessness prevention programs will require a better understanding of who is most likely to become homeless if they do not receive help. Some factors involve demographics, disabilities, family composition, or other risk factors. Even less work has been done to identify a taxonomy of housing crises that allows for some sense of which crises are very likely to lead to homelessness. As the HEARTH Act allows for more communities to experiment with prevention, these kinds of questions will demand answers.

Acknowledgments

The author thanks the many people at the U.S. Department of Housing and Urban Development, at other federal agencies, in Congress, at the National Alliance to End Homelessness, and at homelessness programs, organizations, and systems around the country who are making our work on homelessness more effective, with the goal of bringing the number of Americans experiencing homelessness closer to zero each year.

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The Small Area FMR Demonstration

Peter B. Kahn
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Abstract

Fair Market Rents (FMRs) are used to define payment standards that govern the amount of assistance that Housing Choice Voucher Program (HCVP) participants receive. The U.S. Department of Housing and Urban Development (HUD) currently publishes a single FMR for each HUD metropolitan FMR area. To provide program participants with wider access to opportunity areas, the Department developed Small Area Fair Market Rents (SAFMRs). SAFMRs represent a fundamentally different way of operating the HCVP in metropolitan areas; therefore, HUD is testing SAFMRs through a demonstration program to better understand the programmatic effects.

Fair Market Rents (FMRs) are primarily used to determine payment standard amounts for the Housing Choice Voucher Program (HCVP). Local administrators of the HCVP set the payment standards that are used to calculate the value of the housing subsidy for each voucher holder. FMRs are gross rent estimates: they include the shelter rent plus the cost of all tenant-paid utilities, except telephones, cable or satellite television service, and internet service. The U.S. Department of Housing and Urban Development (HUD) sets FMRs to assure that a sufficient supply of rental housing is available to program participants. To accomplish this objective, FMRs must be both high enough to permit a selection of units and neighborhoods and low enough to serve as many low-income families as possible. Currently, a single FMR[1] is produced for each metropolitan area and for each nonmetropolitan county in the country.

At the direction of HUD Secretary Shaun Donovan, the Office of Policy Development and Research (PD&R) undertook the task of developing FMRs that vary within metropolitan areas.

[1] HUD estimates FMRs for units of different sizes as measured by the number of bedrooms, from zero-bedroom (efficiency) units to four-bedroom units. For purposes of this discussion, the set of FMRs HUD estimates for an area is referred to as "the FMR."

After examining a variety of levels of geography, PD&R developed Small Area Fair Market Rents (SAFMRs) for ZIP Codes within metropolitan areas. SAFMRs are designed to enable HCVP tenants to access more units in neighborhoods of opportunity, because they more accurately reflect the cost of rental housing in these areas. At the same time, and for the same reason, SAFMRs will discourage HCVP tenants from locating in neighborhoods of concentrated poverty.

An SAFMR is calculated by first dividing the median gross rent across all unit sizes for the small area (ZIP Code) by the median gross rent for the whole metropolitan area. This rent ratio is then multiplied by the current two-bedroom 40th percentile rent for the entire metropolitan area containing the small area to generate the current year's two-bedroom SAFMR. In small areas where the median gross rent is not statistically reliable, because the rental sample is too small, HUD substitutes the median gross rent for the county containing the ZIP Code in the numerator of the rent ratio calculation. The methodology used to determine the two-bedroom 40th percentile rent for the entire metropolitan area is identical to the methods used previously to calculate metropolitan FMRs. For fiscal year 2013 SAFMRs, the rent ratio calculation is based on 2006 through 2010 5-year ZIP Code Tabulation Area median gross rent data in the numerator and 2006 through 2010 5-year median gross rents for metropolitan areas, as defined by the Office of Management and Budget, in the denominator.

SAFMRs represent a fundamentally different way of operating the HCVP in metropolitan areas; therefore, HUD is testing SAFMRs through a demonstration program to better understand the programmatic effects. The purpose of the SAFMR Demonstration is twofold: (1) to evaluate the effectiveness of the SAFMR in improving tenants' housing choices in areas of opportunity and the effect on tenants in areas with SAFMRs that are less than the metropolitan FMR, and (2) to understand and evaluate the administrative and budget effects of converting to operating the HCVP using SAFMRs.

