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Contents

Cityscape
Volume 9, Number 3 • 2007

Cityscape | A Journal of Policy Development and Research
Volume 9, Number 3 • 2007

Cityscape
A Journal of Policy Development and Research

Planning for Catastrophe
Volume 9, Number 3 • 2007

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PD&R

Cityscape

A Journal of Policy Development and Research

PLANNING FOR CATASTROPHE
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The goal of *Cityscape* is to bring high-quality original research on housing and community development issues to scholars, government officials, and practitioners. *Cityscape* is open to all relevant disciplines, including architecture, consumer research, demography, economics, engineering, ethnography, finance, geography, law, planning, political science, public policy, regional science, sociology, statistics, and urban studies.

Cityscape is published three times a year by the Office of Policy Development and Research (PD&R) of the U.S. Department of Housing and Urban Development. It is available at no charge in hard copy and on line at http://www.huduser.org/periodicals/cityscape.html.

PD&R welcomes submissions to the Refereed Papers section of the journal. Our referee process is double blind and timely, and our referees are highly qualified. The managing editor will also respond to authors who submit outlines of proposed papers regarding the suitability of those proposals for inclusion in *Cityscape*. Send manuscripts or outlines to Cityscape@hud.gov.

Opinions expressed in the articles are those of the authors and do not necessarily reflect the views and policies of HUD or the U.S. government.

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Contents

Publisher's Announcement

With this issue of *Cityscape*, the Office of Policy Development and Research (PD&R) of the Department of Housing and Urban Development fully inaugurates its new publishing format.

In its 14 years, *Cityscape* has brought numerous valuable contributions to the attention of policymakers, researchers, and practitioners. Its varied audience and its openness to findings from many disciplines have made it a forum of choice for many authors on housing and urban policy, both distinguished researchers with past achievements and investigators still making names for themselves.

But we can do more, and we can do better. We want to reach our readers more often, with the highest quality material that we can make available for a multidisciplinary audience. In pursuit of those goals, we have initiated the following changes:

1. I have appointed a distinguished Advisory Board. The board members, whose names appear on the inside front cover, can attest that we have adopted many of their suggestions.
2. We commit to publishing three issues a year. This issue is the third of calendar year 2007. We anticipate that the increased frequency and regularity of publication will lead to greater recognition for the authors of these pages.
3. We no longer will devote an entire issue to a single theme. Instead, we will offer a Symposium, a set of papers on a common theme. We will add a new section, Refereed Papers, which may analyze a wide variety of topics. We will also add two new smaller features to a Departments section, Policy Brief and Data Shop.
4. Our guest editor or editors will be responsible for the intellectual coherence and integrity of each Symposium.
5. Our managing editor, Mark Shroder, will seek expert opinions to judge submissions for the Refereed Papers.
6. In each issue, a Policy Brief, usually from the PD&R staff, will point researchers to an area in which national policy has undergone relatively recent change and in which the consequences of change deserve the attention of scholars.
7. In each issue, an entry in the Data Shop, edited by David Vandenbroucke, will lay out the technical means by which social scientists can systematically construct variables from data available for public use to test a wide range of hypotheses.

I hope these changes in the frequency and flexibility of the journal will contribute to the vitality of national conversations on public policy. Share your thoughts with us by e-mail to Cityscape@hud.gov.

Darlene F. Williams
Assistant Secretary for Policy Development and Research
U.S. Department of Housing and Urban Development

Guest Editor's Introduction

Dana Bres
U.S. Department of Housing and Urban Development

This issue of *Cityscape* focuses on the challenges facing communities in planning for and responding to disasters. The stark examples of the aftermath of the 2005 hurricanes in the Gulf of Mexico represent the planning challenges New Orleans and other gulf coast communities face following a disaster. Any community faces the same problems and challenges in similar circumstances; only the magnitude of these challenges changes from disaster to disaster.

The purpose of this issue of *Cityscape* is not to perform a postmortem on activities following the 2005 hurricanes in the Gulf of Mexico; the goal is to highlight opportunities planners can use to proactively position their communities for increased disaster resiliency. The theme of the articles in this issue is not how to prevent disaster from happening (which probably is impossible from an engineering or budgetary standpoint) but to illustrate actions that can help minimize the effects of disaster on a community. Planning and preparation can strengthen a community's predisaster environment as well as its response during rescue and recovery.

In the article, "Reconstruction of New Orleans after Hurricane Katrina: A research perspective," authors R.W. Kates, C.E. Colten, S. Laska, and S.P. Leatherman present a sobering perspective on the New Orleans area recovery timeline. This article is unusual for *Cityscape*; it is a courtesy reprint from the *Proceedings of the National Academy of Sciences*. In this article, Kates et al. reveal a disturbing reality—recovery from a disaster takes significantly longer than anyone would anticipate. Kates et al. offer insight on time estimates for identified recovery phases, based on analyses of numerous disasters. This article highlights the reality planners face—community recovery efforts will likely last well beyond the span of their careers.

The focus of the Symposium in this issue of *Cityscape* is how to build and sustain a long-range planning view. At times, planning efforts seem ephemeral and community momentum may be lost while revisiting and revising plans. Planners and policymakers who spend money for preparedness need to cost-effectively integrate those efforts through relationships that allow open dialogue between communities and all planners. A well-developed plan can position communities to accelerate some recovery aspects through rapid, critical decisionmaking. For example, a rundown shopping center previously identified as needing redevelopment into something of greater value to the community could be successfully expedited on a new, disaster-adjusted schedule.

In the article, "Planning, Plans, and People: Integrating Professional Expertise, Local Knowledge, and Governmental Action in Post-Katrina New Orleans," authors Marla Nelson, Renia Ehrenfeucht, and Shirley Laska offer insight into the planning processes in New Orleans. Their poignant

insights as being simultaneously victims and faculty at the University of New Orleans provide a rare viewpoint not readily apparent to other observers. Nelson describes the complex planning process made more difficult and complex by the competing visions for the future of New Orleans. Anyone who has played the integrating role of a community planner can attest to the difficulty of the process—not the least of which was that in the scope of the planning effort, teams grew and reached out to incorporate technical or other experts who might not normally have been involved. Nongovernmental organizations representing local or national groups or interests and an increasing number of citizens also joined the effort.

In the article, "Hurricane Katrina: Environmental Hazards in the Disaster Area," author Danny Reible presents a different viewpoint of the environmental threats in New Orleans following Hurricane Katrina. He assesses the resulting so-called "toxic soup." His analysis and discussion show the importance of planning and preparation to prevent diversion of critical resources from actual threats. He elucidates on how the perception of the toxicity of the flood waters in New Orleans may have prevented some residents from evacuating, deterred some citizens from helping with the rescue efforts, and discouraged government officials from allocating scarce resources.

Technical Notes

In addition to the content of this issue, several technical notes are provided on the HUD USER website (http://www.huduser.org) that are relevant to the discussion. They include a discussion of the model building codes, the origin of the federal disaster planning and response process, and a brief update on the Alternative Housing Pilot Program (AHPP) and the Joint Housing Solutions Group (JHSG).

Mark Dineen from the International Code Council provides background on model building codes in the United States. Effective building codes and code enforcement can be tools to help communities build resilience. The Office of Policy Development and Research (PD&R) has sponsored development of new code provisions for innovative construction materials that make homes stronger and more affordable. Inclusion of such provisions in the building code makes it easier for designers, builders, and code officials to introduce home innovations. This technical note is posted at http://www.huduser.org/periodicals/cityscape/technotes/building_codes.pdf.

In the note, "Evolution of the National System for Emergency Management," authors Bob and Kim Fletcher provide insight for planners on the local-state-federal relationship in disaster response. Their article reflects their more than 35 years of involvement in federal emergency management activities. Bob Fletcher was one of the primary authors of the Federal Response Plan (FRP), the precursor to today's Federal Emergency Management Agency (FEMA) National Response Plan (NRP). Kim Fletcher was also a major contributor to the FRP. The FRP marked the end of the tradition in which agencies developed unique plans for specific hazards and instead moved to an all-hazard response plan, a concept derived from the conclusion that communities experiencing an emergency typically have the same needs regardless of the triggering event. The NRP, a follow-on to the FRP, continues the basic structure. It identifies a series of 15 functional elements called emergency support functions (ESFs) that are assigned to specific organizations with similar missions in their day-to-day operations. ESFs span the spectrum of potential needs—including mass

care, housing and human services, public works and engineering, and public health and medical services. This technical note is posted at http://www.huduser.org/periodicals/cityscape/technotes/FEMA_planning.pdf.

Two notes address FEMA's Alternative Housing Pilot Program and Joint Housing Solutions Group. The AHPP is a $400 million housing production program funded by FEMA to demonstrate alternatives to disaster housing. HUD will be evaluating the AHPP products and processes. The JHSG is a FEMA initiative to examine housing products that could provide emergency housing to disaster victims. Both efforts are relevant to affected communities and HUD because they are targeted at making disaster housing more useful, available, and effective. PD&R is working closely with FEMA on both these efforts. These technical notes are posted at http://www.huduser.org/periodicals/cityscape/technotes/AHPP.pdf and http://www.huduser.org/periodicals/cityscape/technotes/JHSG.pdf.

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Reconstruction of New Orleans after Hurricane Katrina: A research perspective

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Edited by William C. Clark, Harvard University, Cambridge, MA, and approved August 29, 2006 (received for review July 18, 2006)

Four propositions drawn from 60 years of natural hazard and reconstruction research provide a comparative and historical perspective on the reconstruction of New Orleans after Hurricane Katrina. Decisions taken over its 288-year history that have made New Orleans so vulnerable to Katrina reflect a long-term pattern of societal response to hazard events—reducing consequences to relatively frequent events, and increasing vulnerability to very large and rare events. Thus Katrina's consequences for New Orleans were truly catastrophic—accounting for most of the estimated 1,570 deaths of Louisiana residents and $40–50 billion in monetary losses. A comparative sequence and timing of recovery provides a calendar of historical experience against which to gauge progress in reconstruction. Using this calendar, the emergency postdisaster period appears to be longer in duration than that of any other studied disaster. The restoration period, the time taken to restore urban services for the smaller population, is in keeping with or ahead of historical experience. The effort to reconstruct the physical environment and urban infrastructure is likely to take 8–11 years. Conflicting policy goals for reconstruction of rapid recovery, safety, betterment, and equity are already evident. Actions taken demonstrate the rush to rebuild the familiar in contrast to planning efforts that emphasize betterment. Because disasters tend to accelerate existing economic, social, and political trends, the large losses in housing, population, and employment after Katrina are likely to persist and, at best, only partly recover. However, the possibility of breaking free of this gloomy trajectory is feasible and has some historical precedent.

Four propositions drawn from 60 years of research on natural hazards (1–5) and reconstruction after disasters (6) and 288 years of environmental history (7) provide perspective on the vulnerability of the city (parish) of New Orleans to Hurricane Katrina and its prospects for reconstruction. The first addresses the paradox of the human ability to reduce over time the consequences of hazards while increasing their catastrophic potential. The second describes the sequence and timing of reconstruction phases found in a number of long-term studies of reconstruction. The third considers the conflicting goals and behaviors for reconstruction that arise in recovery efforts after disaster. The fourth proposition examines how disasters accelerate preexisting demographic, economic, social, and political trends and lead to very different trajectories of recovery.

Reduction in Consequences, Increase in Catastrophic Potential

Over the long term, societies reduce consequences to relatively frequent hazard events (e.g., return periods of >100 years or less) through improved technology and social organization. However, the reduction in risk to relatively frequent events may increase vulnerability to major hazard events (e.g., return periods of >100 years) resulting in catastrophes characterized by large loss of life or property, major population loss, and out-migration, and even societal collapse. First noted in 1979 in the context of climate fluctuations (8), the reduction of mortality over time, as in death rates and, in some cases, in aggregate deaths, has been found in longitudinal case studies, including drought in the United States and Africa (8), tropical cyclones in Bangladesh (2), and floods and hurricanes in the United States (2, 4). A reduction in property damage is less clear because aggregate property damages have risen along with increases in the population, material wealth, and development in hazardous areas (9). At the same time, the individual losses for hazard victims have been reduced as the larger society absorbs a portion of their losses through disaster relief and insurance (2–4).

Catastrophes from rare events can be attributed to the sheer magnitude of such events. Thus, the linkage between reducing consequences to relatively frequent events and increasing catastrophic potential needs to specify the mechanisms involved. For example, the successful prevention or rapid suppression of forest fires leads to a buildup of combustible material that increases the catastrophic potential of fires that escape rapid suppression (10, 11). Most relevant to New Orleans is the so-called "levee effect," in which construction of levees induces additional development leading to much larger losses when the levee is eventually overtopped (12). A more general statement of this proposition is found in the safe development paradox in which increased safety induces increased development leading to increased losses (13). It is this perspective that helps explain the vulnerability of New Orleans to Katrina.

New Orleans Flood and Hurricane History Before Katrina. For three centuries, New Orleans sought to lessen the impacts of its recurrent floods and hurricanes by providing marginal increases in safety. However, in doing so, they laid the groundwork for the next catastrophic failure. In its 288-year history, New Orleans has had 27 major river or hurricane-induced disasters at a rate of one about every 11 years (14, 15). A pattern of three responses runs through that history. After each event, the city rebuilt and often expanded, small differences in elevation determined the location of the well-to-do and the poor, and levees were rebuilt and often raised. River floods in the years after the city's founding in 1718 did not deter its French founders from pressing forward with

building the colony's capital at this strategic location, nor were they deterred in 1722 and 1723 when hurricanes destroyed the incipient city. Inequity in the location of neighborhoods and in the distribution of flooding burdens also appears early. When levees failed in 1816 and again in 1849, high water drove many of the city's poor, found in the lowest locations, from their homes for up to a month (16, 17).

The response to riverine and hurricane-induced floods in the Louisiana colony was to build levees. By 1728, it was mandatory for all land owners to do so along their riparian frontage. Later, levee heights were increased to 1 foot higher than the last high-water stage. Even as responsibility for levee construction gradually shifted from land owners, to the state, and ultimately to the federal government, designed protection was based on the last storm. Each increase in storm severity thus led to a succession of catastrophic failures. This has continued to this day with the exception of 1927 when the great Mississippi flood threatened New Orleans. State and federal authorities responded by dynamiting a breach in the levee that flooded St. Bernard Parish down-river to the detriment of its residents (18). Further improvement of the levees, aided by two major floodways that divert high waters, has appeared to make the city safer from river floods but not from hurricanes. In a political culture that often rewarded development and patronage at the expense of safety and efficiency, completion of an effective hurricane protection system suffered from misplaced priorities (19).

Exemplifying the safe development paradox, improved drainage techniques enabled expanded development behind the levees. In the 20th century, the city expanded in two major movements off the natural levee, across the Metairie Ridge toward the vulnerable wetlands near Lake Pontchartrain (Fig. 1). In the first period (1900–1950), early suburbs developed assisted by a municipal drainage system that helped dry out the mucky soils north of the city. These areas felt the impact of a severe hurricane in 1915 that damaged some 25,000 buildings. A local levee district was created in 1930 to enable residential development. The state collaborated in the effort to fill in the lakeside from the natural beach and build a massive 9-foot concrete seawall that in turn further encouraged the city's lakeward expansion. In general, the poor remained in the city and often occupied low areas vacated by those leaving for the newer suburbs. In 1947, hurricane storm surge and waves overtopped lakefront levees and produced severe impacts to these suburban neighborhoods in Orleans and Jefferson Parishes.

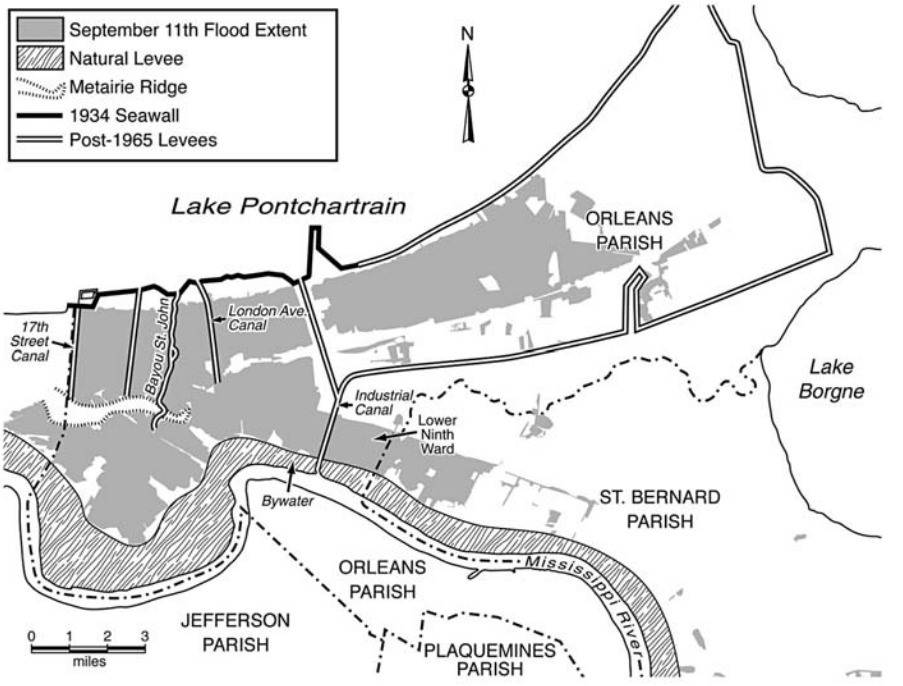
The second, post-World War II expansion (1965–2000) accommodated population growth with public housing and new baby-boomer suburbs (Fig. 1). This expansion followed the last round of levee construction and reconstruction after Hurricane Betsy (1965) when >300,000 residents were displaced and 27,000 houses destroyed (14). The improved and much expanded levee system led to a doubling of the protected area. Expected benefits from new development within that protected area were used to justify the project (7, 13). New massive drainage systems accompanied the levees. When a spate of intense rainstorms exposed the inadequacies of the pumps and canals in the late 20th century, the U.S. Army Corps of Engineers participated in a major overhaul of these elements of the system to protect the development that crowded within the levees.

As in previous episodes of urban expansion, those with means moved to new suburbs, and the poor remained within the core city, generally in the low-lying locations (7, 19, 20). Conflicts between local and federal authorities over the final form of the hurricane protection system greatly

delayed its completion and exposed everyone to heightened risk. Thus, this most recent round of levee construction and its consequences would lead to America's greatest natural hazard catastrophe.

Fig. 1.

Levee construction, subsequent development, and Katrina flood area in New Orleans, 1900–2005.



The Catastrophe of Katrina. In keeping with other disasters, this long history of marginal increases in safety that encouraged new development made New Orleans a catastrophe waiting to happen. Its estimated pre-Katrina population of 437,186 (21) lived in a bowl, half located below sea level, between the natural levees of the Mississippi River and the built levees (pierced by canals) along Lake Pontchartrain. In the 4 years preceding Katrina, there were extensive and repeated warnings from both scientists and the media that the "big one" would eventually hit the city. These included specific concerns for the evacuation of an estimated 130,000 residents without vehicles, homebound, or in hospitals and in-care facilities (22–25).

Beginning on the morning of August 29th, 2005, Katrina brought severe but not catastrophic winds, record rainfalls (up to 14 inches in 24 h), and stormwater damage as the city's pumping system failed to keep up with the rain. Then, within hours of the initial impact, major floodwalls along the 17th Street Canal, London Avenue Canal, and Inner Harbor Navigation Canal (Industrial Canal) failed, allowing water to surge into ≈80% of the city and essentially fill the bowl to depths ranging from 5 cm to 5 m (26). Days later, parts of New Orleans would be reflooded from intensive rains accompanying Hurricane Rita.

As many as a million residents in the metropolitan area may have responded to public calls for evacuation on August 27th and 28th, leaving an estimated one-quarter of New Orleans residents unable or unwilling to leave. These residents took refuge in the Superdome, the Convention Center, in hospitals and nursing homes, in upper stories of their homes, or on elevated highways, or died during the week before full poststorm evacuations could be completed. The evacuated residents traveled or were moved to other cities, and within a month, refugees from New Orleans could be found in every state. Extensive media coverage shared the failure of complete evacuation, the plight of those remaining in the city, and the subsequent outmigration with a global audience. The burden of these failures fell heaviest on the African-American, poor, aged, and infirm members of the population. Four months after Katrina, the population was estimated at 158,353, only 37% of the pre-Katrina number (21).

The full death toll is still not known, and out-of-state deaths in the month after Katrina are still being reviewed. But the estimated death toll for Louisiana is 1,570, most of which were New Orleans residents (27). As in all other disasters, where the costs of hazards are often hidden and underestimated and a consistent set of methods and databases do not exist, the true costs of Katrina in New Orleans will never be known (4, 5, 28). Limited estimates of damage to the built environment, losses to the economy, and the costs of emergency and reconstruction assistance are available, along with some observations of social and environmental consequences (29–35). Putting together these scattered data, we estimate an aggregate monetary loss of around $40–50 billion in Orleans Parish including direct property losses ($20–22 billion), still ongoing economic losses ($4–8 billion), and emergency assistance ($16–20 billion). The human and social disruption has also been extraordinary given these losses, the out-migration, the trauma of experiences, and the breakup of the community. Only the environmental losses have been somewhat less than expected as high levels of toxic materials found in the environment were primarily products of industrial development before Katrina (33).

The Timing of Reconstruction

A review of the limited set of long-term case studies of reconstruction after disasters tells us that reconstruction takes a long time. Reconstruction is part of a sequence of four identifiable postdisaster periods: emergency, restoration, reconstruction, and commemorative or betterment reconstruction. These four periods were first examined in a retrospective study of San Francisco after the earthquake and fire of 1906 (36). The emergency period is characterized by search and rescue, emergency shelter and feeding, the establishment of order, the clearing of major arteries, and the draining of floodwaters. Before this period ends, the restoration period is started, where the repairable essentials of urban life are restored. And well before this stage is over, replacement reconstruction begins to provide the infrastructure, housing, and jobs for the destroyed city and predisaster population, followed often by a commemorative or betterment reconstruction. Studies of earthquakes in Italy (37), Nicaragua (6), and the United States (6, 38), and floods in the United States (8, 39), have found that the second and third periods last approximately 10 times the interval of the previous period. The use of this sequence and time scale of reconstruction can serve two important purposes: to underscore the length of time required for reconstruction and to provide a calendar of historical experience against which to gauge progress in the four periods.

Critics rightly note that the sequence of recovery processes can be uneven, that phases can overlap, and, most importantly, that different social groups, even within the same community, can experience the sequence quite differently (5). Such differences can be partly captured by the initial length of the emergency period, which serves as an overall measure of both the magnitude of damage and the response capacity of different communities subject to the same hazard event (38). These differences can also be evaluated separately for varied groups within a community (40). For example, San Francisco was somewhat analogous to New Orleans with its 1906 population of 400,000 and its catastrophic losses (550 dead, 220,000 homeless, 55% of its housing units destroyed, and 300,000 evacuees). The 1906 emergency period lasted 4 weeks, the restoration period 40 weeks, functional reconstruction 9 years, and the commemorative reconstruction even longer (36). But even in this early study, major differences were observed in the recovery between social, economic, and ethnic groups. For example, a sample of residents selected from city directories showed that 1 year after the earthquake, 74% of unskilled workers had disappeared from the area compared with 40% of white-collar workers (40). Using this sequence and timing, how does the reconstruction of New Orleans compare with other large and rare disasters?

Eleven Months of Restoration, Eight to Eleven Years of Reconstruction

Fig. 2 shows a plot of the reconstruction experience for 1 year after Katrina and projects future reconstruction activity by using the four periods of historical experience. But applying the historical experience to New Orleans is complicated by the magnitude of the damage and failures in response, the massive forced outmigration, and the external aid available for restoration and some reconstruction.