Rather than the SAFMR Demonstration being fully voluntary, public housing authorities (PHAs) were selected at random from a pool of eligible PHAs to be invited to participate. PHAs were offered a lump-sum increase in administrative fees, which varied by the number of vouchers administered by the PHA to a maximum of $300,000 for the largest PHAs, if they accepted the invitation. Selecting participating PHAs at random, but still providing invitees with an opportunity to decline the invitation, afforded HUD the ability to ensure that differences observed in SAFMR agencies are because of the Demonstration rather than preexisting (often unmeasured) characteristics of the agency or the local housing market. PHAs eligible for the Demonstration (1) had at least 500 HCVP tenants as of September 30, 2011; (2) had at least 10 HCVP tenants living in ZIP Codes where the SAFMR exceeded the metropolitan FMR by more than 10 percent; (3) had at least 10 HCVP tenants living in ZIP Codes where the SAFMR was more than 10 percent less than the metropolitan FMR; (4) had attained at least 95 percent HCVP-family reporting in the Office of Public and Indian Housing (PIH) Information Center (PIC); (5) were not *troubled*, as determined by the Section 8 Management Assessment Program; (6) had the administrative capacity to carry out the program, as determined by PIH's Office of Field Operations; and (7) had not been involved in litigation that would seriously impede their ability to administer the HCVP.

Invited PHAs (and alternates) were randomly selected from stratified sets of eligible PHAs. The eligible PHAs were clustered according to (1) HCVP program size, (2) metropolitan FMR, and (3) percentage of working-age heads of household. One PHA from each cluster was presented with the participation agreement, including an offer of supplemental administrative fees to cover the necessary expenses they would likely incur, and given the option to decline to participate. These fees are only to be used for administrative expenses related to the implementation of SAFMRs, not for Housing Assistance Payments. If a PHA declined to participate, an offer was presented to the next alternate until the full slate of Demonstration PHAs was established.

All PHAs that agreed to participate in the Demonstration will operate under SAFMRs for the period from October 1, 2012, through September 30, 2016. Several years of data are needed to examine the effect of SAFMRs because of several tenant protections in the HCVP. For instance, those tenants living in small areas in which the SAFMR is less than the metropolitan FMR who do not move will not experience any reduction in payment standards until their second annual recertification, which means that the entire universe of tenants will not be affected by SAFMRs until September 30, 2014. All new program entrants will immediately use SAFMRs, however, as will any existing tenants who decide to move. In addition, tenants who currently reside in a small area in which the SAFMR is greater than the metropolitan FMR who also rent a unit with a gross rent of more than their current payment standard will see their payment standards increase at their first annual recertification.

The following PHAs will participate in the SAFMR Demonstration.

1. The Chattanooga (Tennessee) Housing Authority.
2. The Housing Authority of the City of Laredo (Texas).
3. The Housing Authority of the City of Long Beach (California).
4. The Housing Authority of the County of Cook (Illinois).
5. The Town of Mamaroneck (New York) Public Housing Agency.

HUD expects to find that SAFMRs will provide HCVP tenants with greater ability to move into opportunity areas—where jobs, transportation, and educational opportunities exist—and prevent undue subsidy in lower rent areas. SAFMRs will alter some administrative responsibilities of PHAs that administer the HCVP, but it is unclear what the net effect will be. For example, SAFMRs are likely to reduce the time needed to determine whether rents are reasonable, because local area baseline rents will largely be embedded in the SAFMR, reducing the need for comparative data. SAFMRs will also increase the number of payment standards used in a metropolitan area, which may increase the time spent administering the program. The Demonstration will help HUD determine if SAFMRs should be implemented nationwide.

The evaluation will collect information from Demonstration PHAs on the additional administrative burdens imposed by the program and on any benefits from increased tenant success rates or other savings that the program may offer. This project will also look at tenant data to determine the extent to which tenants are using the expanded set of payment standards to move into opportunity areas.

HUD analysts using data from HUD's administrative systems, principally PIC historic extracts maintained by PD&R, will perform the primary evaluation studies of the SAFMR Demonstration.

The evaluation will seek to answer the following questions.

1. Are SAFMRs more difficult to administer than metropolitan FMRs?
2. Do SAFMRs incent tenants to move to different neighborhoods more than metropolitan FMRs do?
3. How do SAFMRs affect assistance program costs compared with metropolitan FMRs?

Researchers may have other questions than those listed, which may or may not be possible to answer with administrative data, and we encourage them to contact us with suggestions.

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SpAM

SpAM (Spatial Analysis and Methods) presents short articles on the use of spatial statistical techniques for housing or urban development research. Through this department of Cityscape*, the Office of Policy Development and Research introduces readers to the use of emerging spatial data analysis methods or techniques for measuring geographic relationships in research data. Researchers increasingly use these new techniques to enhance their understanding of urban patterns but often do not have access to short demonstration articles for applied guidance. If you have an idea for an article of no more than 3,000 words presenting an applied spatial data analysis method or technique, please send a one-paragraph abstract to ronald.e.wilson@hud.gov for review.*

Modeling Population Settlement Patterns Using a Density Function Approach: New Orleans Before and After Hurricane Katrina

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Introduction

Before Hurricane Katrina, New Orleans had an estimated population of 454,863. More than 400,000 residents were displaced by the hurricane (Geaghan, 2011). After several years of recovery, the 2010 census reported a population of 343,829, that is, a decline of nearly 25 percent. The population change provides a glimpse of the effect Hurricane Katrina had in terms of population loss and its potential for reshaping the urban structure of the metropolitan area. Using 2000 and 2010 tract-level data from the U.S. Census Bureau, we model changes of population settlement patterns in New Orleans before and after Hurricane Katrina with a density function approach to determine if New Orleans has become a more polycentric city.