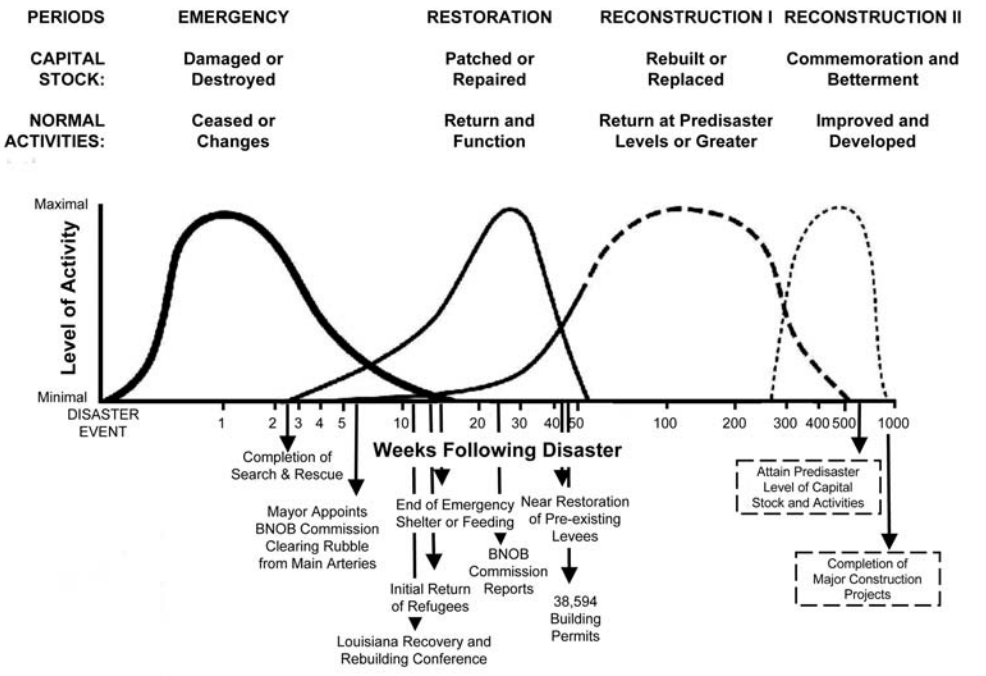
Because of the magnitude of damage and failures in response that characterized Katrina, the emergency period extended over 6 weeks. This endpoint is determined by the "dewatering" of New Orleans, defined as the point when flood waters were pumped and drained from the city. However, because of the extraordinary damage and dispersal of the population, an alternative length for the emergency period could be as long as 14 weeks, when the end of emergency shelter on December 3, 2005, is used as its conclusion.

Restoration—repairing what is repairable in the infrastructure of urban life—began in the second week. But the forced out-migration and low rate of return complicates the calculation of restoration. The result is that much repairable, but population-dependent, infrastructure has not been restored or used. Most services for which there are data available (electricity, gas, public transportation, schools, hospitals, and food stores) are functioning at less than half of pre-Katrina capacity (34).

The emergency period appears to be longer in duration than any other of the studied disasters and can be readily explained by the evident failures in the initial evacuation and response. Using the 6-week emergency period, the expected restoration period should be 60 weeks in duration based on historical experience; however, the actual restoration period is 40 weeks when the near restoration of the preexisting levee system is used as the key indicator for its conclusion. This shorter restoration period can be explained by the major commitment of funding, resources, and leadership to rebuild the levees and to overcome the clear failures of past construction. An alternative explanation might be that because failures in emergency response extended the emergency period

Fig. 2.

The sequence and timing of reconstruction after Katrina in New Orleans with actual experience (solid lines) and sample indicators for the first year along a logarithmic time line of weeks after the disaster. The long-term projections (dashed lines) are based on an emergency period of 6 weeks, a restoration period of 45 weeks, and a 10-fold historical experience for reconstruction.



2 weeks beyond what the logistics of the hazard event might have required, (e.g., 4 weeks in San Francisco), the shorter 40-week restoration period better reflects the historical scale of experience.

Ideas for reconstruction began to circulate even within the emergency period, and serious planning efforts began 10 weeks after Katrina while restoration was underway. Again, the historical experience argues for an extended period of reconstruction, between 8 and 11 years, depending on the restoration period used.

Conflicting Goals and Differential Outcomes of Reconstruction

The long history of urban experience (41) has few examples of cities failing to rebuild in some fashion. For New Orleans, the desire to overcome the failures of the emergency response and to maintain the distinctive role New Orleans plays in African-American politics, culture, and education quickly overcame early commentary that perhaps New Orleans should not be rebuilt. But cities and regions seeking to reconstruct after a disaster seem to simultaneously pursue goals to

rapidly recover the familiar and aspire to reconstruct in safer, better, and sometimes more equitable ways. Conflict arises between groups or institutions and even individuals pursuing these different goals because they cannot be given equal attention in time, resources, and values. In addition, in accomplishing one goal, another may be less achievable. For example, compare achieving both rapidity of recovery and safer reconstruction, or betterment for some segments of the population and equity for others.

For three centuries, New Orleans has had the recurrent opportunities found in other disasters to rebuild the familiar in safer, better, and more equitable ways. It essentially rebuilt the familiar, expanded between disasters, and provided marginal increases in safety but laid the groundwork for the next catastrophic failure with major burdens falling on the poor. Now, 1 year after Katrina, the planning effort and the actions taken to reconstruct New Orleans clearly reflect the pattern of conflicting reconstruction goals. Planning for reconstruction is divided between city, state, and federal government, each assisted by outside advisors and contractors, with distinctive but often overlapping responsibilities and intentions. At the federal level, extensive safety-related studies have been undertaken by the U.S. Army Corps of Engineers (26) and a related planning effort by the Federal Emergency Management Agency (FEMA) for the production of new 100-year flood elevation maps taking into account Katrina's flooding, the subsidence of benchmark levels, and protection from rebuilt levees (42).

At both the state and city level, parallel and competing planning processes were launched by the Louisiana Recovery Authority, appointed by the governor, and the Bring New Orleans Back Commission, appointed by the mayor of New Orleans. The initial plan was a brief "starting point" plan developed by the Louisiana Recovery and Rebuilding Conference (43) and included features that were similar to the city plans developed by the Urban Land Institute with proposals for category 5 flood protection; light rail, parks, and playgrounds; and selective neighborhood rebuilding (44). A more detailed set of reconstruction plans came from the Bring New Orleans Back Commission, whose Urban Planning Committee envisioned a smaller city of 250,000 as a "sustainable, environmentally safe, socially equitable community with a vibrant economy. Its neighborhoods would be planned with its citizens and connect to jobs and the region. Each will preserve and celebrate the heritage of culture, landscape, and architecture" (45).

But 1 year after Katrina, the unified neighborhood planning process, envisioned by the city and the state, has barely begun. Some neighborhoods had begun their own planning process; other neighborhoods had professional assistance provided separately by the mayor and the city council. It has taken 10 months for the mayor, city council, and civic leaders to agree on a unified planning process with professional assistance for 73 neighborhoods and on the preparation of a citywide infrastructure plan (46). Underlying the fits and starts in neighborhood planning has been the reconstruction approach of various planning consultants to rebuild the "high ground first—damaged areas maybe" and its conflict with the most important equity issue—the rebuilding of pre-Katrina African-American neighborhoods.

The major planning documents (43–45) reflect the contrasting planning goals. As seen in other reconstructions, betterment emerges as the major planning goal. Perhaps to compensate for the "high ground first—damaged areas maybe," they do give prominence to issues of equity and citizen participation in the planning process. Safety, with one exception, is presented with few details but

calls on the federal government to provide protection against category 5 hurricanes. Rapid recovery was not a focus of the plans.

In striking contrast to the reconstruction plans, the actual decisions and rebuilding undertaken 10 months after Katrina—the so-called "facts on the ground"—clearly demonstrate the rush to rebuild the familiar found after all disasters. Proposals for a building moratorium were almost universally rejected by residents. Federal government grants to the state and payments of flood insurance will now provide significant, but not sufficient, funds for rebuilding (47). More than 38,000 building permits have been issued for rebuilding to residents, ostensibly with >50% damage (34). Many homeowners succeeded in having their damage estimate reduced to below that key benchmark to enable rebuilding without elevation of the structure. New maps, to be used in testing eligibility for flood insurance, have not been completed because rebuilt levees could not be certified as protecting at the level previously protected. In their absence, FEMA requires ground elevation of up to 3 feet (42). Given the depth of flooding experienced, this appears to be a modest requirement.

A Safer City? Further facilitating a return to the familiar are the completed safety improvements and further work underway. New Orleans will be somewhat safer, but not so safe as it could be. It will surely be flooded again in the future reflecting the threat of even greater or more threatening storms from the multidecadal cyclical period of high hurricane frequency (48). Furthermore, the intensities of these storms are probably being exacerbated by global warming (49–51) and by sea level increase and continued subsidence of the land. Hazard research offers five major types of adaptation that could be used to lessen such risk (1, 2). Adaptive actions taken or planned to make New Orleans safer address three of these: rebuilding of the levees, a limited effort to make buildings flood and wind resistant, and preparation of a new evacuation plan. No actions have been taken to change land use or even to restore wetlands.

The U.S. Army Corps of Engineers nearly fulfilled their promise to rebuild and strengthen the current levee system by June, the beginning of the 2006 hurricane season. This follows in the historical tradition of rebuilding the levee system equal to or slightly higher than the most recent flood. Thus, at a cost of $4.5 billion, the levees that failed have been rebuilt roughly to the nominal 5-m elevation previously authorized but with improved earth materials, better anchored flood walls, and armoring to permit the levees to survive overtopping. Supplementing these improvements are the installation of gates to close off three of the canals and improved pumps and energy supplies for management of interior stormwater or flooding. However, these features may not be sufficient. They will not be fully in place until 2007 and may still leave the city at risk from heavy rains (26).

Protecting individual structures by making them flood- and wind-resistant has been a major feature of modern hazard research. The most common form of flood resistance is elevation above some expected flood level. In New Orleans some individual home and business owners had sought their own protection by elevating structures on piers, often using the space below the structure for open or enclosed garages (e.g., Times-Picayune newspaper), additional storage, or shady workspaces. Nonetheless, there is considerable reluctance to elevate damaged buildings, because of appearance, cost, and the technical limits for elevating concrete slab homes. For most residences, city building permits issued before the FEMA advisory, as well as the FEMA advisory itself, make rebuilding possible with no (or minimal) elevation. As to wind damage, New Orleans had adopted the model international building codes before Katrina. Yet even such highly touted buildings as the Super-

dome, used as a shelter of last resort, showed considerable wind-induced exfoliation, and expert inspections showed that many buildings failed because the code standards were not sufficient, enforced, or applied to older buildings (52).

In early June, a city plan was announced for the complete evacuation of the city including households without cars, the disabled, and the infirm. It specifically rejects "shelters of last resort" within the city (53). But with hurricane season underway, many aspects of the plan (e.g., assistance for elderly in getting to the pick-up points, evacuations sites, use of trains) have not been defined or tested through preparedness drills. Although much discussed, no new action has been taken to change land use or restore wetlands. All current plans recommend creating parks, open space, or restored wetlands in some of the lowest areas for amenity and beautification, as an appropriate use for land that is not rebuilt, and most importantly, as internal stormwater and flood retention basins. But maps showing such parks and open space in badly flooded neighborhoods were seen by many residents as predecessors to the loss of their property or neighborhoods.

Many environmental scientists also argued that wetlands in the delta below the city serve as a buffer zone that dampens the storm surge (54). Before Katrina, a $14 billion marsh restoration plan, known as Louisiana Coast 2050, had been proposed but not funded (55). In the months after Katrina, strong support emerged for river diversion to the west above the Bird's Foot Delta (at the mouth of the river) permitting a release of sediment to enhance the barrier shoreline and thus protect the marshes that protect the city (56, 57).

A More Equitable City? Extreme events reveal the extreme differences in the way we live and die, cope, and rebuild. Historical reconstruction experiences, as well as New Orleans history, consistently report on inequitable patterns of social vulnerability and outcomes of reconstruction. New Orleans was a predominantly black city (68%), and media coverage would easily suggest that poor African-Americans were the prime victims of the flood, the botched evacuation, and the inadequate shelter. But the distinctions were not as sharp as they appeared, because although 75% of the damaged-area population was African-American and 29% poor, areas with little or no flooding had 46% African-American and 25% poor (58). A little over half of the flood deaths were African-Americans, and deaths occurred primarily among the infirm and aged (27).

There were clearer racial and class differences in the ability to cope with the flood, to return, and to rebuild (59). Those with personal transport were able to seek refuge with family, with friends, or in public shelters of their choosing out of the storm's path. After the storm, many evacuees who had to rely on emergency transport out of the city were scattered to totally unfamiliar locations with some family members taken to separate locations. Half of New Orleans residents lived in rental housing. Most public housing remains boarded up, and four major housing developments will not be rebuilt. Temporary housing has been slowed by "not in my backyard" objections.

The far-flung poor are also less able to participate in postflood deliberations, although many did return temporarily in sufficient numbers to reelect Mayor Ray Nagin. Middle class and especially professional residents, both black and white, are core members of the reconstruction planning committees. The new unified effort may provide new opportunity for more equitable participation in the planning effort (46).

A Better City? As is often the case in disasters, in the immediate aftermath of Katrina, hopeful boosters and politicians proclaimed that reconstructed New Orleans will be "bigger and better." Although bigger is not likely, what constitutes better will be the focus of much debate. Three major but overlapping concepts of betterment have emerged. A new urbanism envisions a smaller but carefully *planned city* with revitalized older neighborhoods and restored portions of badly flooded neighborhoods selected by residents. All are equipped with new schools, parks, walks to stores and services, and sustainable architecture built along a backbone of light rail public transport bringing people to both downtown and suburban jobs. The *improved city* focuses on reversing the past by creating a new and advanced school system, an honest city government that is an efficient provider of services and protection, a more multiracial and integrated city that can reverse population loss, and a city safer from crime as well as disaster. The *investment city* focuses on the new economy, creatively using significant public and private funds to rebuild and invest in previous areas of strength: tourism, culture, medicine, education, and the ports.

Some modest progress can be found for each of these visions, but none currently makes a compelling case for their realization. The delayed neighborhood planning, seen as the heart of a new urbanism, is finally underway. State supervision of schools has replaced the local system. Charter schools, church schools, and newly restored and reorganized public schools will create a more diverse system, albeit with fewer pupils. A few new services have been provided, such as public, free WiFi internet connections in the central business district. A few decisions have been made to restore or rebuild key hospitals and education facilities.

Trajectories of Recovery

There is historical and comparative evidence that recovery after disaster generally follows the predisaster trajectory with the disaster even accelerating previous trends. For cities with growing population and economies, the disaster may accelerate that growth; whereas for cities in economic and social decline, it may hasten decline (5, 6, 36–39, 60). This is not encouraging for New Orleans, whose population had declined by 31% from a peak 1960 Census estimate of 627,525 to the estimated July 2005 pre-Katrina population of 437,186 (21). Five months later, the Census estimated the population at 158,253, a loss of 64% from the already lower July 2005 number (21). One future projection to 2008 foresees a population of 279,000 or 60% of the pre-Katrina population (61).

Economic projections are similar. One foresees two possible levels of economic growth for the metropolitan area, as measured by employment. The metro New Orleans area recovers 41% of jobs by the year 2008 in the moderate scenario. In the high-growth scenario, 66% of the 190,000 jobs lost from pre-Katrina levels are recovered, but only if an unprecedented capacity for house construction can be created (32). In a different projection for a five-parish region that has lost 40% of its population and 13% of its pre-Katrina employment, the optimistic economic recovery scenario projects only 73% of its population and 93% of its employment 5 years after Katrina (33).

There will also be less space to support reconstruction because historical experience indicates that reconstruction always requires more land, sometimes two to four times the previous area (6). To replace previous housing and infrastructure, rebuilding must conform to new standards of activity, construction, or comfort. In addition, some previous land uses are diverted to commemorative or

betterment reconstruction. Proposed denser development could house a larger population, but proposed parks, open space, and flood detention basins would remove significant acreage. Future improvements of existing levees and new internal levees would also require additional area. Moreover, some of the city may end up as brownfields requiring long-term cleanup before development.

However, the past is not necessarily a prologue to the future. There are interesting examples of reconstructions that have broken the trends of their predisaster trajectories. In these cases, the city's reconstruction is assisted by some larger contextual changes that overcome the local situation. Three types of such contextual changes have been found after other disasters: external aid that is sufficiently large to actually spur development, spillover effects from larger regions on a different trajectory, or spillover effects of the disaster itself. The first two changes are illustrated in the successful reconstruction of the decaying industrial city Tangshen, China, after the 1976 earthquake that killed over half a million people. The Chinese government refused external assistance from outside China but mobilized exceptional amounts of internal assistance to not only rebuild but to spur development. In addition, the city also benefited from the major economic changes and growth in the Chinese economy that coincided with the completion of its functional reconstruction (62). A more recent example is the growth of Homestead, FL, after it was destroyed by Hurricane Andrew in 1992 and suffered a decade as a depressed local economy. The rising economic tide of downtown Miami and soaring real estate values have made the open farm lands of Homestead into the new suburbia (63).

Disasters themselves have strong spillover effects. Thus, the Great Plains droughts of the 1890s (8), the Mississippi floods of 1927 (18), and the dust bowl droughts of the 1930s (8) all led to massive out-migrations and reshaping of the social and political landscape of the nation. And in Latin America, the failures of the governments in power to rescue, shelter, and rebuild the areas affected by the Managua earthquake of 1972 and the Mexico City earthquake of 1985 led to profound political changes (64).

These examples suggest contextual changes that might reverse the current limited prospects for New Orleans. The first, after the Tangshen experience, would be an extraordinary national effort inspired by the desire to reverse the failures of response to Katrina by all levels of government. Another possibility to reverse decline is the potential impact of upgrading the hurricane protective system to a category 4 or 5, which could encourage a new round of major development while ironically increasing the future catastrophic potential. It is also possible to envision a fortuitous and rapid growth in some of the four economic and employment areas identified by most planners: culture, health, education, and port economy. All four of these are growing rapidly in many other cities fueled by larger national and global trends. Culture economies are replacing retail and office functions in many central cities. The aging of the boomer generation will only add to the rapid expansion of health education and provision of health care services. Globalization will spur educational opportunities to maintain economic and technological competitiveness and draw more international students. It also creates a demand for an expanded and specialized port economy.

Finally, a possible but remote change is the type of political change seen after other great disasters, particularly in Latin America (64). In such a change in trajectory, New Orleans would benefit from a new national initiative to address issues of race and poverty deeply embedded in the society and

for which Katrina served as a metaphor and call to action. But an entrenched local and national political culture does not bode well for such a major trajectory change.

Sustaining New Orleans

From the extensive research on natural hazards and the smaller body of research on reconstruction after disasters, we selected four key propositions to explain the catastrophic vulnerability of New Orleans to Katrina; to observe the pace, process, and progress of reconstruction; and to consider its trajectory for recovery. From this perspective, we argue that the broad sequence of decisions, made during New Orleans' history and resulting in an increased vulnerability to Katrina, reflect a long-term pattern of societal response to hazard events: reducing consequences to relatively frequent events while increasing vulnerability to very large and rare events.

The sequence and timing of recovery is somewhat controversial, but it provides a calendar of comparative historical experience against which to gauge progress in the necessary phases of reconstruction. Using this calendar, the emergency period appears to be somewhat longer in duration than any other of the studied disasters, but the restoration period is in keeping with or ahead of historical experience. The effort to reconstruct the physical environment and urban infrastructure is likely to take a decade, and no commemorative reconstruction is in sight.

The conflicting policy goals of rapid recovery, safety, betterment, and equity and their relative strengths and weaknesses largely reflect experience with large disasters in other places and times. The actual decisions and rebuilding undertaken to date, the so-called "facts on the ground," clearly demonstrate the rush by the residents themselves to rebuild the familiar. This trend is found after all disasters, whereas those involved in the planning process do not share the same urgency. The effort to reconstruct the failed levees to their existing height is also in keeping with historical action. Planning, as in all other studied reconstructions, strongly emphasizes betterment. The considerable emphasis on equity in planning conferences and documents differs from previous experience and may reflect a greater formal sensitivity to minority concerns. The obvious inequities in risks from flooding and in the failures of evacuation result in an inherent conflict with a reconstruction process that although rational, seems to threaten the recovery of some poor and African-American neighborhoods.

Because disasters tend to accelerate existing economic, social, and political trends, the trajectory for full recovery (preexisting population, economy, and infrastructure) is not promising. The large losses in population and employment after Katrina are an accelerated continuation of its 45-year-long decline in population and economic growth, now compounded by the major losses in housing stock. But the bleak prospect offered by the accelerated trends proposition can be yet altered by larger contextual changes found in other reconstruction experiences.

However, drawing upon the extensive research perspective, even the smaller New Orleans of the future can achieve a better balance in its reconstruction efforts. Missing from rapid recovery has been adequate attention to the needs of evacuees who lived in rental housing, especially public housing. The range of safety actions needs to be more redundant than simply restoring or improving the surrounding levee system. Critical areas within the city can be hardened by using

secondary protection both by elevation and by a set of inner levees. Financial incentives are needed to enable all homeowners to rebuild to forthcoming FEMA elevations. Experience from developing countries would argue for a redundant system of neighborhood sanctuaries in the form of public buildings—schools or community centers—with upper floors that are able to withstand flooding, maintain power and water, and be converted easily from everyday use to shelters. Betterment reconstruction could use the opportunity of reconstruction to make New Orleans a sustainable city, and some locally produced plans are already available (65). Some equity would be achieved if all evacuees who want to return have the help needed to return by voucher-supported housing, reconstructed public housing, new developments, or reconstituted neighborhoods. All Americans have a stake in the rapid, safe, better, and just reconstruction of New Orleans.

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Planning, Plans, and People: Professional Expertise, Local Knowledge, and Governmental Action in Post-Hurricane Katrina New Orleans

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Abstract

In rebuilding after the largest disaster in our nation's history—Hurricane Katrina—New Orleans has faced two key challenges: (1) how to enable all residents, including those with the fewest resources, to return to the city without recreating pre-Hurricane Katrina vulnerabilities and the inequities they represent; and (2) how to prioritize limited redevelopment resources. A citywide recovery strategy was necessary to address these challenges.

The purpose of this article is to examine the planning processes and the difficulties the city has faced in developing its recovery blueprint. Two interrelated, yet distinct, tensions played out through these processes: (1) tension between the need for "speed and deliberation" (Olshansky, 2006) in formulating a recovery blueprint and (2) tension between the relative weight afforded professional and resident assessments and priorities in setting recovery agendas. These tensions, accompanied by unanticipated resident distrust of government and professionals and the failure of city officials to designate quickly a single agency with the authority to guide a comprehensive recovery planning process, slowed the development of a citywide rebuilding strategy.

Section 1. Introduction

On August 29, 2005, Hurricane Katrina made landfall in Plaquemines Parish, Louisiana, southeast of New Orleans. Sections of the levees protecting New Orleans breached from storm surges, flooding 80 percent of the city. In many areas, the water stood for up to 6 weeks and, in some places, the flooding was as deep as 10 to 15 feet. Most of the streets were inundated (UNOP, 2006), and more than 100,000 residential structures were flooded; of those structures, more than 78,000 were severely damaged or completely destroyed (HUD, 2006). Damage to infrastructure and public facilities was equally catastrophic; for example, of 126 public schools, only 7 had no damage and more than half had damage that exceeded 25 percent of their replacement value (UNOP, 2006). The schools, like much of the city's infrastructure and public facilities, had also suffered from years of deferred maintenance. Although the Federal Emergency Management Agency (FEMA) is providing resources to repair infrastructure and public facilities to pre-Hurricane Katrina levels, the resources are not, in many cases, adequate to bring those facilities to levels that approach current standards.

With such extensive damage, rebuilding any city would be difficult. The situation was more complex in New Orleans, however, because of its trenchant pre-Hurricane Katrina problems. With a July 2005 population of a little more than 452,000 (U.S. Census Bureau, 2007), New Orleans had been losing population since 1960. Population decline was accompanied by an increasingly polarized, slow-growing economy and extreme poverty. Although the flooding impacted 77 percent of the city's population (UNOP, 2006), affecting people and neighborhoods across sociodemographic lines, Hurricane Katrina disproportionately affected African Americans, renters, people with low incomes, and the elderly, exacerbating many pre-Hurricane Katrina inequities (Hartman and Squires, 2006; Laska and Morrow, 2006; Logan, n.d.).

Because New Orleans faced so many pre-Hurricane Katrina problems, rebuilding the city as it had been was impossible. Many people hoped that New Orleans could be rebuilt better. New Orleans could have good schools, less violence, higher paying jobs, and better city services and could be less susceptible to damage from future flood events. Some observers outside New Orleans, however, questioned whether New Orleans should be rebuilt at all, given its vulnerable location, declining population, and relative poverty. If the latter argument had any merit, it quickly became moot as residents and business owners, relying on savings, insurance money, and other resources, returned to New Orleans and began to rebuild. In July 2007, nearly 2 years after Hurricane Katrina made landfall, the city had an estimated 300,000 residents, two-thirds of its pre-Hurricane Katrina total, and redevelopment was occurring throughout the city (Eggler, 2007).

In rebuilding after the largest disaster in our nation's history, New Orleans has faced two key challenges: (1) how to enable all residents, including those with the fewest resources, to return to the city without recreating pre-Hurricane Katrina vulnerabilities and the inequities they represent and (2) how to prioritize limited redevelopment resources.

In addition, rebuilding has had to occur at three, interrelated scales: (1) the individual/household level, (2) the neighborhood level, and (3) the citywide level. Each rebuilding level involves corresponding decisions and actions.

1. People have been making individual and family decisions about returning and rebuilding their properties and acting on these decisions.
2. Individual decisions both depend on and affect neighborhood recovery. Residents who have decided to return are committed to rebuilding their neighborhoods and thus work with neighbors to (a) make sure property adjacent to theirs is not abandoned, (b) clean the streets, (c) advocate for those who need help, and (d) encourage nearby institutions and businesses to rebuild.
3. Decisions about infrastructure, public building repairs, and city service priorities must be made at a citywide scale.

Inevitable, but necessary, tension exists among these scales of decisionmaking. Although individual and neighborhood actions can and should influence citywide rebuilding strategies, simply allowing neighborhood efforts to filter up to the municipal level will not always enable city officials to make difficult decisions. Not all facilities can be rebuilt at once, and, after a disaster has occurred, enough money is never available for every project (Olshansky, 2006). Scarce resources will inevitably benefit some neighborhoods more than others, and the situation in New Orleans begged for a citywide plan to reduce future flood risks and prioritize rebuilding in the most equitable way possible.

To address these challenges, New Orleans Mayor C. Ray Nagin initiated a citywide recovery planning process in September 2005. Almost 2 years and two planning processes later, the city has adopted multiple plans with differing priorities as its official recovery document. A citywide reconstruction framework is just taking shape through the designation of 17 damaged business zones targeted for investment.

The purpose of this article is to examine the planning processes and the difficulties the city of New Orleans has faced in developing its recovery blueprint. We identify two significant sources of conflict or tensions that played out through the recovery process: (1) tension between the desire to rebuild quickly and the deliberation necessary to craft credible programs and policies to ensure safe and equitable rebuilding (Kates et al., 2006; Olshansky, 2006) and (2) tension in striking a balance between professional and resident guidance in the planning processes and establishing citywide rebuilding priorities. We demonstrate how residents are critical in rebuilding efforts but also how neighborhood efforts are not enough. The failure of local officials to designate a single, accountable agency to oversee recovery planning hindered the development of a clear, citywide rebuilding strategy. Furthermore, in failing to anticipate and comprehend resident distrust, local government missed an opportunity to engage residents early on in a constructive dialogue about the difficult decisions the city had to make to reduce risk and facilitate an equitable and efficient recovery.

In the following sections, we discuss the tensions and local government missteps that impeded the development of a citywide recovery strategy. In Section 2, we detail three (of four) post-Hurricane Katrina citywide planning processes and the city of New Orleans Office of Recovery Management's (ORM's) recovery strategy, discussing how the tensions between "speed and deliberation" (Olshansky, 2006) and between resident and professional guidance played out in each of them. Each process approached planning and participation differently, and we discuss the consequences of using differing approaches as well as how the processes built on one another. In Section 3, using risk as an example, we discuss the differences in professional and resident knowledge and how these differences have resulted in conflicting recovery priorities and strategies. In Section 4, we focus on neighborhood

rebuilding efforts and provide an example of a rebuilding policy negotiated between residents and professionals. Finally, in Section 5, we highlight lessons from New Orleans for other cities that are strategizing disaster recovery plans.

Section 2. Multiple Processes in Search of a Plan: The Planning and the Participants

Planning in a postdisaster environment poses both opportunities and challenges. New Orleans experienced an unprecedented level of neighborhood activism as residents returned and began rebuilding. Residents were attentive to activities at all three scales of rebuilding and were ready to participate, an ideal situation for participatory planning. Additional participants add complexity to planning processes, however, and residents were also wary that some proposals might impede their rebuilding efforts. The two tensions that we mentioned in the introduction—(1) tension between the need for speed and the need for deliberation in formulating a recovery blueprint and (2) tension between the relative weight afforded professional and resident assessments and priorities in setting recovery agendas—also played out through these processes.

In the 2 years following Hurricane Katrina, New Orleans has had five citywide recovery planning schemes. The mayor appointed the Bring New Orleans Back (BNOB) Commission in the fall of 2005. In the spring of 2006, the city council implemented a neighborhood planning process, the New Orleans Neighborhoods Rebuilding Plan (NONRP), more colloquially called the Lambert plans. The Louisiana Recovery Authority (LRA), the state agency charged with planning and coordinating rebuilding efforts and serving as a conduit for federal aid to the city, initiated a districtwide and citywide planning process funded by a consortium of local and national philanthropies in the summer of 2006. In January 2007, the mayor established the Office of Recovery Management to coordinate the overall recovery process. The Federal Emergency Management Agency (FEMA) also led a planning process that resulted in plans issued in August 2006; the plans have had little influence within Orleans Parish, so we will not discuss the FEMA process further here. In this section, we examine the first four of these distinct recovery planning efforts to explain what they accomplished, what differences exist among them, and what accounts for the approaches each scheme took.

1. **BNOB.** The BNOB Commission's planning effort, a top-down process driven by professional planners and designers, resulted in a citywide plan that focused on urban design and land use solutions to reduce risk from future flooding, prioritize redevelopment resources, and sustain key services for a smaller projected population.

2. **NONRP.** In contrast, the city council's NONRP planning process, drawing from a community development and organizing framework that developed neighborhood plans for all flooded areas, identified resident-generated priorities and policies concerning what each neighborhood needed to rebuild. Unlike the BNOB Commission's process, the NONRP process was based on the assumption that all areas of the city would be rebuilt.

3. **UNOP.** The Unified New Orleans Plan, the subsequent philanthropic-funded process, worked on two spatial scales: the districtwide level and the citywide level. Planning teams produced 13 district rebuilding plans and 1 citywide plan. The district plans offered primarily urban design and land use solutions that drew on previous neighborhood planning efforts and on information from a series of UNOP-sponsored district and neighborhood meetings. The citywide plan proposed policy-oriented or regulatory mechanisms to prioritize rebuilding and promote safer development.
4. **ORM.** After these three planning processes, ORM was charged with developing a recovery *strategy*, a difficult task given the lack of coordination from plan to plan.[1]

Although all four recovery planning approaches have merit, given high levels of both community activism and resident mistrust, not all were equally effective. The mayor, when designing the BNOB Commission, did not fully acknowledge the need for a participatory process to both build residents' trust and foster dialogue among all stakeholders about rebuilding strategies and concerns. The city faced a significant conflict between needing to act quickly to get the city up and running and developing an inclusive, deliberative recovery process. This problem was compounded by the fact that most residents, particularly those hardest hit by flooding, were (and many remain) scattered throughout the country. Those residents who have returned have done so at uneven rates and often only temporarily to inspect their destroyed houses and belongings.

The planning process needed to be designed to foster participation. Governmental entities often include residents because doing so leads to more effective programs and policies. Participatory processes can be a way to share information, both for the government to convey information and for agencies to obtain information from residents about local areas and priorities; build trust and knowledge about a process or project; and lead to better, substantive decisions through discussion and information sharing (Beierle and Cayford, 2002).

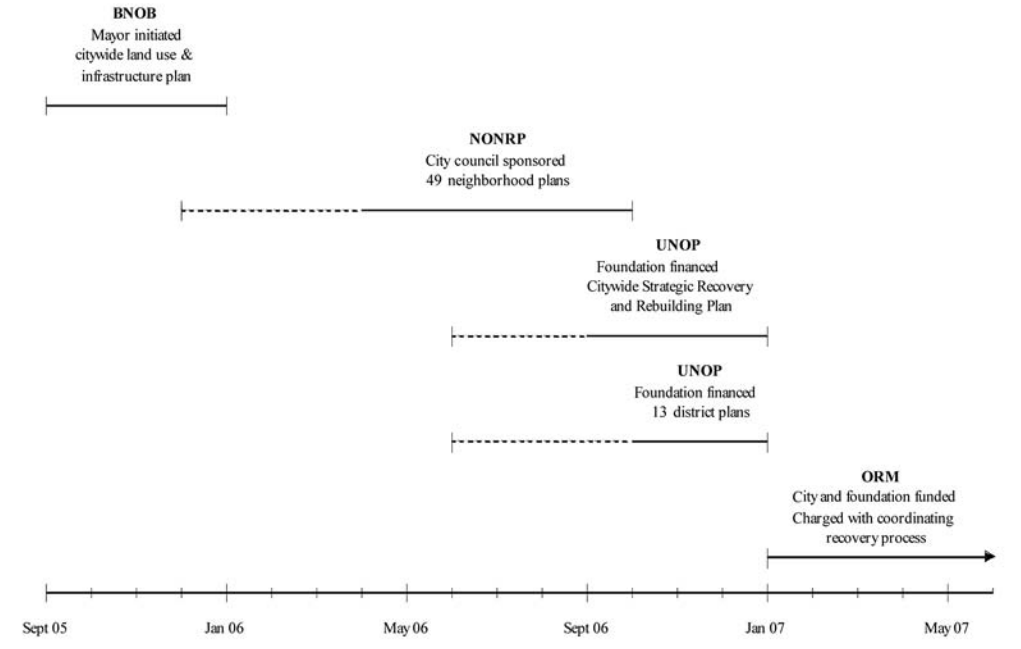
During the first process of the BNOB Commission, meetings were open to the public, but they were not designed to include nonprofessional residents. Out of perceived necessity, they occurred before most people returned, residents had to seek them out, and engaging residents as participants was not a priority. Subsequently, many residents opposed the BNOB Commission's proposals. The processes that followed emphasized more deliberation with residents. They were still designed to be quick and took between 4 and 7 months (exhibit 1).[2] Nonetheless, the longer the planning took, the more it was viewed as a roadblock to recovery. Both public officials and residents involved in planning processes want action and can become tired of endless streams of planning meetings without clear outcomes (Helling, 1998). Residents continued to attend meetings throughout each process; they feared not attending might hurt their neighborhoods, but they were ready to stop planning and start implementing. They were also exhausted by their individual rebuilding efforts and struggle to create a normal life for themselves and their families.

[1] Many stakeholders viewed the emergence of multiple processes as a power struggle among elite groups in the city to guide the direction of the development. The stressful situation and competition for scarce resources in postdisaster environments can also exacerbate existing divisions (Olshansky, n.d.).

[2] All three processes did their best given impossibly short timeframes.

Exhibit 1

Post-Katrina Planning Process Timeline



BNOB = Bring New Orleans Back. NONRP = New Orleans Neighborhoods Rebuilding Plan. ORM = Office of Recovery Management. UNOP = Unified New Orleans Plan.

Notes: The solid lines indicate approximate start and finish dates for the planning processes; the dotted lines indicate periods when the processes became public but had not yet begun.

The Bring New Orleans Back Commission: Resistance to a Top-Down Process

In the aftermath of Hurricane Katrina, New Orleans Mayor C. Ray Nagin appointed the BNOB Commission in September 2005. The commission, a group of 17 business and community leaders selected to assist and advise local officials with rebuilding the city, created seven committees (Culture, Economic Development, Education, Government Effectiveness, Health and Social Services, Land Use, and Infrastructure) to develop rebuilding plans for their respective sectors by the end of 2005. The commission's Land Use Committee, led by Joseph Canizaro, a local developer with strong ties to the White House, drew heavily on a rebuilding strategy proposed by the Urban Land Institute, a national land use and real estate think tank. The Land Use Committee hired Philadelphia-based planning firm Wallace Roberts & Todd to advise the committee and assimilate its discussions into a coherent plan. The committee's preliminary recommendations, announced in January 2006, included shrinking the city's footprint to sustain key services for a smaller projected population, imposing a 4-month moratorium on building permits in flood-affected areas, and implementing a 4-month neighborhood planning process in which residents of the city's 13 planning districts would be able to prove the viability of their neighborhoods by demonstrating that a significant proportion of the residents wanted to return. The recommendations also included the conversion of some properties in badly flooded areas to parks with water management systems.

The public outcry was immediate. The BNOB planning process and the commission's heavy representation from the business community fueled citizen distrust of the commission and its recommendations. Although the mayor was careful to appoint eight African-American, one Latino, and eight White commissioners, many residents, particularly African Americans, did not view the commission as representative of their interests. As Barbara Major, an African American and the only community activist on the BNOB Commission, noted, "I think some people don't understand that an equal number of black and white isn't the same as equity" (Rivlin, 2005: 11). The BNOB Commission likewise exacerbated long-standing tensions between the mayor and the city council. While the mayor put together the BNOB Commission, the city council assembled a rival, although short-lived, advisory committee on hurricane recovery. The mayor appointed then New Orleans City Council President Oliver Thomas to the BNOB Commission only after receiving significant pressure from the council (Burns and Thomas, 2006).

A smaller city footprint suggested that some residents would be prohibited from returning, and New Orleans would become more White and more affluent. Shrinking the city's footprint was particularly unpopular among African Americans, who made up nearly 70 percent of the city's pre-Hurricane Katrina population and were much more likely than White residents to live in flood-devastated areas of the city (Donze and Russell, 2006). No policies, other than some very general statements about mixed-income housing, were proposed to facilitate residents' return to other parts of the city. In the absence of such alternatives, shrinking the footprint was ultimately viewed as a means to keep many African Americans from returning.

Residents across the city demanded the right to return to their houses in their original neighborhoods, prompting the mayor and the city council to reject proposals for a smaller footprint and, instead, allow redevelopment in all areas of the city, even those most vulnerable to future storm damage. Those residents most exposed to flood risk, and those most severely affected by Hurricane Katrina, were the least trusting of the BNOB rebuilding process and the professionals involved in assessing risk. They did not believe their interests were adequately represented among BNOB Commission members and the BNOB planning process, nor did they think that the political leadership and business community had served them well historically. Distrust, which should have been anticipated, had far-reaching consequences because, in the face of strong opposition, the city's administration pulled back from the BNOB's suggestions without further discussing or refining them.

The structure and timing of the BNOB planning process contributed to residents' fears that their interests would not be reflected in the rebuilding plans. As noted at the beginning of this section, although the BNOB meetings had been open to the public, they occurred when most residents, particularly those hardest hit by the flooding, had not yet returned to the city. As a result, the meetings were attended primarily by professionals and residents who had been able to quickly return to the city and were not a representative cross-section of the city's pre-Hurricane Katrina residents. No attempts were made to ensure that more people participated in the BNOB meetings.

It was not solely the ideas generated by the BNOB Land Use Committee that engendered fear; it was the way the information was conveyed. The local newspaper, *The Times-Picayune,* ran a front-page article on the Land Use Committee's plan the morning it was presented to the public (Donze and Russell, 2006). The article contained a map with large green dots over areas at higher risk to flooding, visually suggesting that those areas should be converted into park space or green space.

Although the reporters attempted to convey that the green dots were not finalized decisions, a newspaper article was inadequate for explaining the complexity of the proposals and it was unable to engage in a discussion with a city of people still mourning their losses and trying desperately to decide how to move forward. Many residents understood that all green areas were slated for green space, and the green dot became a threat to neighborhood residents. Rather than be "green spaced," residents organized to prove the viability of their neighborhoods.

The New Orleans Neighborhoods Rebuilding Plan: Formalizing Neighborhood Planning

The BNOB Land Use Committee proposed a neighborhood planning initiative, which was to be led by local architect Ray Manning and former dean of the Tulane School of Architecture Reed Kroloff, to help neighborhoods establish their viability. It stalled, however, because FEMA was unwilling to fund a multimillion dollar planning process and the commission failed to secure funding from other sources for Manning and Kroloff's work. Despite the absence of a formalized process, neighborhoods, acting on their own, continued to organize and plan.

In December 2005, the city council passed a motion (Motion M-05-2005) to establish a neighborhood planning process. In contrast to the proposed BNOB process, the city council intended to facilitate recovery of all flooded neighborhoods. In the spring of 2006, the city council hired Miami-based Lambert Advisory and New Orleans-based SHEDO, LLC, to offer assistance to neighborhoods and develop plans for 49 of the 73 neighborhoods that experienced flooding depths of 2 feet or more. The purpose of the New Orleans Neighborhoods Rebuilding Plan, more colloquially called the Lambert plans, was twofold. The city council wanted to focus the disparate efforts of all the neighborhood groups and to provide technical assistance to develop project lists for procuring funding to facilitate the rebuilding of neighborhoods citywide. Although some residents and planners criticized this approach, research on city recovery from disasters has found that cities generally rebuild with similar urban form and that residents resist relocation efforts (Kates et al., 2006; Olshansky, n.d.).

Lambert Advisory and SHEDO contracted with numerous New Orleans-, Boston-, and Miami-based firms; held more than 100 formal meetings in the neighborhoods; attended additional meetings with organized neighborhood groups and helped groups form in other areas; met with individual residents; and produced plans that incorporated all flooded neighborhoods. The plans identified needed repairs to infrastructure and public facilities and included proposals to rebuild neighborhood and regional commercial centers. With estimated costs at $4.4 billion, the projects were divided into early-action (critical), mid-term (needed), and long-term (desired) categories (NONRP, 2006).

The city council, responding to the pushback from city residents, opposed several of the BNOB Commission's recommendations, and the assumptions underlying the NONRP reflected these concerns. Three assumptions addressed risk from future storm events: (1) with the help of the federal government, the storm protection system would be designed to withstand a 100-year storm; (2) stringent building codes would be enacted to limit wind (but not flood) damage from future storm events; and (3) the city would develop an effective evacuation plan to ensure that loss of life in future storms would be averted. A fourth assumption focused on what parts of the city would be rebuilt; NONRP respected the existing street grid and urban structure and planned for the recovery

of every neighborhood (NONRP, 2006). The final NONRP plan emphasized the need for adequate storm protection for the entire city, including areas considered higher risk, instead of emphasizing safe rebuilding practices to reduce relative risk within the city. This plan contrasted with the initial BNOB proposal to shrink the city's footprint or create an internal water management system that would convert some residential land to open space. The NONRP approach was consistent with the city council members' charge to represent their constituents, many of whom wanted their pre-Hurricane Katrina neighborhoods rebuilt and protected.

NONRP proposed four citywide policies to address key impediments to recovery that residents articulated. To partially combat the "jack-o'-lantern effect"—an unplanned mix of occupied and vacant houses throughout areas of the city devastated by Hurricane Katrina—the planners proposed a "lot-next-door" program that gave property owners the first opportunity to buy the lot adjacent to them, a program the city subsequently enacted. The planners highlighted a need for new, safer housing for seniors and outlined a strategy to facilitate its development. They also outlined a method for the city to direct money that would eventually be available from reselling property the state acquired through The Road Home Program, Louisiana's Community Development Block Grant-funded housing recovery program, to low-income neighborhoods that needed investment before Hurricane Katrina and needed additional reinvestment.[3] Finally, in response to an overwhelming desire for revamped neighborhood and regional commercial centers, while acknowledging that city governments have relatively less influence on this area of development, NONRP suggested an incentive program to encourage commercial revitalization (NONRP, 2006). By focusing on all flooded neighborhoods, the process also reassured residents that their neighborhoods would not be designated "unviable."

All four policies reflected neighborhood-scale concerns that would have a citywide impact. Professional and nonprofessional participants bring different types of information and thinking to the conversation (Fischer, 2000). When considering their own neighborhood, residents will more likely focus on detailed knowledge and systematic concerns about the neighborhood and examine the specificity of the situation. Professionals bring their disciplines' priorities and systematic thinking to rebuilding challenges. They will be less knowledgeable, however, about a particular neighborhood. Although the planners proposed policies to address major issues across the city, three of the four policies were within-neighborhood instead of between-neighborhood strategies, even though the actions were needed throughout the city. The fourth policy was citywide in scale, but it was a longer term strategy to direct resources to economically distressed neighborhoods. None of these was a strategy for prioritizing among neighborhoods in the short term.

A motion (Motion M-06-460) to accept the NONRP plans policies was unanimously passed by the city council on October 27, 2006. The motion directed that the plans be sent, along with select BNOB and Sewerage and Water Board of New Orleans projects, to the LRA.

[3] The Road Home Program entitles property owners to rebuilding funds (based on a formula that takes into consideration property value and damage minus insurance proceeds) and alternatively gives property owners the opportunity to sell their houses. The program includes a smaller, competitive component for rental buildings with one to four units that makes funds available for larger developments that provide affordable housing. The rental programs have an explicit criterion to choose neighborhoods that do not have high levels of "concentrated poverty." Because some neighborhoods have very low homeownership rates and high poverty rates, these areas will receive little benefit from either the owner-occupied or rental housing recovery programs.

The Unified New Orleans Plan: Integrating Participation in Difficult Decisionmaking

As the NONRP process was winding down, a third planning process, UNOP, got off the ground. The explicit thrust behind the new process reportedly was that the LRA would accept only a citywide plan that addressed both the flooded and unflooded neighborhoods. After FEMA decided not to fund the BNOB's neighborhood planning initiatives, representatives from the LRA approached the Rockefeller Foundation for financial support (Nee and Horne, 2007). The foundation contributed $3.5 million to the UNOP planning process. UNOP secured an additional $1 million from the Greater New Orleans Foundation and the same amount from the Bush-Clinton Katrina Fund.

UNOP became public in June 2006 with the issuance of a request for proposal (RFP) for planning teams. Representatives of Concordia Architecture & Planning, a local firm that acted as project manager, began attending community meetings to explain the process. UNOP's emergence caused confusion among residents about the legitimacy of the city council planning process that had been well under way when UNOP was announced. Although initial proposals for the UNOP process called for shutting down the city council planning efforts, the council's opposition to the idea prompted the decision that the UNOP process would integrate previous planning efforts into a single, citywide rebuilding plan (Warner, 2006) that would be used to guide the investment of public rebuilding funds and secure additional resources from federal, state, private, and philanthropic sources.

The Community Support Organization, a nonprofit association, and a nine-member advisory committee, composed of representatives from the Mayor's Office, New Orleans City Council, City Planning Commission (CPC) of New Orleans, and Greater New Orleans Foundation and five citizens (each representing one of the five city council districts), acted as the UNOP fiduciary and advisory agent. UNOP held public meetings in August 2006 to enable community members to provide input to the teams of local and national planners to which they would be assigned, and the planning teams officially held their first neighborhood meetings in October 2006. The planners produced plans for each of the city's 13 planning districts, and a separate team produced a single plan known as the Citywide Strategic Recovery and Rebuilding Plan (or the citywide plan).[4] The result was a 5- to 10-year blueprint for recovery that identified 95 capital and infrastructure projects totaling more than $14 billion in federal, state, and private funding. The plan was completed in January 2007 and approved by the CPC in May 2007.

Among the UNOP citywide plan's core principles was the decision to rebuild New Orleans as a "safer, stronger, and smarter" city through a number of voluntary programs designed to protect those residents most vulnerable to future flood events and enable all areas of the city to be rebuilt. Specifically, the plan proposed financial incentives for elevating homes to the FEMA Advisory Base Flood Elevation, rebuilding slab-on-grade homes on piers or with first-floor basements, and "clustering" households and businesses in areas that could support higher population and had less flood risk or could be made safer through flood-resistant designs.

[4] Planning district boundaries were determined during the completion of the 1999 Land Use Plan by the New Orleans City Planning Commission.

The concept of clustering represents a compromise between forcibly shrinking the city's footprint to restrict redevelopment in the most flood-prone areas and permitting redevelopment to continue throughout the city in a haphazard or unplanned manner. Although clustering has received praise from some local officials, the concept remains vaguely articulated. Because clustering is an abstract idea, not a well-defined policy or program, it has yet to gain traction among residents and, concomitantly, has faced no strong resistance from the public. It remains unclear where the financial incentives to encourage clustering would come from, how local officials would administer clustering programs, if encouraging relocation on a voluntary basis would produce substantial clustering, and, finally, what clustering would look like.

Although UNOP brought explicit discussions of risk back into the rhetoric concerning rebuilding, it was criticized from different sides. The Bureau of Governmental Research (BGR), a local watchdog organization, derided the citywide plan for failing to include any long-term, comprehensive flood protection projects (BGR, 2007a; BGR, 2007b). Moreover, BGR argued that, although the plan identified the vulnerability of specific areas to future flooding, it did not address location-based vulnerabilities in its proposed programs. Furthermore, because the plan's programs were vague and relied on voluntary actions instead of government mandates, critics have questioned the plan's usefulness as a guide for the city's future development (BGR, 2007a; BGR, 2007b). The plan's lack of clarity was heightened by the absence of maps showing where its various recommendations might apply.