Population Density Models

Two models are used for city structures. The first model is *monocentric* (Mills, 1972; Muth, 1969), in which a city has only one primary economic activity center, the central business district (CBD). The monocentric model assumes the population distribution is affected in such a way that settlement patterns symmetrically radiate outward from the city center, decreasing in density the further away from the CBD. The second model is *polycentric* (Berry and Kim, 1993; Ladd and Wheaton, 1991), in which cities have several smaller secondary economic activity centers, or subcenters, along with a CBD. With polycentric models the population distributions are affected with settlement patterns concentrating around multiple subcenters and the CBD. The population decreases in density away from each subcenter, sometimes converging between them (Small and Song, 1994). The underlying assumption of both models is that people value proximal access to economic activity centers to reduce commuting and transportation costs to workplace, shopping, and service activities.

Density functions are commonly used to examine the validity of these two models and measure residential settlement density patterns over time. Changes in the intercept and gradient across time from a monocentric model can indicate whether areas close to the CBD have lost population and whether areas toward the edge of the region have gained population; that is, suburbanization. On the other hand, the polycentric model can identify which centers exert influence on citywide population density patterns and whether the influences of one subcenter have weakened or strengthened over time. We analyze both models to detect changes in settlement patterns to determine if Hurricane Katrina had an effect on the urban structure of New Orleans.

Data Sources

We use two primary sources of data in this analysis. First, we use census demographic data (by residence) for 2000 and 2010 to analyze population changes at the tract level.[1] Tract centroids were weighted on population data at the census block level to better represent a tract's actual center of population. We converted the population data in the 2010 census tracts (source layer) to 2000 tract boundaries (destination layer) by spatial interpolation because several census tracts had different configurations in 2000 and 2010.

Second, we used the Census Transportation Planning Package (CTPP) Urban Element Part 2 data (by workplace)[2] for defining employment. Employment centers were identified solely from the 2000 data, because the 2010 CTPP data were not yet available. To determine the validity of using only 2000 data to represent 2010 employment patterns we conducted fieldwork and used another employment data source. Fieldwork indicated that no significant new employment centers emerged in 2010. Our fieldwork was then verified using the 2010 Longitudinal Employer-Household Dynamics (LEHD)[3] data.

[1] http://www.census.gov/geo/www/tiger/.

[2] http://www.transtats.bts.gov/tables.asp?DB_ID=630.

[3] http://lehd.did.census.gov/.

We used only the urbanized parishes[4] in our analysis to represent the New Orleans Metropolitan Area, which consisted of Orleans, Jefferson, and St. Bernard.[5] Exhibit 1 shows the population data by parish. All three parishes lost population, with Orleans and St. Bernard Parishes losing substantial amounts, an indication of Hurricane Katrina's effect.

We mapped the 2000 and 2010 population densities separately to examine the differences in geographic distributions. Exhibits 2 and 3 show that census tracts away from the CBD became more scattered in population densities in 2010, with several tracts consolidating around the CBD.