For UNOP planners fearful of a public backlash, a certain level of abstraction was necessary; greenspacing of neighborhoods was not an option, and place-specific recommendations threatened to derail the process. The emphasis on individual decisionmaking reflects residents' uneasiness about mandates despite their desire for the creation of standards for reducing flood risk (America*Speaks*, 2006). Mandates not only threaten the sanctity of individual property rights, but many low-income and minority residents view them as mechanisms to keep them from returning to the city. As one ORM official described public perception, "recommendations to reduce flood risk equal 'ethnic cleansing'" (Nance, 2007).

In June 2007, the city council passed a motion adopting the BNOB, NONRP, and UNOP plans along with two community plans: (1) a plan developed by residents of the city's Broadmoor neighborhood and (2) the People's Plan for Rebuilding the 9th Ward (also known as the People's Plan), developed by the Association of Community Organizations for Reform Now (ACORN)—as the Citywide Strategic Recovery and Redevelopment Plan. The LRA accepted this plan later that same month.

The city's recovery plan needed to fulfill both communicative and substantive objectives. It had to convey to the LRA and to potential developers, philanthropic organizations, and federal agencies that the city had a credible rebuilding strategy. To rebuild effectively, the plan also should have included a strategy to focus infrastructure repairs and target funds given that not all improvements would occur at once and resources would be limited. Although the adoption of the citywide recovery document communicates to a national audience that city officials and residents have agreed on and adopted a roadmap for rebuilding, it is uncertain at this juncture as to what degree it will be able to guide rebuilding because it incorporated multiple plans with differing approaches and priorities.

In hindsight, instead of designing a new planning process, UNOP organizers should have added a citywide infrastructure recovery strategy to the ongoing process and, if necessary, expanded

NONRP's scope to include unflooded neighborhoods. These efforts would have been a more efficient use of time and resources, and they would also have lessened confusion about the planning efforts. The possibility of doing this, nonetheless, was hampered by too little time to come up with a workable collaboration and differing perspectives represented by NONRP and UNOP. On one hand, BGR and some LRA representatives were concerned that the NONRP planning process was viewed as "business-as-usual Louisiana politics" (that is, corrupt or potentially corruptible). On the other hand, many residents thought that UNOP was not only circumventing the democratically elected city council but also representing White, elite interests and would shift resources from flooded to unflooded areas.

The Office of Recovery Management: Developing a Citywide Strategy

As UNOP was finishing the city's last planning process, Mayor Nagin established the Office of Recovery Management to coordinate the overall recovery process. In December 2006, the mayor appointed Edward Blakely, an internationally recognized disaster recovery expert, to head the office. Blakely began working at ORM in January 2007, and, in February, he announced the names of five key ORM staff members, including a planner, lawyer, developer, business owner, and environmental planner. Four of the five staff members had lived in New Orleans before Hurricane Katrina occurred. The city gave ORM an annual budget of $500,000, which was supplemented with $1.54 million from the Rockefeller Foundation, Ford Foundation, and Bill & Melinda Gates Foundation (Donze, 2007; Hammer and Donze, 2007).

Blakely and his office were greeted with enthusiasm. In what many perceived as a leadership void, someone who confidently offered direction was greatly welcomed (Howell, 2007). Blakely's belief in his primacy, however, at times caused difficulty. In February 2007, *The Times-Picayune* reported that Blakely threatened to quit if his office was not in control of $117 million that the LRA designated for recovery projects in Orleans Parish. The LRA thought the newly restructured New Orleans Redevelopment Authority would receive the money. This was not the first time that Blakely had insisted on absolute control, having previously stated that FEMA recognized him as the only authority setting priorities for the city of New Orleans. FEMA had suggested that ORM be the coordinator of recovery efforts using federal disaster funds (Hammer and Donze, 2007).

On March 29, 2007, ORM announced its preliminary rebuilding strategy. From the start, Blakely expressed a need to identify trigger projects that would spark further development, stating that he hoped to have "cranes in the sky" by September (Bourbon, 2007), and ORM designated 17 target areas to receive a first round of funding. Blakely asserted that the target areas were chosen based on science, not politics (Krupa and Russell, 2007). The areas were, nonetheless, distributed throughout the storm-damaged areas, and the largest projects were in areas that had suffered the most damage. The two target areas slated to receive the most investment, the 80-acre Lake Forest Plaza Mall in New Orleans East and an area in the Lower 9th Ward, were also locations that, according to the UNOP assessment and the latest U.S. Army Corps of Engineers risk maps, were in drainage basins with less storm protection infrastructure and, therefore, were at greater continued risk.

The target areas were designated as "rebuild," "redevelop," or "renew" zones based on the amount of damage they had sustained (Krupa and Russell, 2007). The projects, drawn from the NONRP neighborhood and UNOP district plans, range in size from a farmer's market to a town center on

the Lake Forest Plaza site. Because two areas designated as renewal zones were located in New Orleans East and the Lower 9th Ward and other heavily damaged areas such as Gentilly and Lakeview have designated target zones, a columnist for *The Times-Picayune* speculated that the plan would lift the "curse of the green dot" (Grace, 2007).

ORM staff have suggested that the larger zones will encourage clustering, a UNOP policy recommendation. In this case, clustering refers to a process of targeting improvements so that residents and businesses would have incentive to concentrate in that area. Blakely's view of the purpose of clustering differed from that of the UNOP planners. The UNOP planners promoted clustering to reduce flood risk and allow for efficient service provision; when asked if he supported turning areas into green space or retention ponds, Blakely responded that economic development was his goal and that he would like to see "spaces that produce green dollars in the recovery areas. It's a lot better to have a small factory knocking down a (storm) surge than a blade of grass" (Hammer and Donze, 2007). In the former case, the city would have to acquire and maintain greenspace. In the latter, the property would be privately held and generate tax revenues.

Even though many residents welcome an established strategy, those living outside the target areas are concerned about whether their areas will receive needed infrastructure improvements, according to opinions expressed at the June 13, 2007, meeting of the Recovery Committee. ORM identified funding sources totaling approximately $1.1 billion from federal grants and bonds, but, at the time of this writing, the funding sources had not yet been secured.[5] ORM also has not provided details about what incentives, if any, other than rebuilt infrastructure, the city eventually hopes to offer developers in the target areas or how funds will be distributed among the areas.

Section 3. Government Efforts To Promote Safer Rebuilding **Strategies: Disagreements Between Experts and Residents**

After experiencing catastrophic events such as Hurricanes Katrina and Rita, many people might expect that rebuilding safely would be the city's foremost priority. In New Orleans, however, the issue continues to be one priority among many. In New Orleans and elsewhere, local governments are often unwilling to take action to manage development in a manner that reduces natural hazards despite the losses suffered by residents as a result of disasters. Burby (2006) attributes the failure of local government to mandate safe rebuilding practices to uninformed decisionmaking about urban development. To characterize local government action as merely uninformed, however, fails to explain the complexity of postdisaster planning and decisionmaking and the role politics plays in determining how recovery takes shape (Laska and Morrow, 2006; Wisner, 2004).

After a disaster occurs, city officials must make decisions quickly to guide all individual decisions that will be made and reduce uncertainty for individual decisionmakers (Haas, Kates, and Bowden,

[5] Proposed revenue sources include $260 million in general obligation bonds approved by New Orleans voters 10 months before Hurricane Katrina occurred; $300 million in "blight bonds," which would use city-owned blighted property as collateral; $117 million in Community Development Block Grant funds; $324 million from monies that the state of Louisiana put aside to cover the local match on Federal Emergency Management Agency (FEMA)-financed projects; and $57.4 million from FEMA hazard mitigation money.

1977b, discussed in Olshansky, n.d.). The time immediately following the disaster is also the window of opportunity that cities have to initiate any significant changes (Johnson, 1999, discussed in Olshansky, n.d.). In New Orleans, the city gave precedence to the residents' desire to return to their homes over policies that would reduce risk from natural hazards. Acting on the advice of outside and local professionals, the mayor initially supported citywide solutions to rebuild a safer New Orleans. A key misstep of the mayor and the BNOB Commission was not anticipating the level of skepticism and hostility to rebuilding proposals and underestimating the commitment residents had to rebuilding their neighborhoods. The BNOB Commission members also failed to acknowledge that residents had a plan in mind—the same city, only better (Haas, Kates, and Bowden, 1977a)—and had not had sufficient time to come to terms with their loss and contemplate a new landscape. Facing fierce public opposition to the BNOB proposals, the mayor, in the midst of a reelection run, distanced himself from his commission's recommendations in favor of a "free market" approach that enabled residents to rebuild anywhere.[6] Strategies for reducing and managing risk from future flood events fell away from the discussion about how the city should rebuild.

In dropping the risk factor from the rebuilding discussion in the first few months after the flooding occurred instead of attempting to mediate between conflicting priorities, local leaders missed an opportunity to empower residents to address risk. Fearing another policy reversal on the city's part and the release of FEMA flood maps that would require home elevation and thus make redevelopment in the most heavily flooded areas more costly, thousands of residents rushed city hall in the first months of 2006 to obtain building permits before the maps were released. The city encouraged homeowners in the hardest hit areas to have their official damage assessments reduced to less than 50-percent damaged to enable them to rebuild their homes without having to elevate them (Meitrodt, 2006). Although the city's hands-off position toward rebuilding in flooded areas satisfied residents' desire to return to their homes quickly and at the lowest cost, it did so at the expense of measures that could reduce risk and limit future losses. The fear and anger caused by initial announcements of a building moratorium and a smaller city footprint intensified the speed and determination with which residents sought to return to their homes despite the risks associated with rebuilding.

The decision to develop community-generated solutions directed the subsequent NONRP planning process, and the city council explicitly prioritized every neighborhood's return. It turned to professional planners to guide the process and offer technical assistance, and NONRP planners offered policies to address the most pressing concerns that arose in the neighborhood meetings. The priority concerns that the professionals addressed shifted from citywide risk reduction, the prioritization of limited recovery resources, and the efficient delivery of services in the BNOB plan to housing and neighborhood recovery. Although the UNOP citywide plan brought risk reduction back into the rebuilding discussion, in the absence of the political will to implement and enforce government mandates to ensure a "safer, stronger, and smarter" New Orleans, UNOP planners proposed a number of voluntary programs to increase resident safety. The impact of these programs, which have yet to be fleshed out and funded, is questionable, particularly in light of the fact that they have come too late for residents who have already returned and rebuilt their homes.

[6] The uncertainty that has permeated rebuilding efforts has prevented markets from operating efficiently.

Understanding Risk

The challenges that local officials and planners in New Orleans face highlight the conundrum that the appropriate actions to take in recovering from disaster are highly contested and not always clear. Disagreements between experts and residents on how to rebuild have led to inconsistent policy prescriptions, prolonged the planning processes, and enabled unsafe redevelopment. These disagreements may reflect a lack of residents' understanding of or concern about hazards, differences in how individuals and groups perceive risk and make decisions, and/or distrust of government officials and experts (Fischhoff, 2006; Laska and Morrow, 2006; Pelling, 2003). They also likely reflect the differential ability to pay for steps needed to reduce personal risk.

Local government inaction often is reinforced by lack of citizen concern about hazards (Burby, 2006; May, 1991). Failure to understand risk can result in the absence of residents' support for government standards to reduce risk or can cause noncompliance with such regulations (Laska and Morrow, 2006). Despite residents' resistance to early recommendations that would limit the city's vulnerability to future flood events, evidence indicates that concerns about future flooding and hazard mitigation are foremost on the minds of New Orleans' residents. In a survey of two planning districts hit hard by Hurricane Katrina, residents ranked concerns about the levees and future flooding among the top concerns influencing their decisions about whether to return to or stay in New Orleans (Laska, Gremillion, and Nelson, 2007; Laska et al., 2006). In March 2007, nearly all (93 percent) respondents polled by Louisiana Speaks stated that funding and implementing the coastal recovery plan was important; 80 percent of respondents found it very important. These results were consistent between African-American and White respondents (Louisiana Speaks, 2007). During Community Congress II, one of the large-scale community meetings that was part of the UNOP process, more than 2,500 residents of New Orleans weighed in on rebuilding issues, including hazard mitigation. When asked what should be done to reduce flood risk, 71 percent of participants expressed a high level or very high level of support for the creation and enforcement of mitigation standards (America*Speaks*, 2006).[7]

The apparent contradiction between residents' desire to return to their neighborhoods regardless of the environmental and economic risks of rebuilding and their concern for reducing their flood vulnerability reflects the fact that decisionmaking in postdisaster environments occurs in conditions of information scarcity and uncertainty and tremendous complexity. As a result, Pelling (2003: 70) notes, "decisions therefore take place within the context of bounded rationality. In this way, individuals who may otherwise have been perceived as acting irrationally in failing to reduce environmental risk in living environments can now be seen to have acted rationally in uncertain and possibly hostile informational and political environments, and to have been risk-averse in a world of multiple-layered risks." To residents faced with rebuilding their lives and communities, protection from future hurricanes and flood events is one of many concerns. Equally as worrisome

[7] Hazard mitigation happens at multiple scales, including individual, neighborhood, citywide, and regional levels. Support for citywide or regional efforts, such as building safer levees or investing in coastal restoration, does not necessarily mean support for local standards. Likewise, the enforcement of local standards does not ensure that the city of New Orleans will be safe from future flooding. New Orleans will not be safe without regional protection, and regional measures have gained almost unanimous support. Resident support for citywide or regional measures is likely due to the fact that residents have little direct responsibility for them.

is the loss of social ties and support systems, livelihoods, local culture, and the ability to make their own decisions about how and where to rebuild. Moreover, in the absence of any mechanisms that would enable residents of the most flood-prone parts of the city to move to safer areas, residents returning to New Orleans have been left with no other viable alternative than to rebuild in place.

Distrust

Residents' fundamental distrust of government and experts also blocked local government officials from addressing risk. The response to the BNOB process and recommendations highlights the initial distrust many residents felt for both local and national professionals and the government.[8] Although residents responded to specific proposals, the very fact that the initial response was resistance indicates that, instead of assuming governmental agencies and their representatives were looking out for city residents, many felt they had to protect themselves *from* the planners and decisionmakers.

The distrust of government officials and expert opinions was deeper than skepticism about the BNOB proposals and must be considered within the context of a history of discrimination and mistreatment. Development patterns that place some people at more risk than others reflect social disparities associated with race and income (Hurley, 1995; Laska and Morrow, 2006). The uneven distribution of environmental hazards has been well documented (Bullard, 1994, 1990; Hurley, 1995; Pastor, Sadd, and Hipp, 2001; United Church of Christ, 1987), and efforts to draw attention to and end these patterns have been termed "environmental justice."

Many residents, particularly African Americans, believed that their concerns and neighborhoods were neglected before the storm occurred. New Orleans East and the Lower 9th Ward, the two flooded areas that had weaker levee protection, are predominantly African American. Many residents of these areas articulated this injustice and suggested that their need for flood protection had gone unattended before Hurricane Katrina occurred.

Federal redevelopment policies such as urban renewal and highway development have repeatedly hurt African-American and low-income neighborhoods and residents nationwide, and New Orleans has been no exception. In the 1960s, when Interstate 10 was constructed along Claiborne Avenue, it cut through an African-American neighborhood and destroyed a vital retail corridor, and the recent HOPE VI redevelopment of the St. Thomas public housing development (now called River Garden) resulted in a net loss of affordable units to townhouses constructed for middle-income residents (Bagert, 2002).

In addition, in New Orleans, residents have not forgotten the 1927 Mississippi River flood. Other cities' attempts to raise their levees benefited White residents at the expense of African-American residents. In Greenville, Mississippi, for example, the police department forced African-American men into service shoring up the levees; if someone refused, he was beaten, jailed, or, on occasion, killed (Barry, 1997). On April 29, 1927, New Orleans officials dynamited a stretch of levee south of the city to protect New Orleans at the expense of the residents in downriver parishes. The decision

[8] Residents distrusted all levels of government and governmental agencies, but we discuss those aspects that had the greatest effect on the planning processes.

to flood downriver parishes was particularly heinous given that victims were promised compensation that they never received and officials had the option of dynamiting an upriver stretch of the levee that would not have affected any residents. The officials, however, wanted to inspire confidence that New Orleans was ready for business and, for that purpose, the upriver cut would have not have given the same sense that New Orleans was safe from disaster (Barry, 1997; Kelman, 2003; Powers, 2006).

In the context of these historical precedents—systematic federal policy failures, the experience of African Americans during the 1927 flood, and the city's proven willingness to breach the levees to protect one part of the region at the expense of another—many residents in New Orleans believe, or at least find it probable, that the breaches along the New Orleans Industrial Canal that flooded the Lower 9th Ward when Hurricane Katrina struck were intentional. Although this belief might appear irrational to outsiders and government officials, it highlights a powerful distrust regarding government protection of African Americans' interests.

Poor response to a disaster can further weaken belief in government (Ganapati, 2006). In New Orleans, the levee failures and the disastrous response to Hurricane Katrina reinforced residents' distrust of the federal government. Distrust permeated the planning processes because many people had no confidence that the proposals were in their best interest. When Mayor Nagin appointed the BNOB Commission, he failed to recognize that many visible BNOB Land Use Committee members would fuel suspicion because it was precisely developers such as Land Use Committee co-chair Joseph Canizaro who might benefit at the expense of ordinary residents.

Many African Americans viewed BNOB proposals as a means to keep them from returning to the city. This fear has been particularly acute (and hardly unreasonable) in light of the lack of viable policies or programs proposed by planners or local officials to help residents in the most flood-prone areas consider means of successfully returning and rebuilding safely. Instead of developing such programs, city officials responded to pressure from residents in unflooded areas who resisted temporary housing and increased density. In the fall of 2005, as the mayor's office and FEMA staff developed a list of trailer sites, they were met with resistance, and areas that exhibited more propensity toward collective action (as measured by voting rates before Hurricane Katrina occurred) were more successful in preventing trailer parks from being placed in their neighborhoods (Aldrich and Crook, 2006). When UNOP planners raised the possibility of proposing infill housing in unflooded neighborhoods in District 3, a planning district with significant income disparities, the response from residents in the district's wealthier, unflooded neighborhoods was negative, according to opinions expressed at the October 11, 2006, UNOP informational meeting for District 3.

Even when residents and experts agreed on the facts—which areas were less safe, who was disproportionately affected, who would be in danger—these factors alone did not result in fair policies that ensured that residents could return. The concern that some people will comparatively lose out is supported by research on previous disasters. Not all groups recover at the same rates, and those with more resources rebuild sooner and better (Haas, Kates, and Bowden, 1977b; Olshansky, n.d.). Following Hurricane Andrew in South Florida, recovery assistance was not distributed evenly, even among those with similar needs (Peacock, Morrow, and Gladwin, 1997), and after the 1994 Northridge earthquake in Los Angeles, areas with higher numbers of socially disadvantaged residents received less federal residential assistance than other affected areas (Kamel and Loukaitou-Sideris, 2004).

Despite the degree to which residents were wary of governmental actions, UNOP, a foundation-funded process operating outside of government, invoked equal or more suspicion. Although UNOP proponents hailed the effort as a resident-driven process, many New Orleans residents perceived the effort as one that would benefit White, wealthy residents; divert scarce rebuilding resources from flooded to unflooded neighborhoods; circumvent the city council planning process and independent, grassroots planning efforts; and create a public process to justify the BNOB Commission's earlier findings.[9] Furthermore, although the concept of clustering introduced in the UNOP citywide plan offers a middle-ground alternative between unplanned rebuilding throughout the city and proposals that prohibit rebuilding in the most flood-prone sections, some residents have suggested that clustering is just another attempt to deny them the right to return to their neighborhoods (Green, 2007).

The scientific rationale behind the planning proposals—assessments of storm patterns, safety in elevation, growing coastal erosion and the need to stem it, limited safety from levees, and the fear of increased frequency and intensity of storms due to changing weather patterns and global warming—did not engender the support that many professionals expected. Accompanying the distrust of government was skepticism toward scientific and technological knowledge and professional expertise (Fischer, 2000).

Despite the political and social context in which communities and city officials make planning decisions, many professionals continued to present—and even believe in—scientific and technological information as the sole determinant of future action instead of using it as a basis for deliberating over potential responses (Klosterman, in press). In New Orleans, the planners initially presented the citywide risk reduction proposals as a rational path to recovery instead of outlining the trade-offs present among various approaches. In many circumstances nationwide, community groups have developed enough knowledge about hazards to challenge industry experts with opposing interpretations, further undermining expert claims about scientific objectivity (Fischer, 2000).

Although New Orleans residents were quick to pick up the facts from the experts, they worked toward different outcomes. As planners proposed restricting the redevelopment of predominantly African-American parts of the city on the grounds that they were too unsafe to rebuild, many residents of those neighborhoods viewed such proposals as a means to keep them from returning to the city and the language of risk as something that could be used against them. In some instances, residents of neighborhoods hit hard by Hurricane Katrina attempted to shift the focus away from the relative risks associated with particular neighborhoods and adopted a "we're all at risk" rhetoric that instead emphasized the risks the entire city faced.

Information Scarcity

Distrust was exacerbated by the lack of information about the city's recovery strategy and how much power would be vested in the plans created. Overwhelmed with the sheer scale of Hurricane Katrina's devastation and with being severely understaffed, city agencies too often failed to convey the basic information residents needed. For residents returning to New Orleans, the most impor-

[9] Although the mayor and city council have accepted the UNOP plans, from their initial perspective, UNOP represented interference from the state and an unnecessary duplication of ongoing planning efforts (Williamson, 2007).

tant first steps in rebuilding their lives were not immediately obvious. Some people, especially those with personal financial resources, immediately began rebuilding their houses, while others waited—for guidance from the city, for the revised FEMA flood elevation maps, to see if their neighbors would return, for insurance money, and, later, for Road Home checks. Residents' lives were in disarray because of the flood, evacuation, and temporary living quarters. In addition, they were returning to a city where information was hard to come by.

When residents began to return in the fall of 2005 and the winter of 2006, they needed information about how to get services, whether their neighborhoods were safe to occupy, if they would have police and fire protection, and what the city's plans were. If their homes had been damaged, they needed to understand the damage assessment and decide whether their homes should be demolished. If they decided to rebuild, they needed to understand available mitigation options. Compounding these various issues, they were absorbing all this information while in a true clinical state of shock, which is typical in postdisaster environments (Olshansky, n.d.).

Although decisions were being made, residents were unclear about who the decisionmakers were. In addition, with the absence of adequate communication, many residents were unconvinced that the decisionmakers' priorities supported their own. Local officials did not have all the answers residents needed. City agencies did not know, for example, when a given street would be fixed or when the revised FEMA flood maps would be released. An understanding of what was known and what was yet to be determined was nevertheless important for residents. In addition to furthering the disbelief that the city was functioning effectively, the ongoing confusion advanced the sense that if anything was going to be accomplished, residents had to do it themselves. At times, engaged residents felt as if they were working against the city. The most visible officials—the city council members—bore the brunt of all rebuilding questions from their constituents, which taxed their busy offices and supported the perception that answers were hard to come by. Now, 2 years after the storm, this condition still fundamentally exists.

Section 4. Post-Hurricane Katrina Engagement: What Neighborhood Activism Can Accomplish

The unprecedented engagement in planning efforts by New Orleans residents has greatly influenced the direction of rebuilding. Fearing they would be prohibited from rebuilding, residents immediately resisted the BNOB Land Use Committee proposals and began proving the viability of their neighborhoods. New organizations sprang up overnight, and established organizations turned their attention to recovery, including searching for their neighbors to determine who would return and evaluating the conditions on every neighborhood block.[10] Soon, however, the residents' discussion shifted from proving neighborhood viability to taking charge of the recovery because they felt less confident that the leadership was in fact leading. News and media stories frequently report ways in which residents continue to perform functions that, before Hurricane Katrina, the city would have done. Examples abound: picking up debris, gardening median strips, getting construction companies to fill potholes, posting makeshift street name signs, and trimming trees on public land.

[10] New Orleans had an active base of neighborhood organizations before Hurricane Katrina. The storm provided a sense of urgency and helped reinvigorate many established organizations.

Neighborhood organizations across the city also began to plan their neighborhoods' recovery. According to the CityWorks Directory of Neighborhood Organizations for Orleans Parish, more than 200 neighborhood-based groups are located throughout the city (CityWorks, 2007). Numerous umbrella organizations have also been established. The Gentilly Civic Improvement Association's board, for instance, is composed of leaders from most of the 23 neighborhood organizations in Planning District 6. Other organizations, such as the Neighborhoods Partnership Network and the Planning Districts Leadership Coalition, act as networks and coalitions with differing degrees of formal structure.

Post-Hurricane Katrina activism was to be expected. Evidence from other cities recovering from disasters suggests that disasters spur activism. Ganapati (2006) found that new social networks developed among affected people after the 1999 earthquake in Golcuk, Turkey, and argues that after such a significant event, people who were affected might increasingly want to determine their fate. The 1985 Mexico City earthquake damaged downtown neighborhoods that housed, employed, and provided basic services for hundreds of thousands of residents. After the earthquake occurred, residents organized to challenge and redirect the city's response priorities (Davis, 2005). In Homer, Alaska, after the 1989 Exxon Valdez oil spill, emergent groups immediately formed to protect fisheries, while others later took on diverse projects such as rehabilitating otters, cleaning beaches, and establishing cleanup priorities (Button, 1993). In all three places, residents responded to immediate needs that the government did not satisfactorily address. New social networks were also necessary for residents as they faced losses, decided how to rebuild their lives and their cities, and procured resources and other assistance.

The evacuation from New Orleans disrupted existing social networks, and new organizations needed to be formed. Long-lasting social and familial networks had been fundamental to residents' attachment to the city and the neighborhoods where they lived. Nonetheless, these social networks did not always translate into structural change in the sense that, despite these connections and a strong faith-based nonprofit sector, significant portions of the pre-Hurricane Katrina population had low incomes, attended inadequate schools, and had few employment opportunities. Ganapati (2006) differentiates between the cognitive components of social capital—trust and reciprocity that create supportive networks—and the structural components—civic networks that achieve structural changes through collective action. In New Orleans, there is a strong consensus that the cognitive elements of social capital before Hurricane Katrina were very strong; however, the structural components may not have been as strong, or at least sufficient, to overcome the economic, social, and political challenges. In this new environment, the focus was on creating organizations to facilitate structural change and, as a result, successful rebuilding.

Engagement took different forms. New community organizing institutions such as the People's Hurricane Relief Fund and Oversight Coalition and Common Ground Collective joined established community organizers such as the Association of Community Organizations for Reform Now. Community organizing institutions differ from other neighborhood- and community-based organizations in their approach. Although many neighborhood organizations focus on specific issues and work within the existing political structure, community organizing institutions also attempt to change the social and political structure that produces inequity (ACORN, n.d.; Common Ground, n.d.; People's Hurricane Relief Fund, n.d.). These distinctions can become blurred in practice

(Saegart, 2006); thus, these organizations focused on both meeting immediate needs, such as gutting houses, cleaning streets, and providing information, and attending to more structural questions of justice, including advocating for the right to return, opposing demolition in low-income neighborhoods, and focusing on the fact that low-income African-American neighborhoods had been hard hit and their residents faced structural obstacles to return. ACORN also initially participated as a planning team in the UNOP process but ultimately carried out an independent planning effort that resulted in the People's Plan that included the 9th Ward (ACORN, 2007).

Neighborhood residents met to share information and determine whether others intended to rebuild; many residents also wanted to develop organizations with formal structures and build their capacity to undertake specific recovery and redevelopment projects. Numerous neighborhood organizations established community development corporations (CDCs) to address redevelopment in their neighborhoods. The Mary Queen of Vietnam Church in New Orleans East established a CDC in June 2006. In the past year, according to information reported at the City Council Recovery Committee Meeting on May 30, 2007, the CDC has distributed $21 million to small businesses, organized to close a landfill near the community, and is working to develop senior housing. The Hollygrove and Broadmoor neighborhoods also have active CDCs. The Lower 9th Ward organization Neighborhood Empowerment Network Association (NENA) applied for and received funding to open a community center and hire staff to help residents work with contractors, negotiate The Road Home Program, and provide other services that returning residents needed.

Community groups have targeted local rebuilding issues and simultaneously taken on citywide or regional problems, including affordable housing, wetland restoration, landfill and storm debris management, historic preservation, levee integrity, and future storm protection. Because much work will be initiated and funded by the federal and Louisiana state governments, groups have advocated for programs and funding and, in the process, have highlighted their priorities, raised awareness of these challenges, and acted as watchdog organizations. As noted earlier, this important grassroots work throughout the city, nevertheless, does not offer a framework for making difficult decisions about how to prioritize limited redevelopment resources. These issues are particularly contentious given that some neighborhoods stand to benefit more from the city's investment decisions, or at least benefit sooner, than others do.

Policymakers and residents also have collaborated to modify mitigation policies. Broadmoor, one of the neighborhoods lowest in elevation, was "green dotted" by the BNOB process. As a result of local activism, Broadmoor residents have pushed FEMA to consider the idea of "buying out" basements; residents can currently use National Flood Insurance Program Increased Cost of Compliance funds to remove all items from their basements if their homes' main floors are above the FEMA Advisory Base Flood Elevation levels. Broadmoor residents are trying to get FEMA to buy out a portion of their mortgages if residents are unable to use their basements. Although mortgage buyout might not happen, it exemplifies the type of solution that a dialogue between residents and professionals can develop. During the planning process, city officials avoided such dialogue, did not encourage or reward mitigation efforts, and lost an opportunity to work with the residents to develop risk reduction strategies.

After a disaster occurs, community involvement should be anticipated because people must rebuild their lives. Demand for participatory democracy emerged in the 1960s and 1970s, when people

nationwide demanded more influence over policies and programs that did not always work in their best interests. Innovations in participatory urban governance have been a quiet revolution in U.S. cities (Sirianni and Friedland, 2001), and New Orleans has many models from which to draw to establish long-lasting networks. Although it is too early to assess the long-term changes associated with post-Hurricane Katrina activism in New Orleans, demand for government access by residents and assurances by the city council provide hope or awareness that open discussion has indeed become an expected priority. In the words of one resident, spoken at the June 13, 2007, City Council Recovery Committee Meeting, "the growing passion we have in this city for participation will accept no less."

Section 5. Conclusion: Lessons From New Orleans

The recovery planning processes in New Orleans highlight important planning lessons that will enable other communities to contemplate the recovery-strategy tensions that inevitably arise in the wake of disasters and to consider the key needs that must be addressed. An understanding of these tensions and needs may help communities alleviate or avoid some of the oversight and missteps that have impeded postdisaster recovery in New Orleans.

Anticipate the Tension of Timing in the Pace of Recovery Planning

The tension between the conflicting needs for speed and deliberation in recovery planning has surfaced in both the development of policies to ensure a safe recovery and the planning processes to create a citywide recovery framework. Although the tension of timing is to be expected in a postdisaster environment (Kates et al., 2006; Olshansky, 2006), it was exacerbated by local government missteps.

In the "rush to rebuild the familiar," (Kates, et al., 2006: 14,656) residents rejected the proposed building moratorium that could have provided sufficient time to engage residents, planners, and officials in a dialogue about the difficult tradeoffs the city faced and could have facilitated the development of policies or guidelines that would have helped residents rebuild their homes and communities more safely. Local government should have anticipated residents' negative reaction and responded to their concerns in a way that would have encouraged conversations about the most contentious issues. Instead, the mayor, seemingly caught off guard by residents' response, distanced himself from BNOB recommendations and skirted those important discussions altogether.

A deliberative, participatory recovery planning process was necessary to ensure that residents would help guide the rebuilding of New Orleans and to foster support for associated policies. A participatory process could also help incorporate residents' and other stakeholders' different knowledge bases and priorities in recovery policies. Although thousands of residents took part in the various processes, many became tired of the endless stream of planning meetings. For some residents and leaders, planning was seen as a roadblock to recovery. Planning fatigue and residents' demand for implementation illustrate important weaknesses of participatory planning: participatory planning is slow, and it can be difficult to sustain energy and confidence during the process.

Such weaknesses are heightened in a postdisaster setting, considering the fragile emotional state of many residents and the numerous demands on their time. The time required for any delibera-

tive process can be taxing. In New Orleans, this fatigue was aggravated by multiple, competing planning processes that heightened the confusion and anxiety common in postdisaster recovery and cast doubt that planning would actually accomplish anything. An organized process would at least convey that the meetings were accomplishing concrete objectives and, even if the amount of time spent on planning seemed endless compared with the need for quick recovery, the time spent would feel purposeful.

Develop a Plan To Plan

Having a "plan to plan" in the aftermath of a disaster can increase the speed and transparency of postdisaster decisionmaking. Such a plan would outline what work needed to be accomplished, how it would be accomplished, and who would accomplish it. Because recovery planning involves stakeholders with competing priorities, it is particularly important to designate an agency or authority to guide and oversee a process with well-defined ground rules and an explicit intent to integrate divergent interests into a coherent and fair recovery blueprint. Designating a single authority to oversee recovery planning and subsequent implementation efforts would also eliminate duplicative efforts by rival agencies or authorities.

The absence of a single authority or agency to oversee post-Hurricane Katrina planning fundamentally compounded the confusion about recovery and rebuilding in New Orleans. The City Planning Commission, the city-chartered body responsible for planning, was largely overlooked by the multiple processes. The CPC, however, was granted the authority to review and recommend the recovery plans and, therefore, would have been an appropriate agency to oversee a comprehensive recovery planning process from the start. A single agency could have streamlined the process and eliminated duplication of efforts, thus saving valuable time, resources, and residents' energies and, potentially, could have quelled tensions between the mayor and the city council and between city and state officials. The designated agency, however, would have to have the capacity to do the work and, depending on the size of the agency before the disaster and the scale of the disaster, this capacity might require augmenting. In New Orleans, the CPC's capacity was decimated. Already understaffed before Hurricane Katrina occurred, the CPC lost two-thirds of its staff in the drastic city employee layoffs that occurred immediately after the storm made landfall (Eggler, 2005). These poststorm cuts reflect a lack of recognition by city officials that such systematic planning was important for the city's successful recovery.

Anticipate Residents' Distrust of Government and Professionals

In New Orleans, a second type of conflict resulted from the differences in how residents and professionals perceive the risks associated with rebuilding and many residents' deep distrust of government and professionals. The residents' fierce resistance to original proposals to rebuild New Orleans safer and smarter, while seemingly irrational to some observers, was not irrational at all. Residents were considering the multiple threats they were facing—the loss of control over where they could live, the loss of tightly knit neighborhoods of extended families and friends, and the fear that political decisions would serve developers before residents and wealthy residents before low-income residents. Safety from future flooding and access to services were only two of their many serious concerns.

Differences in how residents and professionals perceive risk also reflect the great distrust many residents have of government officials, professionals, and subject matter experts. In New Orleans, planners proposed restricting the redevelopment of predominantly African-American parts of the city on grounds that they were too unsafe to rebuild; however, because they offered no viable ways for residents to return to New Orleans, reducing risk would have eliminated African-American neighborhoods. As a result, some residents viewed discussions of risk as a means of exclusion and "shrinking the footprint" as a euphemism for efforts to make New Orleans a more White, more affluent city or as a means for "ethnic cleansing."

Planners and public officials need to anticipate and expect distrust. They need to acknowledge that vulnerabilities to hazards and disasters are products of the social, political, and economic systems (Blaikie et al., 1994), and they must understand the implications of the policies and programs they propose. Gilbert F. White, considered the "father of flood-plain management," wrote in 1942, "Floods are 'acts of God,' but flood losses are largely acts of man" (Bourne, 2007).

Planners must also recognize that existing divisions within a city will also be exacerbated in the stressful postdisaster circumstances. Although public officials or a designated agency must develop a deliberative, participatory planning process to build trust in the process' outcomes and ensure that the plans will, in fact, reflect the interests of multiple stakeholders, these goals are difficult to accomplish because of the significant time pressures and intensification of existing differences. At times, outside experts might be able to facilitate collaboration because they have less invested in specific outcomes. Outside participation does not guarantee neutrality, however, and outside professionals must build relationships and trust and must understand the basis for existing divisions if they intend to bridge them.

Anticipate Engaged Residents

Activism among residents should be anticipated and supported. Activism and the deep commitment to the city it represents are key elements of resiliency. Planning processes need community members to help set priorities and devise projects. To the extent that the planning processes can facilitate building skills and capacity to further neighborhood recovery, they will help with long-term rebuilding and ensure that residents throughout the city develop technical expertise. To build confidence instead of cynicism, however, the participation must result in measurable, visible outcomes benefited by the residents' participation.

In New Orleans, many people hope grassroots energies will grow, the city will develop mechanisms to support and incorporate resident participation, and neighborhood organizations will continue to build their capacity to undertake recovery and redevelopment projects at the neighborhood level and more effectively inform citywide rebuilding policy. The Office of Recovery Management has been tasked with developing such a strategy, and the proposals thus far have indicated that the ORM is mindful of residents' concerns and realistic about the priorities that must be set.

Residents alone cannot do everything, however. Although community energy and efforts and local knowledge can and should shape and direct citywide policy, neighborhood efforts cannot substitute for finalizing that policy. Citywide disasters necessitate hard decisions that will be unpopular with some segments of the population. When such decisions have been identified—for example,

where to direct scarce resources or where to place temporary housing—the process by which those decisions are being made should be transparent and decisions should be made at the city level. To the extent that engagement can be participatory, it should be, but engagement itself cannot replace the fulfillment of substantive objectives, and decisionmaking must continue in the face of opposition. Trust among people and entities is one of the most important factors in communities' resiliency. If a government is to gain and maintain its citizens' trust, it also must act effectively and, in the process, sometimes make difficult and unpopular decisions.

The decisions a city must make after a disaster occurs are complex, and professional expertise will be necessary. Because nonprofessionals will be active, professional experts should contribute their knowledge and technical assistance to ensure that residents not only have the information they seek but also have access to the knowledge they need for making difficult decisions. Outside professionals must participate in the process with a willingness to work with local residents and professionals. Instead of solely offering expertise or assuming that their professional assessments are correct, professionals should acknowledge that few straightforward solutions exist for rebuilding priorities in complex social and political environments. They must engage as knowledgeable participants but be able and willing to adapt their expertise to local circumstances (including cultural and political contexts). They must also recognize what they do not know while contributing what they do know.

Understand What Planning Can and Cannot Do

The New Orleans planning processes have been both important and frustrating for city residents, as is typical in postdisaster circumstances. Despite those challenges, residents participate because their recovery depends on it. Although some degree of frustration must be anticipated, allowing planning to perform many functions can ensure that everyone's time is at least well spent.

Plans were needed to convey to investors, the federal government, and philanthropic organizations that the city had a recovery strategy and to lay out what that strategy was. Both objectives had to be clear to participants, including what specific outcomes could and could not be expected. Although plans are never final or absolutely determinative, they are influential. For example, the target areas that the ORM decided on were identified in the New Orleans Neighborhoods Rebuilding Plan and UNOP processes, and the specific proposals in the plans will guide future development.

Planning can do so much more. Plans are limited and, at best, act as guides for future development. The relationships and visions spawned from planning, however, can inspire and sustain residents throughout a long rebuilding process and help direct efforts to fulfill shared goals. The planning process can and should build relationships and create collaborations among a wide array of stakeholders. In addition, in postdisaster circumstances, if necessary, the process can also be used to disseminate basic information and ensure that all residents have access to accurate information from the city and other involved entities.

Although no planning process can make amends for past injustices or benefit everyone equally, building trust in the city and recovery efforts is something that it can begin to do. To build trust, the process and policies must be fair. Ultimately, some people will comparatively lose out and will be individually dissatisfied—and, although cities will recover, not all individuals in those cities will fare well (Olshansky, n.d.). A worthwhile objective would be to design policies that would neither

be perceived as or have the effect of sacrificing any group's safety or inclusion under the guise of betterment for the city as a whole.

Recovery after a large disaster will be slow, but the passion that people have for their cities ensures that, even facing an arduous path, residents will return and rebuild. Unprecedented resident activism demonstrates both residents' capacity to grow under adverse conditions and the strong attachment residents have to New Orleans. Both are indicators of resilience and ensure that New Orleans will recover. New Orleans residents can never lose sight of the goal: to not only recover but to rebuild better and create a city where all residents, including those with the least resources, have an opportunity to safely return and thrive.

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Hurricane Katrina: Environmental Hazards in the Disaster Area

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Abstract

The flooding of New Orleans by Hurricane Katrina provides many lessons for the environmental and engineering communities and raises public policy questions about risk management. Although serious environmental and waste management issues were expected as a result of the flooding, extensive environmental sampling largely failed to substantiate them. The attention of those managing the emergency was diverted from critical issues to addressing this area of public apprehension. The potential environmental consequences were of concern because many chemical plants, petroleum facilities, and contaminated sites, including Superfund sites, in the area were covered by floodwaters. In addition, hundreds of commercial establishments, such as service stations, pest control businesses, and dry cleaners, use potentially hazardous chemicals that may have been released into the environment. The potential sources of toxics and environmental contaminants include metal-contaminated soils typical of old urban areas. Compounding these concerns is the presence of hazardous chemicals commonly stored in households and the fuel and motor oil in approximately 350,000 flooded automobiles. Uncontrolled biological wastes from human and animal sources also contributed to the pollutant burden. By and large, however, the environmental problems in the city are not significantly different now from environmental conditions before Hurricane Katrina. This discussion focuses on successes and failures in responding to the environmental concerns and on lessons learned for future disasters.

Introduction

Hurricane Katrina made landfall on August 29, 2005. The storm surge devastated the exposed coastline, including portions of the Louisiana and Mississippi coasts. In addition, failures in the hurricane protection system around New Orleans led to extreme flooding in portions of the city.

Much of the city was inundated by floodwaters 2 to 3 meters deep and, in some cases, 5 meters or more deep. New Orleans is a city at risk, with much of the city well below sea level. The city's protection against that risk includes levee structures that divide the city into a number of polders and large pumping stations that can be used to drain water from those tracts of reclaimed lowlands. When portions of the levee system failed, combined with the failure of or inability to activate the pumping systems, extensive flooding was the inevitable result. In some areas, near catastrophic failures of the levees were noted, and the ensuing rush of water destroyed homes and businesses immediately. In other areas, floodwaters overtopped and undermined levee systems and slowly flooded portions of the city. The flooding led to other infrastructure failures, such as the shutdown of power generation facilities necessary to operate the massive flood control pumping stations and the release of oil from a crude oil tank that led to further destruction in the community.

The flooding had a variety of effects beyond direct or indirect destruction of homes and property. When Hurricane Katrina flooded the city of New Orleans and adjacent areas, one of many concerns was whether widespread chemical contamination resulted from the flooding. In any city, many potential sources of toxic chemicals, such as hydrocarbon fuel storage and distribution facilities and commercial chemical storage, exist. Old inner-city neighborhoods often exhibit elevated levels of metals such as lead and arsenic. Homes and vehicles are also sources of toxic contaminants, with gasoline or diesel and crankcase oil from vehicles and toxic materials such as herbicides and pesticides that may be found in homes. In addition, several large chemical and petroleum production facilities operate in and around New Orleans, as well as old contaminated sites that have undergone or are currently undergoing remediation. Exhibit 1 shows the potential petroleum-related release points, including refineries, oil and gas wells, and service stations near the city. Exhibit 2 shows the major hazardous-material storage locations, Superfund sites, and Toxics Release Inventory reporting facilities.

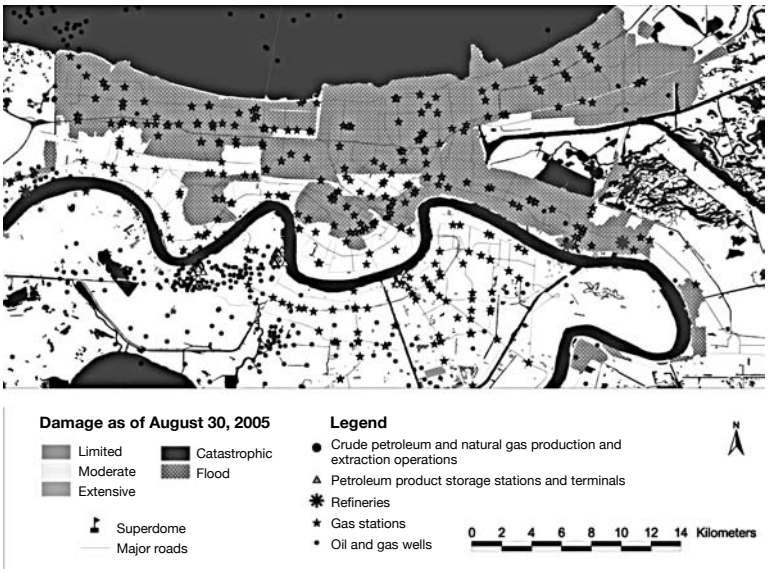
This combination of potential contamination sources led to concerns that the flooding produced a "toxic gumbo" that would significantly affect emergency response and both short- and long-term rehabitation by posing a risk to human health. A number of sampling efforts were initiated to understand and effectively respond to any potential concerns. In addition to concerns about the human health risks associated with floodwaters or any postflood residual, another environmental concern was the solid waste and debris left in Hurricane Katrina's wake. The extensive flooding resulted in significant amounts of solid waste that challenged the community's means of disposing of such waste. Given limited secure landfill space and a desire to avoid large-scale transportation of waste, much of the waste was disposed of in less-secure landfills, raising additional concerns about the long-term environmental hazards posed by the flooding.

This article focuses on assessing the environmental challenges posed by Hurricane Katrina and the implications of those challenges for both short- and long-term risks to the community[1] (Reible et al., 2006). The primary focus, however, is not to detail the events of Hurricane Katrina but to provide

[1] The discussion here is largely excerpted from Reible et al. (2006). This discussion also was presented as part of the North Atlantic Treaty Organization Advanced Research Workshop on Decision Support for Natural Disasters and Intentional Threats to Water Security held April 2007 in Dbrovnik, Croatia, and was published in the proceedings of that workshop. For additional information, see Walsh et al., 2006, which further examines the legal and policy issues raised by the flooding of New Orleans.

Exhibit 1

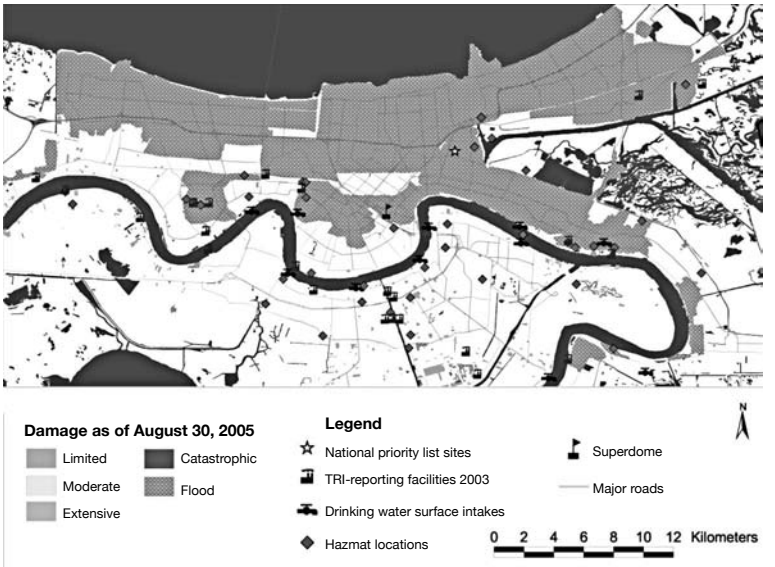
Map of New Orleans Showing Flooded Area and Petroleum and Natural Gas Extraction, Refining, and Distribution Facilities



Source: NIEHS (2005)

Exhibit 2

Map of New Orleans Showing Flooded Areas and Hazardous-Material Release, Storage, and Disposal Areas



TRI = Toxics Release Inventory.
Source: NIEHS (2005)

lessons for future similar disasters. This article raises questions that must be resolved when a community is appropriately responding to and recovering from such a calamity. In addition, this article addresses the failures that led to the human and economic disaster and the potential for more effectively avoiding such a disaster in the future.

Causes of the Disaster

Although Hurricane Katrina was certainly the instigating event for the disaster in New Orleans, only the catastrophic damages in the exposed Louisiana and Mississippi coasts can be considered largely unavoidable. The flooding in New Orleans has been found to be largely the result of a variety of human failures, including the following:

- Inadequate safety factors were used in the design of hurricane protection levees.
- Different political jurisdictions were responsible for constructing and maintaining the levees, leading to uneven design and levels of protection.
- The wetlands in the surrounding area, which could have acted as buffers and mitigated the effects of the hurricane, had been lost to development.
- The presence of potentially aggravating factors, including a navigational canal (the Mississippi River-Gulf Outlet Canal), allowed the full storm surge to penetrate deeply into the New Orleans area.

The causes of the catastrophe and the failure of the inadequate human response have been detailed in several studies and reports, including those of the Interagency Performance Evaluation Task Force (IPET, 2007), American Society of Civil Engineers External Review Panel (ASCE, 2007), and National Research Council Committee on New Orleans Regional Hurricane Protection Projects (NRC, 2006). In addition, both the coastal areas of Louisiana and Mississippi and the city of New Orleans suffered from inadequate evacuation efforts that certainly contributed to the loss of life. Evacuation problems included citizens' failure to heed the calls for evacuation and inadequate planning for citizens who had no practical means of evacuating.