Exhibit 1

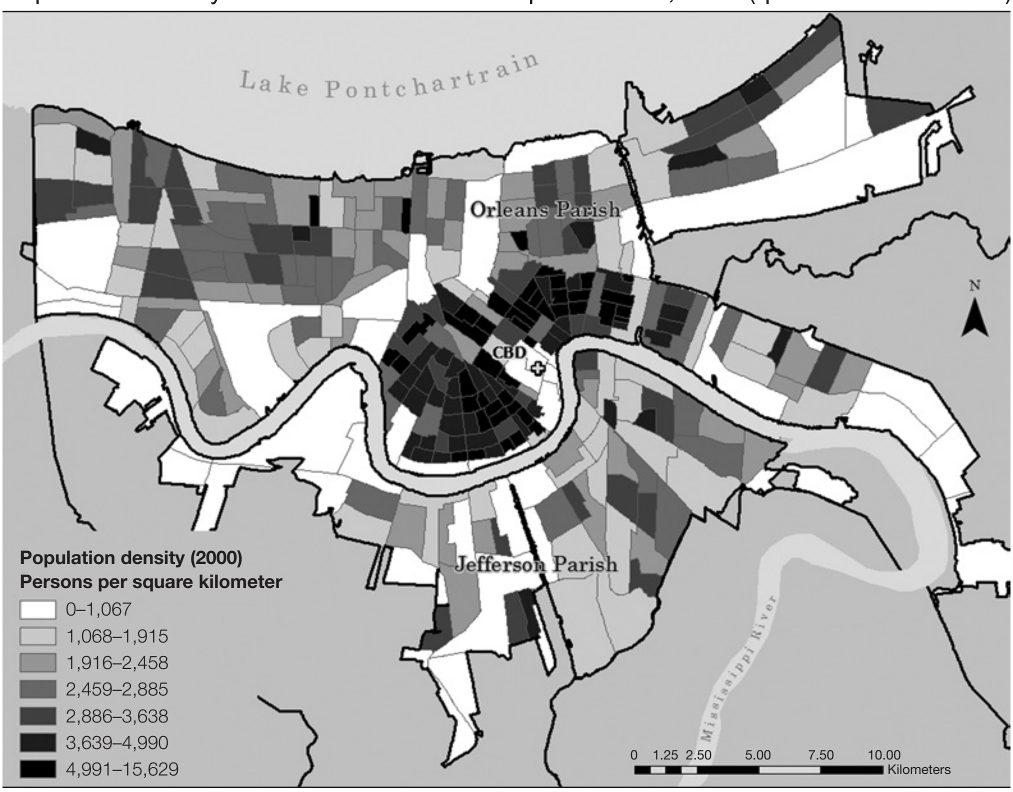
Population Change by Urban Parish in New Orleans, 2000 Through 2010

	Orleans	Jefferson	St. Bernard	Total
2000 population	484,674	455,466	67,229	1,009,369
2010 population	343,829	432,552	35,897	814,288
Percent change	– 29.1%	– 5.0%	– 46.6%	– 19.3%

Note: N = 200 census tracts.

Exhibit 2

Population Density in the New Orleans Metropolitan Area, 2000 (quantile classification)



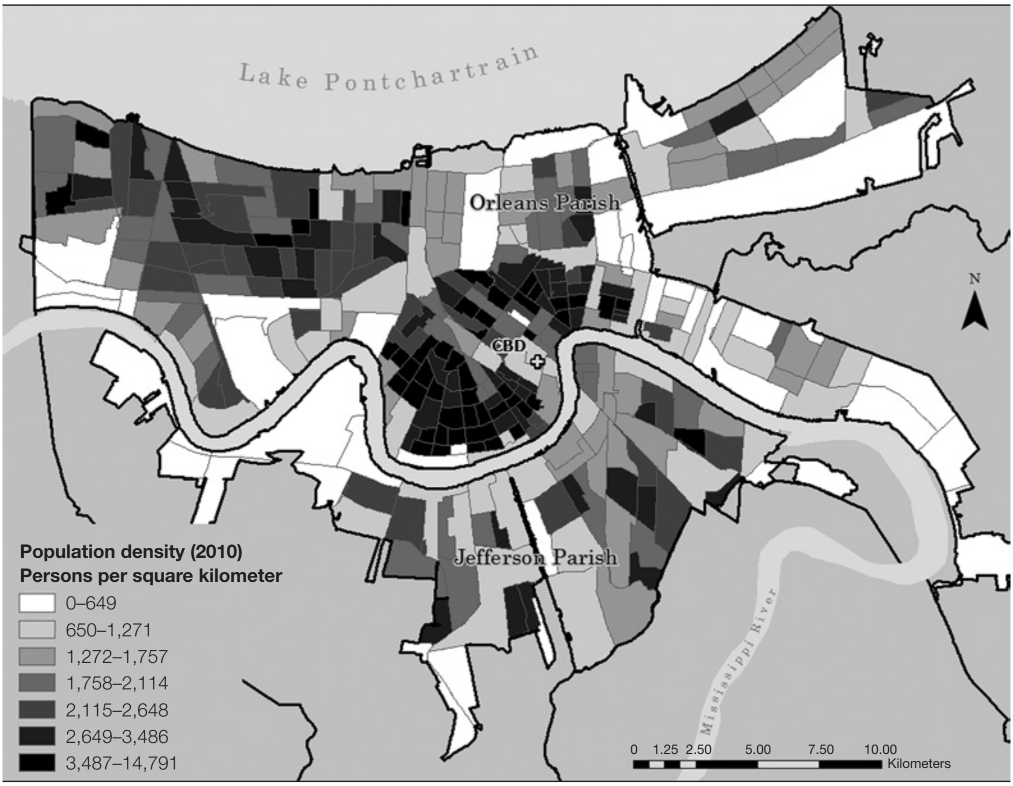
CBD = central business district.

[4] A parish in Louisiana is equivalent to a county in other U.S. states.

[5] The original spatial layers included major water and wetland areas, which were excluded to contain only the land area for subsequent area calculation and density computation.

Exhibit 3

Population Density in the New Orleans Metropolitan Area, 2010 (quantile classification)



CBD = central business district.

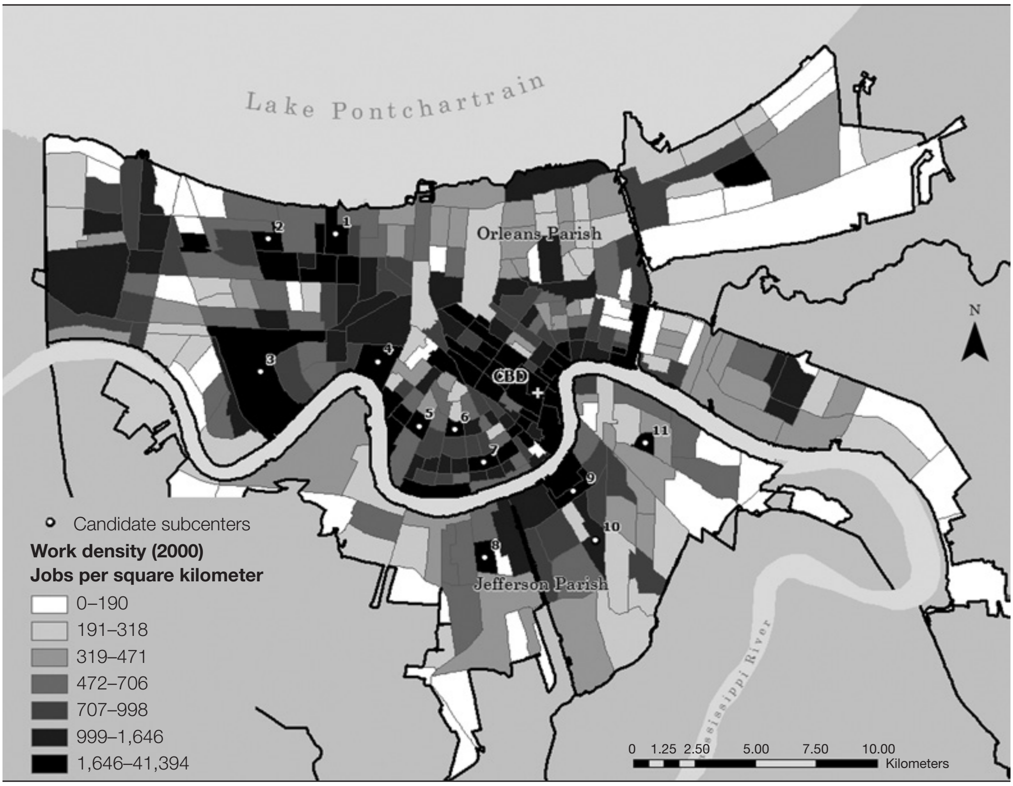
We next identified the CBD and other centers of economic activity through an analysis of employment distribution patterns with the 2000 CTPP Urban Element Part 2 data (see exhibit 4).

Exhibit 5 shows the employment density distribution from the LEHD data and confirms that our use of the 2000 data to represent economic centers in 2010 is valid.

Using a surface model in ArcGIS, we identified candidate employment centers by identifying peak density areas (exhibit 6). Candidate employment centers were indexed from 0 to 11, with 0 indicating the CBD and 1 to 11 indicating smaller subcenters.

Exhibit 4

Employment Density in the New Orleans Metropolitan Area, 2000
(quantile classification)