Environmental Implications of the Flooding

The focus in this section is on the environmental consequences of the disaster during the event and long after floodwaters were removed from the city. Federal and state officials made several efforts during and after the flooding to monitor and quantify chemical and biological contamination and assess exposures to, and risks from, toxics and contaminants. Federal agencies, including the U.S. Environmental Protection Agency (EPA) and National Oceanographic and Atmospheric Administration, collected environmental samples both in New Orleans and from the surrounding area affected by Hurricane Katrina. Initial concerns in the city focused on acute exposures for stranded residents and relief workers. Subsequent efforts focused on acute exposures for returning residents and initial assessments of chronic exposures. Pardue et al. (2005), Presley et al. (2006), and the Natural Resources Defense Council (NRDC) (2005b) have reported the results of independent sampling.

Floodwaters were present in the city from the passage of the storm on August 29, 2005, until the U.S. Army Corps of Engineers (USACE) declared the city to be dewatered on October 11, 2005. Sampling showed elevated levels of inorganic and organic contaminants and biological constituents, including pathogens. The level of inorganic contaminants was generally low, even compared with drinking water standards. Presley et al. (2006) found no floodwater samples with concentrations higher than those designated for drinking water or acute and chronic threshold concentrations. Pardue et al. (2005) noted consistently high levels of arsenic in the floodwaters (a mean of 30 parts per billion, or micrograms per liter, compared with a maximum contaminant level of 10 micrograms per liter in drinking water). Drinking water standards, however, are not an appropriate indicator of water quality for floodwaters because exposure to floodwaters is expected to occur through contact, not ingestion. The standards do, however, provide at least a conservative (that is, protective) basis for comparison.

Organic constituents in floodwaters were also observed at relatively low concentrations. This observation was initially met with some surprise because of the evident oil and hydrocarbon fuel spills in many locations. Soluble petroleum oils and fuel constituents, such as benzene, however, are typically volatile, leading to rapid release to the air; less-soluble constituents would partition to sediments left behind by the floodwaters. EPA concluded that inorganic and organic chemical concentrations in the floodwaters were generally below levels of concern for short-term (90 days) dermal contact and incidental ingestion (EPA, 2005b).

Bacterial contamination in the floodwaters was a source of great concern. Both *most probable number* (MPN) and *colony forming units* (CFU) are measures of the number of bacteria. Median concentrations of fecal coliform of approximately 104 MPN per 100 milliliters were detected in the floodwaters (Pardue et al., 2005). This concentration can be compared to a water quality standard for primary contact of 200 MPN per 100 milliliters. The detection of human pathogens, such as *Aeromonas spp.*, at concentrations on the order of 107 CFU per milliliter at two locations in the downtown area raised even greater concern (Presley et al., 2006). Members of the genus *Aeromonas*, which has been associated with diarrhea and wound infections in humans, have also frequently been isolated from soils and fresh water.

Another major concern was the immediate and long-term effects of the discharge of floodwaters into Lake Pontchartrain. From September 6, 2005, to October 11, 2005, the floodwaters, which had largely originated in the lake, were returned to their source. Lake Pontchartrain is a brackish, shallow lake with a surface area of approximately 1,630 square kilometers and an average depth of about 4 meters; an active commercial fishery is on the lake. Pardue et al. (2005) detected low levels of dissolved oxygen in floodwaters and discharged water, which likely resulted in low oxygen levels in the immediate vicinity of the discharge point, but which had a minimal effect on the lake as a whole. Similarly, the generally low levels of inorganic and organic contaminants in the floodwaters were unlikely to have significant effects on Lake Pontchartrain. According to one estimate, 200 billion gallons of floodwaters (about 11 percent of the volume of Lake Pontchartrain) were pumped from New Orleans (Roper, Weiss, and Wheeler, n.d.).

The sediments at the mouths of the discharge canals contained some contaminants before the flooding due to normal wastewater and stormwater discharges from the city. The Hurricane Katrina floodwaters were similar in character, although significantly larger in volume, to the normal

stormwaters discharged into the lake (EPA, 2005b). Bacterial contamination of the discharge waters was typically an order of magnitude greater than it was before they were discharged into the lake (as measured by fecal coliform concentration). Despite this contamination, in more than 100 samples collected by EPA in September and October 2005, bacterial levels in the lake were within recreational limits (EPA, 2005b).

In summary, with the possible exception of biological pathogens, direct exposure to floodwaters either in the city or in Lake Pontchartrain appeared likely to have minimal toxic or contaminant effects. Although direct exposure to floodwaters appeared to have minimal long-term consequences, the long period of exposure to floodwaters led to extensive mold growth in homes. Airborne exposure to mold appears to be one of the most serious short-term issues residents faced during post-Hurricane Katrina reconstruction. Using respiratory protection during the removal of all mold-contaminated materials and reconstruction, however, can mitigate the risk of exposure to airborne mold.

Environmental Implications of Residual Sediment

Although floodwaters were removed from the city of New Orleans by October 11, 2005, their legacy of contaminated soils, sediments, debris, and houses remained. In addition, sediment mobilized from storm surge moving through Lake Pontchartrain and the Mississippi River-Gulf Outlet/Industrial Canal was deposited in the city. Additional sampling was done to assess the concentrations of chemical and biological contaminants in these media. Presley et al. (2006) found several inorganic constituents (arsenic, iron, and lead) and organic constituents in sediments from New Orleans that exceeded EPA Region 6 Human Health Medium-Specific Screening Levels for soils. The organic constituents of concern were mostly polycyclic aromatic hydrocarbons (PAHs), which are complex, high-molecular-weight compounds that result from the incomplete combustion of fossil fuels and are also present in natural sources. EPA Region 6 Human Health Medium-Specific Screening Levels are used to evaluate the "relative environmental concern for a site or set of environmental data. The values are not regulatory, but are derived using equations from EPA guidance and commonly used defaults" (EPA, 2005a).

The screening levels are not intended to represent action levels or cleanup levels but rather are intended as a technical tool for identifying potential hazards. The screening levels correspond to fixed levels of risk based on simplified assumptions of uniform lifetime exposures.

Of the 430 sediment samples that EPA collected between September 10, 2005, and October 14, 2005, a number exceeded the screening criteria of the local regulatory authority, the Louisiana Department of Environmental Quality (LDEQ), which developed the criteria in conjunction with its Risk Evaluation/Corrective Action Program (RECAP) (LDEQ, 2005). The criteria were developed to meet objectives similar to those of the EPA Region 6 Human Health Medium-Specific Screening Levels and were derived similarly. The constituents most often found to exceed the RECAP screening criteria were arsenic, lead, several PAHs (including benzo[a]pyrene, a carcinogen), and diesel range organics (diesel fuel and byproducts).

On November 19 and 20, 2005, EPA resampled areas where previous sampling had indicated contaminant concentrations in excess of screening criteria and where sediment depth equaled or

exceeded 0.5 inch (EPA, 2005b). Because of the complex nature of the storm surge, levee breaches, and overtoppings, the amount of sediment deposited in flooded areas varied widely, and only 14 of the 145 locations resampled by EPA had sufficient sediment depth for testing. Three samples showed arsenic concentrations higher than 12 parts per million or milligrams per kilogram (14.4 to 17.6 milligrams per kilogram); one sample showed a benzo[a]pyrene concentration of 0.77 milligram per kilogram and one sample showed a concentration of diesel range organics of 2,100 milligrams per kilogram. Other samples were below applicable screening values.

The EPA also collected samples at specific sites where known or potential leaks of hazardous materials existed. Elevated concentrations of total petroleum hydrocarbons and a variety of crude oil-associated contaminants were observed in the vicinity of the Murphy Oil crude oil tank failure and spill; these chemicals and contaminants had a clearly identifiable source and could be easily differentiated from the general flooding-related contamination. The Murphy Oil-contaminated area is being managed separately from the rest of the flooded area and is not addressed further in this article.

EPA also collected 74 soil samples at the site of the Agriculture Street Landfill, a closed Superfund hazardous waste site that was flooded by Hurricane Katrina and that is still undergoing cleanup. The samples were collected immediately above the geotextile liner (12 to 24 inches below ground), which was installed as part of the site remedy. All samples were analyzed for lead, the contaminant of concern that defined the cleanup, but none showed concentrations that exceeded the lead cleanup standard or EPA screening standards for lead. EPA concluded that the flooding did not affect the effectiveness of the remedy (EPA, 2005c).

The NRDC analyzed samples from the Agriculture Street site for other contaminants and found arsenic at levels similar to those found at other New Orleans sites and a variety of high-molecular-weight PAHs at somewhat elevated levels (NRDC, 2005c). Although NRDC ascribed the presence of the high-molecular-weight PAHs to leachate from the landfill, due to the hydrophobic nature of these compounds, they more likely had been transported by resuspended soil from the site or elsewhere. Further assessment of the Agriculture Street area might be warranted.

Another phase of focused sampling of soil and sediment ended February 22, 2006. This phase involved taking 147 composite samples in 43 specific flood-affected residential areas where previous sampling found concentrations of arsenic, lead, or petroleum indicators in excess of risk management screening levels. The purpose of this sampling effort was to determine whether the locations with elevated levels of these chemicals were isolated or whether they were representative of a larger contaminated area.

Arsenic levels did not exceed EPA's safe risk management level, although apparently elevated concentrations were often noted. The concentrations of arsenic throughout the Mississippi River Delta region of south Louisiana is on the order of 10 milligrams per kilogram (Gustavsson et al., 2001), and LDEQ has reported a background arsenic concentration of 7 milligrams per kilogram. Pre-Hurricane Katrina concentrations of arsenic could be even higher in residential areas because of arsenic in lawn fertilizers (WSDA, 2001).

The only area with a PAH contamination in excess of risk screening levels was an area near the Agriculture Street Landfill. Lead concentrations exceeded 400 milligrams per kilogram (the screening level) in 57 of 147 composite samples (38.1 percent). The level of exceedances is similar to a pre-

Hurricane Katrina study of New Orleans that indicated that about 40 percent of nearly 5,000 soil samples had lead levels in excess of 400 milligrams per kilogram (Mielke et al., 2004; Pelley, 2006). Nationwide, approximately 23 percent of privately owned homes in the United States built before 1978 are estimated by EPA to contain soil-lead levels above 400 milligrams per kilogram. In 2000, 14 percent of the children tested in the vicinity of the city of New Orleans had lead levels in excess of the federal advisory level of 10 micrograms per deciliter of blood.

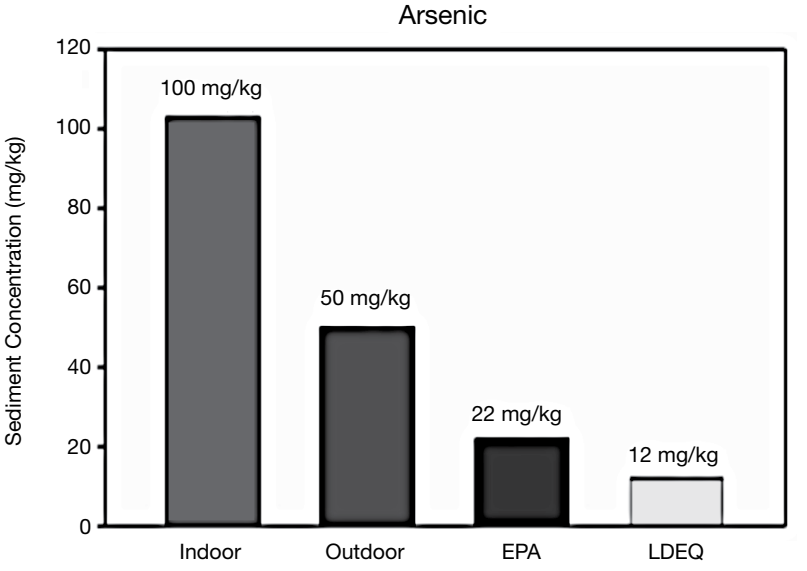
A fourth phase of sediment sampling (also conducted in February 2006) in flood-affected areas involved taking 712 samples from 586 locations in Orleans and St. Bernard Parishes based on a 200-foot grid. EPA was unable to collect samples at another 1,090 locations because either insufficient or no sediment was present to sample or the location was in a commercial area; only 35 percent of the locations had sufficient sediment or were residential. In only one sample, arsenic, lead, and benzo[a]pyrene each were detected in concentrations exceeding the risk management screening level (that is, the one-in-one hundred thousand excess lifetime cancer risk level for arsenic and benzo[a]pyrene or the 400-milligrams-per-kilogram risk management screening level for lead), which equates to roughly 0.4 percent of the samples. The reduced frequency of elevated contaminant levels was associated with the random sampling rather than biased sampling toward areas that had previously exhibited elevated levels as in the third phase of sampling.

The conclusion from the residual sediment sampling was that, on the whole, post-Hurricane Katrina sediment contaminant levels did not differ significantly from pre-Hurricane Katrina levels. Contaminant levels in specific areas, such as the vicinity of the Murphy Oil crude oil spill, were significantly affected by the flooding, but generally the flooding and deposition of residual sediments appeared to have little effect on exposure to contaminants. This observation does not suggest, however, that the contaminant exposures were of no concern or were inconsequential. Significant concern about chronic contaminant exposures in the city of New Orleans was present before Hurricane Katrina occurred, and this concern persisted after the hurricane affected the area.

Of special concern is the limited evidence that indoor biological and chemical hazards may be far greater than suggested by generalized outdoor sampling and assessments. The sheltered environment indoors provides an opportunity for the growth of biological hazards, including bacteria and mold, but also is a source area for chemical hazards as a result of the storage of household hazardous materials. Furthermore, as shown in exhibit 3, for arsenic, limited sampling of residual sediments indoors has suggested that these sediments may be significantly concentrated with respect to contaminants relative to outdoor soils and sediments (Ashley, Valsaraj, and Thibodeaux, 2007). These elevated concentrations may be the result of the low-energy indoor environment leading to the deposition of fine-grained particles that are dispersed more widely outside. Fundamental research is needed to better understand the relationships between regional assessments of environmental exposure and local and individual exposures.

Exhibit 3

Indoor and Outdoor Arsenic Concentrations in Post-Hurricane Katrina New Orleans and Comparison to EPA and LDEQ Screening Levels.



EPA = U.S. Environmental Protection Agency.
LDEQ = Louisiana Department of Environmental Quality.
Source: Ashley, Valsaraj, and Thibodeaux (2007)

Environmental Implications of Waste and Debris

Although most portions of the city did not exhibit substantially different soil or sediment contamination levels after the hurricane occurred, an unprecedented legacy of waste and debris was present. An estimated 120 million cubic yards of construction and demolition debris were generated by the storm and the subsequent flooding. In addition, the flooding destroyed approximately 350,000 automobiles and some 750,000 white goods (washers, dryers, and refrigerators). The volume of solid waste was unprecedented, and the removal and disposal of this waste significantly delayed recovery and reconstruction.

Problems associated with managing the waste included both the inability to marshal sufficient resources to pick up and transport the waste to disposal sites and the insufficient capacity at appropriate disposal sites. As with many other tasks in New Orleans, the unavailability of workers significantly constrained progress. Although no contractor could be expected to have the readily available capacity to address the volume of waste, some firms that initially contracted to assist in the effort proved incapable of developing that capacity. Automobiles rendered worthless by the flooding, for example, sat for many months awaiting removal of crankcase oil and fuel and then destruction. Additional delays in managing the solid waste were associated with the failure of many residents to return in a timely manner to conduct demolition. Waste and construction debris on private property generally could not be transported for disposal.

Disposal of this waste posed other problems. The shear volume of waste required alternative disposal sites. Transportation of the waste to disposal sites out of the area was not available, partially as a result of concerns about Formosan subterranean termites that are quite common in the New Orleans area. Initial interest in open-air burning of combustible debris was abandoned due to air quality concerns. Ultimately, much of the waste was disposed of under the presumption that the waste was solely construction and demolition waste. Closed, insecure landfills not meeting current design standards for household waste, such as the Chef Menteur Landfill in eastern New Orleans, were opened and used as disposal sites for the flood debris. The use of such landfills, however, depends on the ability to adequately separate household and commercial hazardous waste, and evidence shows that that separation of the flood debris was inefficient (Pardue, 2006). Concerns have been raised about the future environmental consequences of such disposal (Pardue, 2006). Even if household hazardous waste was effectively separated from the other waste, components of construction and demolition waste have also generated concerns about problems such as arsenic leaching from treated wood (Khan et al., 2006). Recognition and management of those problems will be an important role for city and regional managers in the years ahead.

Building a More Resilient New Orleans

Recognition of the consequences of Hurricane Katrina and the subsequent flooding in New Orleans leads to obvious interest in avoiding a repetition of the events. A variety of preventive measures are available depending on the primary objective of any mitigation efforts. Perhaps the most obvious effort would be improving the hurricane protection system to ensure its protectiveness in the face of likely hurricane events. This improvement would help prevent the loss of human life and help protect property. Clearly, significant gains in protectiveness could be achieved by relatively modest improvements in the design, construction, and integration of the hurricane protection systems. A variety of recommendations for such improvements can be found in the report of the USACE's Interagency Performance Evaluation Taskforce (IPET, 2007). At the same time, it is important to note that the standard for protection against dam failure in the United States (USBR, 2003) is that risks that might lead to fewer than 1,000 deaths in a million years provide "diminishing justification to take action to reduce risk." Conversely, risks that might lead to more than 1,000 deaths more often than once in 10,000 years provide "justification to take expedited action to reduce risk." By such a standard, the loss of 1,000 lives as the result of a storm that has an expected return frequency of less than once per 100 years is clearly unacceptable.

On the basis of protection systems alone, can New Orleans be protected sufficiently to avoid repeating the events stemming from Hurricane Katrina? A number of factors suggest that this degree of protection is not possible or is not a wise use of resources.

First, New Orleans has a variety of risk factors that cause the city to be more vulnerable to hurricanes. Much of the city is well below sea level and is built in areas that are not possible to protect without extraordinary efforts such as massive pumping systems that are currently in use in the city. Making protection more difficult is the specter of global sea level rise and, more significantly, relatively rapid subsidence in and around the city of New Orleans. Sea level rise is currently on the order of 1 millimeter a year, but subsidence in New Orleans is 5 to 10 times greater (Dokka, 2006).

Subsidence is likely caused by a combination of regional oil, gas, and water extraction and the normal consolidation of south Louisiana sediments, especially because channelization of the Mississippi River limits the introduction of new sediment to the area. It was, in fact, the deposition of these sediments that lead to the existence of south Louisiana. The levees and other flood control structures along the river, however, discharge most of this sediment to the Gulf of Mexico, leading to severe declines in land mass and protective wetlands along the coast. Although efforts are under way to partially restore the natural flow of sediment, complete restoration without loss of flood protection function is unlikely.

Equally challenging is the fact that the variability of storm events in the Gulf of Mexico is quite high. The extensive flood control systems of the Netherlands have often been cited as a model for protecting New Orleans, but the storms of the North Sea are, by some measures, less intense than those of the Gulf of Mexico. The ratio of wave height in a 10,000-year storm to that of a 100-year storm in the North Sea is about the same as that expected in a 1,000-year storm in the Gulf of Mexico. In addition, the Netherlands can be protected by the construction of storm control structures between peninsulas that limit the size of the structures relative to the area being protected. This type of storm protection is much more difficult to construct in the "convex" coastline of the Mississippi River Delta. Finally, a large fraction of the Netherlands' gross national product depends on the storm control structures put in place subsequent to the 1953 floods. In comparison, both the total economic impact and the proportion of the U.S. economy that depends on New Orleans are relatively small. It may not be possible to marshal the will and resources to adequately protect New Orleans to meet the "1,000 lives, million years" risk standard currently in place.

Alternatively, planning to more effectively respond to the consequences of a major storm and flooding may be more fruitful. This response could take the form of improved evacuation planning to reduce the loss of human life or rebuilding a more resilient city that could better weather the storm and flooding and recover more quickly. Resiliency could be implemented by better land use restrictions that could discourage building in the most hazardous areas and improve design or construction in other areas. Especially important infrastructure (bridges, communication, or other critical services infrastructure) could be designed and constructed for survivability in much the same way that such structures are designed and constructed in earthquake-prone areas.

Regardless of any efforts to improve the effectiveness of the hurricane protection infrastructure or the resiliency and survivability of the critical infrastructure, improved planning for recovery from the inevitable catastrophic storm and flood must be implemented. An examination of the aftermath of Hurricane Katrina and the slow and still incomplete recovery from that catastrophe provides a number of recommendations that could help guide future recovery efforts.

First, it must be recognized that the problems associated with a major natural disaster are not uniformly distributed throughout the community. Problems, of course, arise in that individuals have different capacities to respond to the destruction caused by such a disaster. Decisions to equitably support reconstruction in the face of this uneven capacity should be made openly and adequately reflect the values of the community.

Although environmental contamination, which involves the consideration of chemical and biological contamination, mold issues, and the potential for future floods, influences habitability and reconstruction decisions, it is likely that other factors, such as the potential for future floods, will control these decisions. As indicated previously, contaminant concentrations in soils in New Orleans are generally similar to those recorded before Hurricane Katrina occurred. Elevated concentrations, however, may be found in specific areas. The ability to translate communitywide effects of exposure and risks to the individual homeowner should be improved.

Where these elevated concentrations are associated with a recognized source, identification of both the contamination and liability is relatively easy. More difficult are those situations leading to isolated areas of contamination. How can a homeowner be confident that his or her home and yard do not exhibit elevated contaminant levels? In the absence of assistance programs, the cost of testing and cleanup would fall to the homeowner. Because reconstruction or other recovery efforts would likely be more important to the homeowner, environmental remediation and restoration may never be conducted. Should an event such as Hurricane Katrina be viewed as an opportunity to improve environmental conditions in the city? It is clear that the flexible sampling and expedited analyses that EPA and LDEQ used in the New Orleans area were effective in characterizing the general contamination characteristics, but these tools may need to be supplemented with low-cost screening for individual properties. Moreover, future catastrophic events of a similar nature will likely result in similar needs, suggesting that a national program of environmental screening analysis would be worthwhile. Such a program could be built on the model used for routine low-cost screening of physical and chemical properties of soil for agricultural purposes. The extensive quality assurance and quality control programs that drive much of the cost of environmental analysis could be relaxed for such a screening program.

In some areas, general environmental assessment efforts after Hurricane Katrina were lacking. The habitability assessment should also address potential concerns posed by the presence of mold and airborne mold spores in homes and concerns about indoor sediment and dust. Unlike air, water, and soil contamination, currently little scientific basis exists for evaluating the potential effects of mold and indoor dust on human health or for developing risk-based action or cleanup standards. Airborne mold counts of 50,000 spores per cubic meter are considered very high, yet mold counts as high as 650,000 spores per cubic meter were observed by NRDC in one home in mid-city New Orleans after Hurricane Katrina (NRDC, 2005a). Because no standards have been developed to which these mold counts can be compared, little guidance is available regarding how to appropriately respond to such high mold counts. In addition, no clear regulatory responsibility has been delegated among federal agencies for indoor air quality. High mold counts are cause for concern, however; both NRDC and EPA recommended that returning residents remove all porous construction materials, including carpets and drywall, from flooded homes and use respiratory protection while removing such debris. The pervasive nature of mold contamination in New Orleans in the aftermath of Hurricane Katrina and the lack of knowledge about the risks of mold and airborne mold spores suggest that additional research is needed to improve the ability to respond to this problem.

The precise processes used to integrate the best scientific understanding of future flood risk, the risk of levee failure, the risk of mold contamination, and what, if any, chemical contamination in the redevelopment and habitability decisions is beyond the expertise of the author or the scope of

this article; however, master reconstruction plans, zoning, and other mechanisms exist to integrate the actions of federal, state, and local governmental entities and the private sector. The existing data suggest that the level of chemical contamination in New Orleans may be of lesser concern than other reconstruction issues.

Future habitability decisions after events such as Hurricane Katrina and the subsequent flooding are likely to require input from a wide range of stakeholders. The criteria by which decisions are made should be uniform, transparent, and consistent with existing hazardous waste and natural disaster cleanup criteria. Fortunately, the sampling to date suggests that only a very small number of locations, if any, contain chemical concentrations in the soil that warrant remedial action.

The critical test of a legal process is not whether an agency chooses the alternative preferred by the public but whether the public perceives the process as fair. A necessary predicate to fairness is communication of the nature of such a process. The discrepancy between some of the concerns expressed by local residents and environmental groups and the results of the EPA and LDEQ sampling efforts suggests that, despite the unprecedented public involvement efforts (and challenges), more extensive efforts to maintain a dialogue with the public may be needed. The experience in New Orleans once again reflects the difficulty associated with calculating risks, communicating with the public about such risks, and building trust about risk, particularly in the midst and aftermath of an emergency.

A key policy issue facing New Orleans, and likely to recur in other communities faced with major flooding, is whether reconstruction should include cleanup of preflooding contamination. EPA and LDEQ repeatedly note that the level of some isolated contaminants is the same as it was before Hurricane Katrina came ashore. Clearly, these levels were not caused by the storm. Not surprisingly, however, local residents and other groups demand that the soil be safe regardless of the cause or who pays for the remediation. Thus, the question arises as to whether individuals might be willing to delay their return and support governmental decisions about which neighborhoods might be rebuilt, based on the levels of chemicals in the sediment or soil, even if these levels are the same as or even reduced from the levels that existed before Hurricane Katrina occurred.

The ongoing cleanup decisionmaking process might also be an opportunity to reduce exposure to toxics and other contaminants (for example, ensuring that any soil contaminated from lead-based paint or lead-based paint remaining in homes is removed), regardless of whether the contamination was present before or after Hurricane Katrina. As a practical matter, such an approach is likely to require that the citizens of New Orleans accept a diversion of reconstruction funds to environmental cleanup.

Every effort should be made to put aside partisan concerns to solve real, significant problems concerning the way we process information in emergencies and to make sensible, safe, and equitable cleanup and habitability decisions in an environment of great uncertainty. Because existing institutions were largely unprepared for a disaster the scale of Hurricane Katrina, it may not be possible to implement these principles in New Orleans. Nevertheless, we can learn from Hurricane Katrina and implement more effective responses to future catastrophes.

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Income Targeting of Housing Vouchers: What Happened After the Quality Housing and Work Responsibility Act?

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Abstract

The Quality Housing and Work Responsibility Act (QHWRA) of 1998 overhauled the nation's approach to managing publicly owned housing and consolidated the Section 8 certificate and voucher programs into a new streamlined Housing Choice Voucher (HCV) Program. With the repeal of federal preferences for new admissions before QHWRA and the anticipated poverty deconcentration within public housing anticipated to occur following the adoption of QHWRA, new federal income-targeting requirements were established as part of QHWRA to ensure that the nation's neediest families would continue to receive first priority in the allocation of tenant-based housing assistance. These requirements stated that no less than 75 percent of any local public housing agency's (PHA's) new admissions to the HCV Program in any given fiscal year must be families with extremely low incomes (ELIs) (income at or below 30 percent of the area median income).

This research examines data from the U.S. Department of Housing and Urban Development (HUD) administrative records for all households receiving housing choice vouchers from 1997 through 2005 to determine if the income-targeting goals of QHWRA are being met at the national and local levels. Analyses of the characteristics of new admissions between 1997 and 2005 reveal several important trends. First, while most PHAs were in compliance with the income-targeting goals of QHWRA during the 1997-through-2005 period, nearly 40 percent of PHAs still are not in compliance with the goals of QHWRA. On average, larger PHAs are more likely to comply with the goals of QHWRA than are small PHAs, although rural PHAs have made substantial strides in meeting the goals of QHWRA. Since the enactment of QHWRA, there has been a trend toward increased HCV participation among Hispanic households and a general trend toward smaller family sizes, older household heads, and fewer ELI female-headed households with children.

Section 1. Introduction

The Quality Housing and Work Responsibility Act (QHWRA) of 1998, also known as the Public Housing Reform Act, established a new direction for U.S. federal housing policy. The act overhauled the nation's approach to managing publicly owned housing and consolidated the Section 8 certificate and voucher programs into a new streamlined Housing Choice Voucher (HCV) Program.[1] The goals of the legislation included an emphasis on reducing the concentration of poverty in public housing and supporting self-sufficiency among public housing residents, increased flexibility and improved performance in public housing management, and improvements in the quality of public housing units owned by the federal government (www.hud.gov/offices/pih/phr/about).

With the repeal of federal preferences for new admissions and the anticipated poverty deconcentration within the public housing program, new federal income-targeting requirements were established under QHWRA to ensure that the nation's neediest families continue to receive first priority in the allocation of tenant-based housing assistance (Solomon, 2005). These requirements state that no less than 75 percent of any local public housing agency's (PHA's) new admissions to the HCV Program in any given fiscal year shall be families with extremely low incomes (ELIs) (income at or below 30 percent of the area median income). Beyond these minimum targets, QHWRA grants local PHAs considerable flexibility to tailor local admissions standards to local housing needs. Some PHAs may choose to provide most assistance to working families or families actively seeking employment, while others may choose to target assistance to those with the most severe housing needs. To date, no study has examined the effect of this package of reforms on the composition of those newly admitted to the tenant-based assistance program.

This research examines data from the U.S. Department of Housing and Urban Development (HUD) administrative records for all households receiving housing choice vouchers from 1997 through 2005 to determine if the income-targeting goals of QHWRA are being met at the national and local levels. Unlike previous research, this study focuses on only the characteristics of *new* admissions. For those households, I address several questions related to the QHWRA income-targeting goals:

- What proportion of new households admitted to the HCV Program have ELIs and very low incomes (VLIs) (at or below 50 percent of the area median family income [AMFI])?
- As a result of the implementation of the income-targeting provision of QHWRA, has any significant change occurred in the characteristics of families admitted to the voucher program, particularly in terms of age of household head, number of children, race, ethnicity, female-headed family status, and source of income at the time of admission?
- Dividing the nation into quintiles by AMFI, has implementation of the provision had a differential effect on the socioeconomic characteristics of new admissions?
- How many PHAs are in compliance with the statutory requirement that at least 75 percent of admissions after 2000 be made to ELI families? Were most PHAs already meeting the requirement before enactment?

[1] The Section 8 certificate and voucher programs were officially merged into the new Housing Choice Voucher Program after the adoption of a HUD final rule published on October 21, 1999 (Devine et al., 2000).

- What are the characteristics of PHAs (for example, by size category or geography) that are not in compliance with the statutory requirement?
- Particularly for rural[2] PHAs, has this provision made it more difficult to admit families with wage income?
- Is the ELI threshold a realistic income-targeting threshold for use in rural areas, which often have lower median family incomes?

The remainder of the article is organized as follows: Section 2 examines the evolution of federal priorities under the tenant-based housing assistance program. Section 3 describes the data and methodology employed to answer the questions posed in Section 1. Section 4 examines the aggregate national characteristics of new HCV admissions. Section 5 relies on PHA-level data to examine the questions posed in Section 1 concerning PHAs. Section 6 summarizes the major findings of the article and offers policy recommendations based on the findings.

Section 2. Targeting Federal Tenant-Based Housing Assistance

Unlike other social welfare programs such as Medicaid and Social Security, which guarantee federal assistance to those meeting minimum eligibility requirements, federal housing assistance programs have never functioned as entitlement programs. As a result, HUD's evolving funding priorities have been crucial in determining the composition of households receiving housing assistance. This section explores how these priorities have changed over the history of the federal tenant-based assistance program.

Priorities Under the Section 8 Program

The first uniform federal standards defining the low-income families that would be eligible to receive assistance under the Section 8 Existing Housing Certificate Program were adopted with the Housing and Community Development Act of 1974 (Olsen, 2001). Generally speaking, a family of four earning no more than 80 percent of the median family income in the surrounding metropolitan area or county was eligible to receive tenant-based housing assistance under the Section 8 Program. The original income-targeting goals of the Section 8 Program were modest. An amendment passed in 1975 required that 30 percent of all assistance be targeted to families with VLIs. The remaining 70 percent of assistance could be allocated to families earning incomes above this threshold.

During the late 1970s and early 1980s, double-digit inflation and rising interest rates led to an increase in the number of families exhibiting "worst case" housing needs, including high housing cost burdens, conditions of overcrowding, and poor unit quality (Koebel and Renneckar, 2003). In response to these trends, federal preferences for housing assistance were established in 1979 to help prioritize subsidies to those most in need of housing assistance. Families living in substandard housing and that were involuntarily displaced were to receive priority in the allocation of Section 8

[2] Throughout the article, the term *rural* is synonymous with *nonmetropolitan* (outside of a U.S. census-defined metropolitan statistical area).

assistance. In 1983, the list of preferences was expanded to include households that were severely *cost-burdened*, defined as paying more than 50 percent of one's income on rent (National Low Income Housing Coalition, 2005a). Also in 1983, families that were homeless or living in homeless shelters were identified as living in substandard housing and thus were eligible for targeted assistance. A final policy change introduced into law in 1983 established a new Section 8 voucher demonstration program, which provided eligible families more flexibility in their choice of rental unit selection. The Section 8 Rental Voucher Program was made permanent in 1987 (HUD, 2000).

QHWRA and the Evolution of Tenant-Based Housing Assistance

The 1990s ushered in a series of reforms that fundamentally altered the face of federally owned public housing and federally administered tenant-based housing assistance. In 1989, the National Commission on Severely Distressed Public Housing concluded that roughly 86,000 of the nation's 1.3 million publicly owned housing units exhibited conditions of physical deterioration, unsafe living environments, and social and economic distress due to inflexible unit replacement policies and decades of inadequate maintenance funding (Buron et al., 2002). During the mid-1990s, empirical evidence was also beginning to emerge, linking residents in high-poverty public housing complexes to a variety of social and economic ills (Rosenbaum, 1995). The findings from these studies set the stage for a series of public housing reforms that ultimately culminated in the adoption of the comprehensive Quality Housing and Work Responsibility Act in 1998.

The debates surrounding QHWRA resulted in a number of important changes to the income and targeting provisions governing the tenant-based housing assistance program. The first of these changes occurred on January 26, 1996, when Congress suspended federal preference requirements to provide local PHAs increased flexibility to respond to local housing needs. To ensure that this increased flexibility and the new emphasis on poverty deconcentration did not compromise the nation's goals of providing housing assistance to the nation's neediest families, a heated debate erupted over priorities under the tenant-based housing program. With Congress's plan to dramatically relax the income-targeting requirements for public housing, housing advocates sought to ensure that there would be no loss of housing affordable to ELI households if PHAs took advantage of admissions flexibility to admit higher income families into public housing. The argument was that vouchers should be targeted to ELI households so as not to permit further attrition in the share of all housing affordable to ELI households. It was assumed that voucher income targeting would basically preserve the deep targeting of vouchers at roughly the same level that had been achieved by federal preferences while nevertheless granting PHAs greater flexibility to achieve admissions goals.

Previous versions of QHWRA proposed by the House of Representatives recommended that 35 percent of assistance go to ELI families, while the Senate proposed that 65 percent of assistance go to ELI families. The Clinton administration responded with a proposal that 75 percent of assistance go to ELI families. Clinton's proposed target is the one that ultimately appeared in the adopted legislation (Solomon, 2005). In addition to adopting new income-targeting provisions, QHWRA also consolidated the Section 8 Existing Housing Certificate Program and the Section 8 Rental Voucher Program into the newly named Housing Choice Voucher Program.

The Implementation of Income-Targeting Requirements Under QHWRA

The income-targeting requirements under QHWRA state that at least 75 percent of new admissions to the HCV Program must be ELI families. These new income-targeting requirements were written into Title V, Section 513 of the Quality Housing and Work Responsibility Act of 1998 (Title V of Public Law 105–276, 112 Stat. 2518), which formally amended the United States Housing Act of 1937. This act was signed by President Clinton on October 21, 1998. The new income-targeting requirements were officially enacted with HUD's issuance of a Notice of Official Guidance (64 FR: 8192) on February 18, 1999. Interim and final rules providing guidance on these and other PHA requirements under QHWRA were issued on May 14, 1999, October 21, 1999, and March 20, 2000. Housing agencies with fiscal years starting January 1, 2000, were the first to submit administrative plans for implementing the provisions of QHWRA. The first plans were due October 15, 1999 (HUD, 2001).

Although income-targeting provisions were immediately effective on enactment of QHWRA, 1999 and 2000 most likely reflect transitional years in the implementation of the new requirements. In fact, with the repeal of "federal preference" provisions in 1996, along with other interim changes in the administration of public housing and Section 8 programs, one might reasonably expect to find an initial *reduction* in the percentage of newly admitted households with ELIs until the provisions of QHWRA were formally established under federal law and local PHA administrative plans had been implemented.

Although no studies have examined the effect of QHWRA reforms on the composition of new admissions into the Housing Choice Voucher Program, HUD's 2005 *Resident Characteristics Report* finds that, of the nation's 1,830,551 voucher-holding households, 60 percent have ELIs, 18 percent have VLIs, 4 percent have low incomes (income at or below 80 percent of the area median income), less than 1 percent have incomes above the low-income threshold, and 18 percent do not report income. HUD's 2005 *Resident Characteristics Report* cites that 68 percent of voucher-holding households have ELIs (National Low Income Housing Coalition, 2005a). These data do not provide information on the income distribution of new admissions and do not report the success rates for individual PHAs in meeting the goals of QHWRA. The next section describes the methodology employed in this study to determine if PHAs are successfully complying with the goals of QHWRA.

Section 3. Data and Methodology

The primary data source for this study is HUD's household-level Multifamily Tenant Characteristics System/Public and Indian Housing Information Center (MTCS/PIC) file, which provides data on each household admitted to the HCV Program between 1997 and 2005.[3] The analysis relies on all records in this file defined as new admissions in any given year. To address the questions mentioned in Section 1 concerning the geographic location of new admissions and the characteristics of PHAs issuing vouchers, the base MTCS/PIC file was matched to a separate PHA-level file, which describes the census tract location of each household's residential location, and to a file constructed

[3] Ideally, the analysis would also include years before 1997, when federal preferences were still in place. Unfortunately, these data were not available for this study.

from HUD's Comprehensive Housing Affordability Strategy (CHAS) database, which describes the housing characteristics of the renters in the household's surrounding county. The final sample size is restricted by the number of new admissions in each year and the quality of the geographic geocodes for households in each year. These two sample restrictions resulted in a file with the number of household observations by year, indicated in the last column in exhibit 1.

During the entire analysis period, approximately 12 percent of all household observations are classified as new admissions. Of those 1,731,542 households, 88 percent (1,528,326) were retained for the analysis.

The analysis discussed in the next two sections consists primarily of descriptive exhibits and cross-tabulations of the number of ELI new admissions and the characteristics of ELI new admissions by year and geography. Income eligibility limits presented in the article are based on percentages of AMFI as calculated by HUD. Households with ELIs include those with incomes that do not exceed 30 percent of the AMFI, while households with VLIs include those with incomes that do not exceed 50 percent of the AMFI. These limits are adjusted in cases in which area fair market rents (FMRs) are unusually high or low relative to the AMFI. As of fiscal year 2004, income eligibility limits in 5 nonmetropolitan counties and 12 metropolitan areas were increased to the amount at which 35 percent of a four-person family's income equals 85 percent of the two-bedroom Section 8 FMR. Likewise, income limits in one rural county and one metropolitan area were decreased to the greater of 80 percent of the U.S. median family income or the amount at which 30 percent of a four-person family's income equals 100 percent of the two-bedroom FMR (HUD, 2004).

Yearly trends should be interpreted in light of the history of QHWRA adoption and implementation, which is discussed in Section 2. The exhibits presented in Section 4 present the results from cross-tabulations and descriptive statistics calculated at the household level for all newly admitted households. In the analysis described in Section 5, all household records were aggregated to the PHA level to obtain aggregate QHWRA compliance rates for each PHA. These compliance rates

Exhibit 1

Sample Sizes, by Year

Year	HCV Households	New Admissions	Matched to Geographic Variables
1997	1,146,333	144,244	124,732
1998	1,261,449	166,490	148,956
1999	1,467,911	178,769	159,966
2000	1,351,963	174,937	158,872
2001	1,705,079	321,219	248,096
2002	1,691,502	248,000	228,624
2003	1,916,540	202,678	184,409
2004	1,892,230	150,317	138,183
2005	1,977,885	144,888	136,488
Total	14,410,892	1,731,542	1,528,326

HCV = Housing Choice Voucher Program.

were compared with various characteristics of the PHA to determine the location of compliant and noncompliant PHAs along with their characteristics.

A few important caveats should be considered when interpreting the results of the PHA-level analysis. First, several PHA characteristics, such as local ELI thresholds and all renters characteristics obtained from CHAS, are provided at the county level, although PHAs do not always neatly correspond to county boundaries. For regional PHAs that include multiple counties, I address this problem by assigning to each PHA the average characteristics across all counties included in the PHA. Second, a small number of household records report PHA codes that are different from their location of residence. Correspondence with HUD indicated that this anomaly is rare (about 2 percent of the total cases) and results from arrangements among PHAs under the portability option, which allows households to use vouchers in areas other than the area administering the voucher. PHA averages of continuous variables will be biased slightly by this anomaly. For aggregates of categorical variables, I assign to each PHA the most frequent value reported by households within the PHA. This assignment helps ensure that, if one or two households exercise the portability option, these households do not influence the aggregate characteristics reported for most households residing within the PHA.

Section 4. National Trends in New Admissions, 1997 Through 2005

This section examines HUD administrative data to describe trends in the socioeconomic characteristics of those newly admitted to the HCV Program immediately before and after the enactment of QHWRA.

Incomes of Newly Admitted HCV Program Households

I begin with a discussion of the aggregate income characteristics of those households newly admitted to the HCV Program. Exhibit 2 describes the number and proportion of all new admissions with ELIs and VLIs. Although fluctuations have occurred in the proportion of ELI new admissions since 1997, at no time has the proportion fallen below 75 percent. In the years immediately after QHWRA's implementation, the percentage of new households with ELI fell to 76 percent but rebounded to a high of 80 percent by 2003. At no time during the analysis period did the percentage of households with VLIs fall below 98 percent.

Exhibit 3 displays the median nominal household income of new admissions for all years. Despite the slight increase in the percentage of ELI households displayed in exhibit 2, median nominal incomes of new HCV holders rose steadily during the 1997-through-2005 period. This increase of approximately 3 percent is just slightly higher than the U.S. Consumer Price Index inflation rate during the same period.

Exhibit 4 examines the source of income for all new admissions during the analysis period. For all households reporting income by source, exhibit 4 displays the average proportion of income from wages, welfare assistance (Aid to Families with Dependent Children [AFDC], Temporary Assistance for Needy Families [TANF], and other public welfare assistance), Supplemental Security Income, pension plans (including Social Security benefits and other pension benefits), or other sources.

Exhibit 2

ELI and VLI New Admissions, by Year

Year	Number of Non-ELI Households	Number of ELI Households	ELI Households (%)	Number of Non-VLI Households	Number of VLI Households	ELI Households (%)
1997	25,020	98,180	79.69	980	122,220	99.20
1998	33,685	114,053	77.20	1,504	146,234	98.98
1999	36,267	123,273	77.27	1,512	158,028	99.05
2000	37,181	120,434	76.41	1,689	155,926	98.93
2001	55,031	177,637	76.35	2,489	230,179	98.93
2002	47,323	180,262	79.21	2,025	225,560	99.11
2003	36,289	147,551	80.26	1,622	182,218	99.12
2004	27,902	110,281	79.81	1,447	136,736	98.95
2005	30,306	106,138	77.79	2,410	134,034	98.23
Total	329,004	1,177,809	78.17	15,678	1,491,135	98.96

ELI = extremely low-income. VLI = very low-income.

Exhibit 3

Median Household Income of New Admissions, by Year

Year	Median Household Income ($)
1997	6,916
1998	7,332
1999	7,656
2000	8,004
2001	8,304
2002	8,378
2003	8,401
2004	8,400
2005	8,940

Exhibit 4

Percent of Household Income, by Source and Year

Year	Source of Total Income (%)				
	Wage	Welfare	SSI	Pension	Other
1997	26.90	30.43	15.61	18.66	8.41
1998	30.95	24.43	16.24	19.48	8.90
1999	32.53	19.45	17.58	20.89	9.55
2000	34.74	17.99	17.25	19.95	10.07
2001	34.35	18.46	17.44	19.37	10.38
2002	33.00	17.94	17.81	19.08	12.17
2003	31.71	18.28	17.99	19.16	12.86
2004	31.14	18.69	16.81	20.12	13.24
2005	31.00	16.19	17.24	22.62	12.95

SSI = Supplemental Security Income.

The most dramatic trend reported in exhibit 4 is the decline in the proportion of households receiving welfare assistance. The percentage of HCV households relying on wage income increased from 27 percent in 1997 to nearly 35 percent in 2000, followed by a decline to approximately 31 percent by 2005. This decline is possibly due to changes in federal welfare assistance policy in 1996 that replaced the AFDC and other entitlement-based welfare programs with the TANF program. The rising productivity of the overall U.S. economy during the late 1990s also may have contributed to this trend.

Demographic Characteristics of New Admissions

I now turn to an examination of the demographic characteristics of new admissions to determine if the income-targeting provisions of QHWRA have altered the characteristics of households receiving housing choice vouchers. Preliminary data from HUD's *Resident Characteristics Report* suggest that, since enactment of the QHWRA income-targeting provision, a slight national increase has occurred in the percentage of minority HCV Program participants. To determine if these trends hold for all new admissions to the HCV Program and to determine if changes in the demographic characteristics of new admissions are driven by overall changes in household characteristics or changes in the composition of ELI households, I examine exhibits displaying the average socioeconomic characteristics of new admissions by year and ELI status.

Exhibit 5 displays the racial and ethnic composition of new admissions by year and by income relative to the ELI threshold. As indicated in exhibit 5, no dramatic changes occurred in the racial composition of new admissions during the 1997-through-2005 period. A few trends are particularly noteworthy, however. Although the overall proportion of Blacks admitted to the HCV Program has remained fairly constant, slight increases occurred in the number of Blacks above the ELI threshold and slight decreases occurred in the number of Blacks below the ELI threshold. Asians and Pacific Islanders saw a slight decline in total new admissions, which was driven primarily by a decrease in the number of ELI Asians. Among all racial and ethnic groups, Hispanic new admissions saw the largest increase, from around 11 percent in 1997 to nearly 14 percent in 2005. This change was driven primarily by increases in the number of Hispanic households earning incomes above ELI, a group whose relative proportion increased from 11 percent to more than 15 percent between 1997 and 2005.

Exhibit 6 examines similar changes in other household characteristics, including the average number of children per household, the average age of the household head, and the percentage of households with children that are headed by females.

All new admissions saw modest declines in the average number of children per household and modest increases in the average age of the household head. These trends were not significantly different for ELI households relative to other households, however. The representation of female-headed families with children also declined among all households. The declining representation of such households was most dramatic among ELI households. One possible explanation for this finding is that, after the enactment of QHWRA, PHAs were given more flexibility to establish their own local preferences for admissions. It is possible that, with this new flexibility, local PHAs adopted admissions preferences that, intentionally or not, tended to favor households that did not have children.

Exhibit 5

Racial and Ethnic Composition of New Admissions, by Year and ELI Threshold

Income Threshold	Year	Percent of New Admissions				
		Non-Hispanic White	Non-Hispanic Black	Non-Hispanic Native American	Non-Hispanic Asian or Pacific Islander	Hispanic
ELI	1997	44.95	40.80	0.98	2.15	11.12
	1998	44.26	40.12	1.01	2.38	12.22
	1999	46.50	38.90	0.98	2.13	11.48
	2000	45.43	40.82	1.07	1.21	11.47
	2001	44.07	40.54	1.04	1.79	12.56
	2002	40.66	43.15	1.07	1.59	13.54
	2003	42.05	40.54	1.05	2.09	14.26
	2004	43.85	40.05	1.33	1.41	13.36
	2005	45.72	37.97	1.24	1.70	13.36
Above ELI	1997	51.82	34.42	0.87	1.72	11.18
	1998	49.03	35.21	0.96	2.35	12.44
	1999	51.39	34.81	0.91	1.76	11.13
	2000	48.88	37.61	0.87	1.12	11.53
	2001	45.90	38.38	0.98	1.82	12.91
	2002	42.66	39.80	0.97	1.85	14.72
	2003	42.93	38.39	0.82	2.67	15.18
	2004	45.75	37.66	1.03	1.75	13.82
	2005	44.79	36.99	0.85	2.06	15.31
Total	1997	46.34	39.50	0.96	2.06	11.14
	1998	45.35	39.00	1.00	2.38	12.27
	1999	47.61	37.97	0.96	2.05	11.40
	2000	46.24	40.06	1.02	1.19	11.49
	2001	44.50	40.03	1.03	1.80	12.64
	2002	41.07	42.45	1.04	1.64	13.78
	2003	42.23	40.12	1.00	2.21	14.45
	2004	44.24	39.57	1.27	1.48	13.45
	2005	45.52	37.75	1.16	1.78	13.79

ELI = extremely low-income.