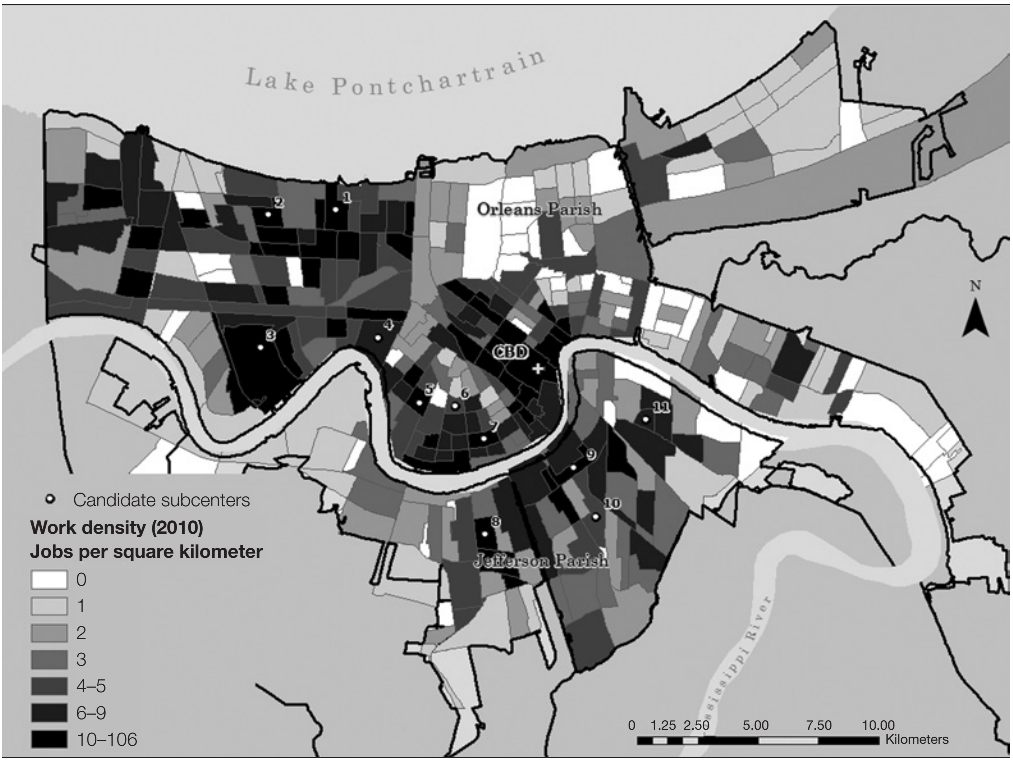


CBD = central business district.

We then ranked the 12 candidate subcenters based on estimated employment densities within 0.7-, 1.0-, and 1.5-kilometer radii from each subcenter tract. We chose an employment density threshold, with at least 10,000 jobs within 1 square kilometer qualified as a job center. Under these two criteria, four subcenters were retained as candidate subcenters (which we numbered 0, 1, 2, and 3, 0 being the CBD). Because of the low density of subcenter 2 and its proximity to subcenter 1, we eliminated this subcenter as a candidate. Subcenters 1 and 3, to the northwest and west of downtown, respectively, and the CBD (0) remained for analysis (see exhibit 6).

Exhibit 5

Employment Density in the New Orleans Metropolitan Area, 2010 (quantile classification)



CBD = central business district.

Modeling Change With the Monocentric Model

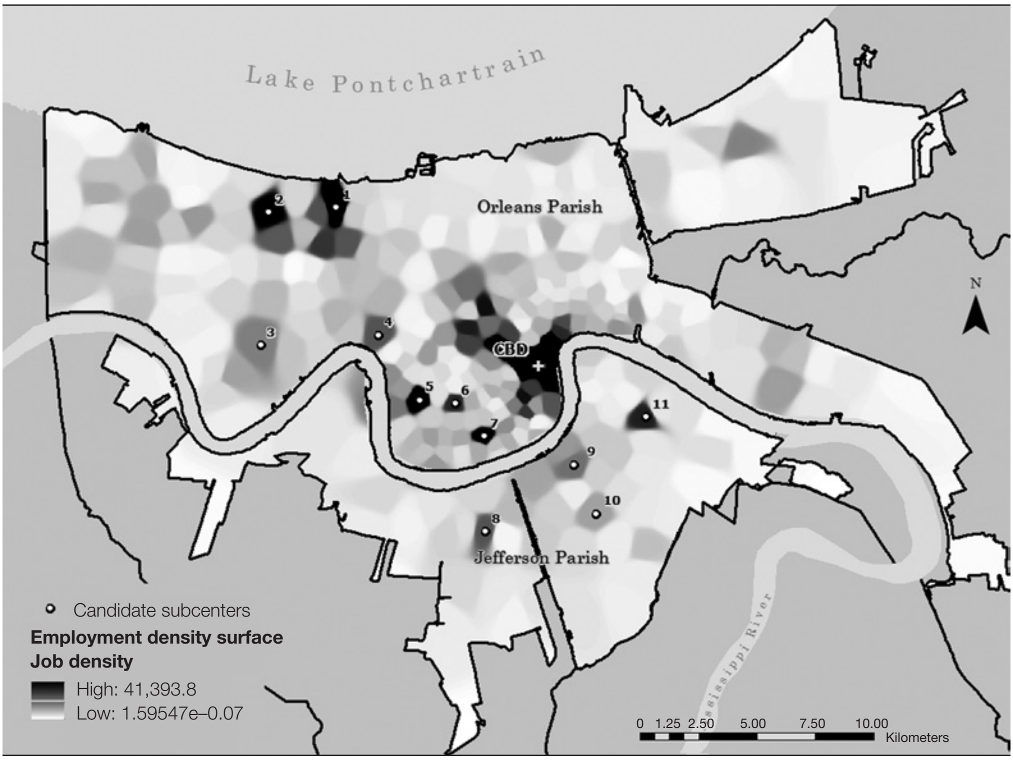
Monocentric models assume population densities symmetrically change at concentric distances away from the CBD only. We employed the four most common bivariate functions to test the relationship between population density (D_r) and distance (r) from the CBD (see exhibit 7).

For all four functions, the regression results of the monocentric model are subpar. The fitting power (R^2) for all four functions is less than 0.30 for 2000 and even less for 2010. The exponential function performed best, with the R^2 having decreased from 0.2935 in 2000 to 0.0775 in 2010. The intercept a decreased from 5,215.8 in 2000 to 2,931.2 in 2010, and the density gradient b (in absolute values) decreased from 0.109 to 0.088. Lower intercept values indicate a declining density around the CBD in New Orleans. Smaller (flatter) density gradients signify a slow (gradual) decrease of population density with increasing distance from the CBD, which reflects a general trend of population loss in the central city and growth in suburbia; that is, *suburbanization*.

The poorer fitting power by the monocentric functions is consistent with most other findings (McDonald, 1989). Nevertheless, all the models are statistically significant and the results are largely valid. The lower fitting power by the exponential function (R^2 = 0.0775) against the logarithmic function (R^2 = 0.1310) is abnormal with respect to model results for other western cities and indicates that Hurricane Katrina created a significant disturbance to the population settlement patterns of New Orleans.

Exhibit 6

Interpolated Employment Density Surface in the New Orleans Metropolitan Area, 2010



CBD = central business district.

Exhibit 7

Regression Results for Monocentric Functions in New Orleans Based on Population

Year	Model		a	b	R^2
2000	Linear:	$D_r = a + br$	4,218.40	– 149.20	0.21
	Logarithmic:	$D_r = a + b \ln(r)$	5,277.60	– 1,233.00	0.21
	Exponential:	$D_r = ae^{br}$	5,215.80	– 0.11	0.29
	Power:	$D_r = ar^b$	7,269.80	– 0.66	0.17
2010	Linear:	$D_r = a + br$	2,838.00	– 77.44	0.02
	Logarithmic:	$D_r = a + b \ln(r)$	3,531.70	– 712.80	0.13
	Exponential:	$D_r = ae^{br}$	2,931.20	– 0.09	0.08
	Power:	$D_r = ar^b$	3,887.00	– 0.55	0.04

Modeling Change With the Polycentric Model

We examined three density functions that correspond to three assumptions about polycentric population densities proposed by Heikkila et al. (1989), which are that (1) residents value access only to their nearest economic subcenter in a city made up of multiple monocentric subregions; (2) the influences of all subcenters are *complementary* to each other, and access to each center is needed (McDonald and Prather, 1994); and (3) the density of any tract is the result of the effect that cumulative distance decay from each subcenter has on that tract. We used a series of regression models to test each assumption.

To test the first assumption, we used a monocentric density function for several subregional divisions across the metropolitan area, each containing census tracts distributed around their nearest economic center (that is, proximal area). Monocentric density functions are estimated for each subregion. The model is written as

$$InD_{r_i} = A_i + b_i r_i \ (i = 1 \ldots n), \quad (1)$$

where r_i is the distance of a tract from center i within the subregion i, D_{r_i} is the population density of that tract, n is the number of centers, and A_i and b_i are parameters to be estimated by a bivariate regression.

Exhibit 8 shows the regression results for the first assumption. In the subregion (proximal area) around the CBD, the exponential density function is statistically significant in capturing the pattern of declining population densities with distance in both 2000 and 2010, which is similar to the regionwide monocentric model reported in exhibit 7. The function, however, is not statistically significant in the two subregions around the subcenters 1 and 3 in 2000 or 2010, indicating minimal influences of these subcenters on the population density patterns.

To test the second assumption, we used a multiplicative function that models subcenters as *complementary*, implying that access to all centers is needed (McDonald and Prather, 1994). The model is written as

$$InD = A + \sum\nolimits_{i-1}^{n} b_i r_i (\mathrm{i} = 1 \ldots \mathrm{n}), \quad (2)$$

Exhibit 8

Regression Results for Polycentric Model, Assumption 1

Center i	2000 Sample	2000 A_i	2000 b_i	2000 R^2	2010 Sample	2010 A_i	2010 b_i	2010 R^2
	$InD_{r_i} = A_i + b_i r_i$ for Center i's Proximal Area							
0 (CBD)	223	8.6118 (– 74.96)***	– 0.1375 (– 8.79)***	0.259	216	8.0647 (– 60.44)***	– 0.1051 (– 6.00)***	0.144
1	44	7.8476 (– 69.96)***	– 0.0077 (– 0.32)	0.0024	46	7.8411 (– 23.57)***	– 0.0808 (– 1.13)	0.0282
3	51	7.4986 (– 28.61)***	– 0.0318 (– 0.68)	0.0093	52	7.3234 (18.73)	– 0.0478 (– 0.69)	0.0096

CBD = central business district.
****Significant at 0.001. t values in parentheses.*

where r_i is the distance of a tract from center *i* within the whole study area, *D* is the population density of that tract, and *A* and b_i $(i = 1, 2 \ldots)$ are parameters to be estimated by a multivariate regression.

Exhibit 9 shows the regression results for the second assumption. The model in 2000 indicates that the population densities decline significantly at increasing distances from the CBD and from subcenter 1 across the whole study area. Densities, however, tend to increase with distance from subcenter 3 in 2000 but not as significantly as the decline from subcenter 1 and the CBD. The positive density gradient from subcenter 3 in 2000 is counterintuitive and raises suspicion of the validity of this assumption. In 2010, the model suggests that only the distance decay in population density is significant with distance from the CBD, and neither subcenter seems to influence the areawide density pattern.

Exhibit 9

Regression Results for Polycentric Model, Assumption 2

$lnD = A + \sum_{i-1}^{n} b_i r_i$ for the Whole Study Area				
Center *i*	**2000**		**2010**	
	b_i		b_i	
0 (CBD)	– 0. 06422 (– 6.39)***	A = 8.75485 *** (65.25) R^2 = 0.23 Sample size = 318	– 0.04563 (– 3.60)***	A = 8.31883 *** (49.36) R^2 = 0.11 Sample size = 314
1	– 0.09011 (-4.67)***		– 0.03030 (– 1.23)	
3	0.03942 (2.26)*		– 0.02092 (– 0.95)	

CBD = central business district.
****significant at 0.001. **significant at 0.01. *significant at 0.05. t values in parentheses.*

To test the third assumption, we used an *additive* distance decay function from each center. The model is written as

$$D = \sum_{i-1}^{n} (a_i e^{b_i r_i}) \ (\mathrm{i} = 1 \ldots \mathrm{n}), \qquad (3)$$

where r_i is the distance of a tract from center *i* within the whole study area, *D* is the population density of that tract, and a_i is a constant specific to center *i*. The function is estimated by a nonlinear multivariate regression.

Exhibit 10 shows the regression results from the third assumption, which most researchers consider reasonable. The model indicates that both the CBD and subcenter 1 are significant in influencing a declining density pattern in 2000, but only the CBD is significant in 2010. These results suggest that New Orleans regressed from a dual-centric structure in 2000 to a monocentric form in 2010, as indicated in the comparison of exhibits 2 and 3, thus reflecting the major effect of Hurricane Katrina on the population settlement patterns in New Orleans.

Exhibit 10

Regression Results for Polycentric Model, Assumption 3

Center i	$D = \sum_{i-1}^{n} a_i e^{b_i r_i}$ for the Whole Study Area			
	2000		2010	
	a_i	b_i	a_i	b_i
0 (CBD)	3,981.44 (8.09)***	– 0.1572 (– 3.00)**	2,451.2 (5.53)***	– 0.2111 (– 2.57)*
1	2,518.57 (3.70)***	– 0.0432 (– 2.61)**	– 883.59 (– 0.10)	0.0087 (0.10)
3	– 1,828.16 (– 1.15)	– 0.5262 (– 0.98)	3,185.91 – 0.37	– 0.0209 (– 0.29)
R^2	0.36		0.25	

CBD = central business district.
****significant at 0.001. **significant at 0.01. *significant at 0.05. t values in parentheses.*

Conclusion

In this research, we measured the spatial distribution of population density changes in the New Orleans Metropolitan Area from 2000 to 2010 to examine the effect of Hurricane Katrina in 2005. This analytical approach enabled a spatial examination of the effect a natural disaster had on the region and its postdisaster recovery. The regressions based on the monocentric model indicated a general trend of population loss in the central city and growth in suburbia, attributable to a combination of suburbanization that began before Hurricane Katrina and the uneven recovery afterwards. The regression results from the polycentric model indicated that the CBD had significant influence on the citywide population density pattern in both 2000 and 2010, but one subcenter declined in influence from 2000 to 2010. The results show that New Orleans has regressed from a polycentric (two-center) structure in 2000 to a more monocentric structure in 2010, which is contrary to many other North America cities. This finding signifies a major effect on city structure by Hurricane Katrina.

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