Exhibit 6

Demographic Characteristics of New Admissions, by Year and ELI Threshold

Year	Average Number of Children per Household			Average Age of Household Head			Percent of Households Headed by Females With Children		
	ELI	Above ELI	Total Households	ELI	Above ELI	Total Households	ELI	Above ELI	Total Households
1997	1.39	1.33	1.38	37.25	40.67	37.95	61.2	58.9	60.7
1998	1.34	1.36	1.35	38.03	40.30	38.56	58.3	59.6	58.6
1999	1.30	1.33	1.31	38.36	40.60	38.86	56.7	59.8	57.4
2000	1.31	1.36	1.32	37.78	39.66	38.21	57.9	62.1	58.9
2001	1.34	1.37	1.33	38.39	40.36	38.83	58.3	61.4	59.1
2002	1.25	1.28	1.26	38.00	41.12	38.64	55.4	58.1	56.0
2003	1.22	1.25	1.23	38.45	42.13	39.16	53.7	55.6	54.1
2004	1.22	1.23	1.22	38.13	42.21	38.95	54.5	55.4	54.7
2005	1.16	1.20	1.17	39.90	43.34	40.66	51.0	54.2	51.7

ELI = extremely low-income.

Are HCV Program Admission Trends Sensitive to Local ELI Thresholds?

It is possible that the aggregate national trends reported previously are highly sensitive to local ELI thresholds. If PHAs in areas with lower thresholds experience greater difficulty meeting the QHWRA income-targeting requirements, then local PHAs may adopt other local preference policies to ensure that the neediest local families are still being served. Furthermore, local ELI thresholds reflect varying local socioeconomic conditions, which may influence the types of households seeking housing assistance.

Exhibit 7 displays the percentage of households earning ELIs as a percentage of the local area ELI income threshold. Unlike exhibit 2, which presents the distribution of households by each HCV household's income level compared with the ELI cutoff, exhibit 7 presents the relative number of HCV households earning incomes that fall within different quintiles of the surrounding area's ELI limit, which is a function of the median family income of all households in the surrounding county and not simply those receiving vouchers.

As might be expected, areas with higher ELI thresholds, and which can draw from a larger income range to meet QHWRA goals, are more successful in attracting ELI households. Even those areas with the lowest ELI thresholds have been successful in meeting the Act's 75-percent goal, however.

Exhibit 8 replicates exhibit 5, replacing the cross-tabulation of household-level ELI with a cross-tabulation by quintiles of the areawide ELI threshold, as in exhibit 7, to determine how racial and ethnic compositions changed within areas with different ELI thresholds.

Whites have increased as a proportion of new admissions relative to non-Whites in all quintiles, except the lowest, of the ELI threshold. This trend contrasts sharply with the trend for African Americans. In all quintiles of ELI, Blacks constitute an increasingly lower proportion of new

admissions over time. Hispanics have increased in number within the lowest and highest ELI quintiles but have stabilized or decreased in proportion within intermediate ELI threshold areas. Among the two extremes, the increase in the relative proportion of Hispanics is greatest in areas with the lowest ELI thresholds.

Exhibit 7

Percent of New Admissions Earning Extremely Low Incomes, by Quintile of Area ELI Threshold

Year	Quintile Percentages of New Admissions Earning by ELI—				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1997	77.59	80.02	80.42	81.93	84.13
1998	75.84	76.93	77.27	78.23	81.29
1999	76.82	76.80	77.19	76.66	80.36
2000	76.64	76.80	75.66	74.83	78.50
2001	75.10	77.49	76.14	75.39	77.63
2002	77.44	79.04	79.48	79.18	80.06
2003	81.00	81.80	79.29	79.93	80.10
2004	80.57	80.09	79.39	79.85	79.69
2005	77.31	79.40	78.19	77.71	76.75
Overall average	76.96	78.52	78.04	78.05	79.28

ELI = extremely low-income.

Exhibit 8

Racial and Ethnic Composition of New Admissions, by Year and Quintile of Area ELI Threshold (1 of 2)

ELI Quintile	Year	Percent of New Admissions				
		Non-Hispanic White	Non-Hispanic Black	Non-Hispanic Native American	Non-Hispanic Asian or Pacific Islander	Hispanic
1st	1997	62.37	26.71	1.00	0.40	9.52
	1998	62.47	25.71	1.03	0.51	10.28
	1999	64.56	24.50	1.02	0.36	9.56
	2000	64.75	23.71	1.08	0.26	10.19
	2001	63.87	23.60	1.25	0.38	10.89
	2002	60.17	24.15	1.27	0.32	14.09
	2003	58.78	22.89	1.19	0.29	16.86
	2004	60.37	25.38	1.25	0.20	12.79
	2005	55.79	24.86	1.15	0.21	17.98

Exhibit 8

Racial and Ethnic Composition of New Admissions, by Year and Quintile of Area ELI Threshold (2 of 2)

ELI Quintile	Year	Percent of New Admissions				
		Non-Hispanic White	Non-Hispanic Black	Non-Hispanic Native American	Non-Hispanic Asian or Pacific Islander	Hispanic
2nd	1997	46.37	41.45	1.08	0.95	10.15
	1998	45.92	39.85	1.02	1.02	12.19
	1999	53.71	35.12	1.12	0.71	9.33
	2000	51.76	35.27	1.25	0.62	11.09
	2001	53.53	33.53	1.23	0.71	11.01
	2002	53.00	34.01	1.41	0.81	10.77
	2003	52.90	34.70	1.19	0.90	10.33
	2004	57.75	31.19	1.17	0.48	9.41
	2005	61.38	27.77	1.29	0.45	9.11
3rd	1997	37.26	48.87	0.97	1.84	11.06
	1998	38.42	45.89	1.13	2.31	12.24
	1999	43.32	43.18	1.01	1.46	11.02
	2000	44.60	43.32	1.02	0.93	10.12
	2001	45.05	40.83	0.98	1.06	12.07
	2002	43.25	41.35	1.15	1.15	13.10
	2003	47.66	36.56	1.10	1.39	13.30
	2004	49.50	36.45	1.39	0.99	11.68
	2005	50.34	35.99	1.18	0.91	11.58
4th	1997	26.25	54.55	0.88	4.14	14.18
	1998	28.46	52.90	0.85	4.09	13.69
	1999	32.01	51.96	0.75	2.43	12.85
	2000	32.34	53.15	0.91	1.41	12.20
	2001	35.55	48.53	0.92	2.01	12.99
	2002	36.20	47.88	0.93	1.63	13.36
	2003	40.63	43.54	0.97	1.81	13.05
	2004	41.94	41.78	1.46	1.72	13.10
	2005	45.26	39.30	1.34	1.87	12.24
5th	1997	17.58	53.25	0.50	11.15	17.52
	1998	20.55	50.29	0.79	10.53	17.84
	1999	21.95	49.12	0.70	9.47	18.75
	2000	22.92	56.83	0.67	3.92	15.65
	2001	24.92	53.35	0.75	4.77	16.20
	2002	25.60	53.94	0.70	3.28	16.48
	2003	27.67	48.91	0.79	4.55	18.08
	2004	27.65	50.36	1.06	2.74	18.18
	2005	30.00	47.25	0.91	3.58	18.27

ELI = extremely low-income.

Exhibit 9 examines the average number of children per household, for new admissions, by area ELI threshold. Among all ELI thresholds, there is a trend toward smaller families among new admissions. The decline is most dramatic in the middle range of the ELI threshold distribution. In the highest ELI threshold, family sizes have declined somewhat but are still much higher than they were in other ELI threshold ranges.

Exhibit 10 examines the average age of household heads by area ELI threshold. As this exhibit suggests, there is an overall trend toward families headed by older household heads. The increase in age is most dramatic in lower ranges of the ELI threshold. In the highest ELI threshold range, the average age of household heads remained relatively constant during the analysis period.

Exhibit 9

Average Number of Children per Household, by Quintile of Area ELI Threshold

Year	Average Number of Children per Household				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1997	0.67	1.28	1.72	2.30	2.99
1998	0.61	1.14	1.55	2.14	2.99
1999	0.52	1.01	1.36	1.99	2.82
2000	0.47	0.92	1.32	1.89	2.83
2001	0.42	0.84	1.18	1.65	2.61
2002	0.35	0.66	0.94	1.31	2.32
2003	0.24	0.50	0.84	1.25	2.24
2004	0.16	0.47	0.81	1.35	2.31
2005	0.24	0.40	0.67	1.23	2.21
Overall average	0.48	0.82	1.11	1.58	2.45

ELI = extremely low-income.

Exhibit 10

Average Age of Household Head, by Quintile of Area ELI Threshold

Year	Average Age of Household Head				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1997	40.69	36.93	35.60	35.29	36.59
1998	40.99	38.56	37.20	35.93	36.34
1999	42.10	39.18	37.81	35.54	36.56
2000	42.77	39.34	36.62	34.88	34.56
2001	43.38	40.85	38.57	36.35	35.21
2002	43.13	41.26	39.18	37.40	35.23
2003	45.07	42.77	39.94	37.56	35.82
2004	45.44	42.78	39.74	37.03	35.39
2005	46.39	44.24	42.52	39.10	36.86
Overall average	42.54	40.50	38.75	36.77	35.69

ELI = extremely low-income.

The final exhibit in this section, exhibit 11, examines the proportion of new admissions headed by females with children, disaggregated by ELI threshold, as in the previous exhibits.

Exhibit 11 suggests that the overall decline in female-headed families with children reported in exhibit 6 differs by area ELI threshold. Within areas with the lowest ELI threshold, the relative number of female-headed households with children declined dramatically from 42 percent of new admissions in 1997 to 18 percent in 2005. As ELI thresholds increase, the magnitude of the decline is much smaller, with the relative percentage of female-headed households with children declining by only about 4 percentage points in areas with the highest ELI thresholds. These trends suggest that most new female-headed households with children receiving vouchers can be found in areas with the highest ELI thresholds.

Given that federal targets for new admissions are now expressed in terms of minimum income targets rather than household composition targets, the dramatic changes in the demographic and household composition of new admissions suggest that PHAs may be focusing more carefully on meeting the new federal goals, possibly at the expense of monitoring changes in other household characteristics and need categories. If this hypothesis is true, then additional monitoring may be required to ensure that certain household and demographic groups are being adequately served through federal housing subsidy programs, particularly in areas with low ELI thresholds, as these areas have experienced the most dramatic changes in household and demographic characteristics since 1997.

Exhibit 11

Percent of Households Headed by Females With Children, by Quintile of Area ELI

Year	Percent of Households Headed by Females With Children				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1997	42.34	63.95	73.90	82.12	79.95
1998	39.99	58.72	67.81	78.23	77.81
1999	35.08	54.91	64.00	78.99	77.36
2000	32.72	52.26	65.86	78.74	83.01
2001	29.83	48.14	60.80	74.08	81.95
2002	24.99	40.34	51.60	63.81	79.25
2003	19.45	33.14	47.82	62.58	75.85
2004	14.26	32.94	48.17	64.75	78.46
2005	18.03	27.76	41.14	60.56	75.73
Overall average	18.03	27.76	41.14	60.56	75.73

ELI = extremely low-income.

Section 5. Trends in PHA Compliance With QHWRA, 1997 Through 2005

This section examines PHA-level trends in QHWRA compliance rates over time. I also compare the characteristics of QHWRA-compliant PHAs with PHAs that did not comply with income-targeting goals. Each of these analyses was performed using HUD administrative data aggregated to the level of the PHA.

National and Geographic Trends in QHWRA Compliance

How many PHAs have met the goals of QHWRA, and how have QHWRA compliance rates varied over time? Furthermore, what are the characteristics differentiating QHWRA-compliant PHAs from those not complying with the goals of QHWRA? I now turn to an examination of these questions. The exhibits presented in this section are calculated for PHA aggregates of the data described in the previous section. See Section 3 for more details on the methodology.

Exhibit 12 displays QHWRA compliance rates for PHAs by year. Approximately 62 percent of PHAs were compliant with QHWRA the year before its enactment (1997). In the year of enactment, this percentage declined to 55 percent and moved steadily upward until it reached a maximum of 69 percent in 2003. Between 2003 and 2005, compliance rates fell off somewhat but still remained approximately what they had been before the enactment of QHWRA. This finding is also supported by the household-level analysis reported in exhibit 2. One possible explanation for the dropoff in ELI compliance rates immediately after the enactment of QHWRA is that the new ELI requirements were adopted immediately after the elimination of federal admissions preferences. Thus, two major changes in federal admissions criteria occurred within a very short time. Although the elimination of federal admissions preferences presumably gave PHAs more flexibility in establishing local admissions criteria, it is possible that it took some time for PHAs to learn about the new rules and incorporate the changes into local policies and procedures.

Exhibit 13 breaks down the PHA compliance rates by U.S. census region. Overall, compliance with QHWRA is much higher in the Midwest and South. Furthermore, all regions saw relatively higher compliance rates before the enactment of QHWRA followed by a decline in compliance rates. By the end of the analysis period, compliance rates had risen back to approximately what they were before the enactment of QHWRA.

Exhibit 12

Total Number of PHAs Compliant With QHWRA*

Year	Noncompliant	Compliant	Compliant (%)
1997	788	1,307	62.39
1998	971	1,196	55.19
1999	961	1,256	56.65
2000	1,045	1,220	53.86
2001	1,045	1,263	54.72
2002	842	1,469	63.57
2003	725	1,586	68.63
2004	759	1,533	66.88
2005	812	1,481	64.59
Total	7,948	12,311	60.77

PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998.

**Compliant PHAs are those in which at least 75 percent of new admissions annually are from extremely low-income households.*

Exhibit 14 breaks down the PHA compliance rates by the central-city, suburb, or rural status of the PHA.[4] It also presents results for statewide PHAs. Overall compliance rates are highest in statewide PHAs and central cities and lowest in rural areas. For central cities and suburbs, compliance rates were highest before QHWRA; after the enactment of QHWRA, compliance rates fell and then rose during the analysis period but never to the level observed before the enactment of QHWRA. This

Exhibit 13

Percent of PHAs Compliant With QHWRA, by Region*

Year	PHA Region			
	Northeast	Midwest	South	West
1997	59.84	61.33	65.22	61.62
1998	47.83	56.17	59.84	53.71
1999	51.79	58.99	61.42	48.16
2000	46.08	55.85	59.49	48.86
2001	43.06	64.42	59.09	45.05
2002	52.88	72.89	67.36	54.52
2003	62.06	78.89	69.78	57.64
2004	58.74	75.65	69.06	57.77
2005	61.33	76.15	60.27	59.18
Overall average	53.76	66.67	63.55	53.97

PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998.

**Compliant PHAs are those in which at least 75 percent of new admissions annually are from extremely low-income households.*

Exhibit 14

Percent of PHAs Compliant With QHWRA, by Intrametropolitan Location*

Year	Intrametropolitan Location of PHA			
	Central City	Suburb	Rural	Statewide PHA
1997	72.99	66.53	52.42	77.78
1998	61.75	57.61	49.07	71.43
1999	64.50	57.33	51.10	70.00
2000	56.15	55.17	50.91	67.44
2001	60.99	52.76	52.52	68.42
2002	69.49	61.58	61.56	77.78
2003	76.28	63.15	69.09	75.68
2004	72.05	61.71	68.09	77.50
2005	69.98	61.40	63.49	87.18
Overall average	67.15	59.65	57.66	87.18

PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998.

**Compliant PHAs are those in which at least 75 percent of new admissions annually are from extremely low-income households.*

[4] Multicounty regional agencies are assigned to either the central-city, suburb, or rural category, depending on which of these three categories has the largest share of the agency's new admissions.

trend did not occur in rural areas, which saw compliance rates rise to levels in 2005 that were more than 10 percentage points above their levels in 1997. Thus, although rural areas are still less likely to comply with the goals of QHWRA, these PHAs saw the largest gains in QHWRA compliance during the analysis period. Statewide agencies also saw gains in compliance rates, although the percentage changes were relatively more modest than they were in exclusively rural areas.

Do Compliant PHAs Differ From Noncompliant PHAs?

Exhibit 15 displays averages of the following PHA characteristics by QHWRA compliance status and year: ELI threshold, number of Section 8 units, percentage of total renters who are ELI, ratio of ELI cost burdened renters to very low-income cost burdened renters, and ratio of ELI renters with housing problems to VLI renters with housing problems. The last two variables provide a measure of the extent to which ELI households are experiencing housing problems at a rate that is similar to other VLI renters.

Compliant PHAs are much larger, in terms of Section 8 units served, than noncompliant PHAs but not remarkably different along any other dimension. Several explanations are possible for the higher compliance rates among larger PHAs: (1) Smaller PHAs are located in rural areas with lower

Exhibit 15

Average Characteristics of Compliant and Noncompliant PHAs*

Compliant With QHWRA?	Year	ELI Threshold	Number of Section 8 Units	ELI Renters (%)	Ratio of Cost Burdened ELI to VLI	Ratio of ELI to VLI Housing Problems
Yes	1997	11,341.555	1,211.138	24.238	0.602	0.597
	1998	11,466.051	1,261.265	24.431	0.604	0.599
	1999	11,897.048	1,197.873	24.688	0.607	0.602
	2000	12,200.095	1,123.743	24.749	0.609	0.603
	2001	12,610.968	1,051.480	24.852	0.608	0.604
	2002	13,439.572	1,076.498	24.511	0.607	0.602
	2003	14,014.182	995.399	24.491	0.606	0.601
	2004	14,321.386	1,037.175	24.302	0.605	0.600
	2005	14,511.032	1,043.508	24.572	0.606	0.601
No	1997	10,392.700	511.030	23.069	0.592	0.588
	1998	10,608.060	572.273	23.108	0.592	0.587
	1999	11,157.996	605.120	22.870	0.589	0.584
	2000	11,680.016	720.955	22.873	0.588	0.583
	2001	12,164.170	756.788	22.971	0.588	0.583
	2002	12,771.552	622.423	23.036	0.587	0.582
	2003	13,880.126	721.201	22.684	0.584	0.580
	2004	14,278.920	661.827	22.846	0.586	0.581
	2005	14,221.759	669.611	23.001	0.587	0.582
Overall average		12,687.616	921.668	23.976	0.599	0.595

ELI = extremely low-income. PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998. VLI = very low-income.

**Compliant PHAs are those in which at least 75 percent of new admissions annually are from extremely low-income households.*

median family incomes, which limits the number of ELI households that can be targeted for HCV assistance; (2) smaller PHAs lack the data and tracking systems needed to determine whether they are meeting federal ELI targeting goals; (3) smaller PHAs are not aware of the new ELI requirement; or (4) smaller PHAs may be putting other goals, such as achieving family self-sufficiency, above federal ELI goals. Further research is needed to determine which of these factors is most important.

Exhibit 16 displays the percentage of household income from wages by PHA for all years, for each QHWRA compliance status, and by intrametropolitan location to determine if the income-targeting requirements under QHWRA have resulted in increases in the number of households relying on nonwage income, particularly within rural PHAs.

Exhibit 16 suggests that, in most years, statewide PHAs were the least likely to admit households relying on wage income. Among other PHAs, compliant rural PHAs exhibited the lowest reliance on wage income. Households in compliant rural PHAs increased their reliance on wage income at a higher rate than in other areas, however. This trend suggests that, although rural PHAs complying with the goals of QHWRA are accepting families with the highest reliance on nonwage income, this phenomenon does not seem to be related to the timing of QHWRA provisions.

Exhibit 16

Percent of Household Earnings per PHA From Wages, by QHWRA Compliance, Year, and Intrametropolitan Location*

Compliant With QHWRA?	Year	Percent Relying on Wage Income, by Location			
		Central City	Suburb	Rural	Statewide PHA
Yes	1997	26.01	30.09	25.29	25.07
	1998	31.18	31.39	27.13	28.88
	1999	32.39	32.04	29.18	29.24
	2000	32.59	34.48	32.14	32.83
	2001	32.05	34.75	31.92	29.79
	2002	32.04	32.35	30.89	27.61
	2003	31.94	31.99	31.14	27.64
	2004	28.57	29.96	30.07	25.59
	2005	26.89	30.03	28.45	23.54
No	1997	37.90	38.45	35.97	25.72
	1998	39.11	40.33	37.24	33.75
	1999	39.24	42.82	37.72	30.92
	2000	40.73	43.47	38.23	30.29
	2001	39.35	41.43	37.49	35.45
	2002	37.99	39.67	37.07	31.73
	2003	38.34	40.95	38.22	33.10
	2004	36.93	40.79	37.45	34.99
	2005	36.84	39.52	36.91	27.82
Overall average		33.05	35.49	32.89	28.77

PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998.

**Compliant PHAs are those in which at least 75 percent of new admissions annually are from extremely low-income households.*

PHA Size and QHWRA Compliance

The previous section suggests that, although some smaller rural PHAs have made strides in complying with QHWRA, smaller PHAs are still less likely to comply with the income-targeting goals of QHWRA. To get a more complete picture of the effect of PHA size on QHWRA compliance, I examined additional exhibits displaying (1) QHWRA compliance rates for PHAs of different size categories and (2) the percentage of families admitted to the HCV Program that lived in areas where PHAs complied with the goals of QHWRA. PHA size is defined in terms of the number of Section 8 units administered by the PHA (0 to 100 units, 101 to 250 units, 251 to 500 units, 501 to 750 units, 751 to 1,000 units, 1,001 to 1,500 units, 1,501 to 2,000 units, 2,001 to 3,000 units, 3,001 to 5,000 units, and more than 5,000 units).

As exhibit 17 suggests, QHWRA compliance rates generally increase with the number of units administered by the PHA, regardless of year, although the increase with PHA size is generally larger in earlier years. These results largely corroborate the findings displayed in exhibit 15 regarding PHA size differences in compliant and noncompliant PHAs. In addition to its implications for the types of PHAs meeting the goals of QHWRA, the variation in compliance rates by PHA size suggests that, although many small PHAs may not be adequately meeting the goals of QHWRA, the small number of families served by these PHAs may not pose a significant problem for overall QHWRA compliance. To determine if this hypothesis is true, exhibit 18 displays the percentage of families admitted to the HCV Program that lived in PHAs complying with the goals of QHWRA.

As exhibit 18 suggests, most families newly admitted to the HCV Program were admitted to PHAs meeting the goals of QHWRA. Between 1997 and 2005, the percentage never fell below 62 percent, which suggests that well over half of all admissions were concentrated among compliant PHAs. In other words, even though a larger number of small PHAs are noncompliant, these PHAs also serve fewer families and do not significantly influence the overall percentage of families served by compliant PHAs.

Exhibit 17

Percent of QHWRA Compliance Rates, by PHA Size Category

PHA Size (Number of Section 8 Units)	Year								
	1997	1998	1999	2000	2001	2002	2003	2004	2005
0–100	56.08	53.09	54.12	51.90	58.32	59.30	64.47	60.89	62.09
101–250	55.21	49.11	49.06	50.28	48.75	62.90	67.38	70.09	60.92
251–500	59.45	50.36	54.63	52.86	52.37	58.97	65.97	62.44	63.39
501–750	67.49	56.04	63.76	51.40	56.82	67.57	70.40	69.37	68.92
751–1,000	66.37	55.75	62.93	56.67	54.17	68.64	69.75	66.39	62.81
1,001–1,500	72.22	64.58	57.24	59.18	57.53	67.36	77.24	75.34	65.75
1,501–2,000	78.95	65.82	62.96	57.32	53.01	63.41	70.37	61.90	71.08
2,001–3,000	75.32	68.35	65.38	58.23	61.04	74.03	81.82	73.68	72.37
3,001–5,000	77.59	66.67	70.49	70.97	62.90	72.58	74.19	77.42	79.03
> 5,000	87.50	83.82	82.35	70.00	65.22	82.35	80.88	80.60	78.79

PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998.

A final issue related to PHA size is whether PHAs within different size categories missed meeting the goals of QHWRA by a small versus a significant percentage. To answer this question, exhibit 19 displays the percentage of PHAs that had ELI admissions percentages within certain bracketed categories (below 50 percent, 50 to 55 percent, 56 to 60 percent, 61 to 65 percent, 66 to 70 percent, 71 to 75 percent, 76 to 80 percent, 81 to 85 percent, 86 to 90 percent, 91 to 95 percent, 96 to 99 percent, 100 percent). These results are also broken down by PHA size category. For simplicity, I display the data only for the most recent year in the sample (2005).

Exhibit 18

Percent of New HCV Admissions in QHWRA-Compliant PHAs, by Year

Year	Percent of New HCV Admissions in QHWRA-Compliant PHAs (%)
1997	75.45
1998	68.40
1999	67.42
2000	62.23
2001	62.81
2002	73.82
2003	72.92
2004	73.34
2005	68.56

HCV = Housing Choice Voucher Program. PHA = public housing agency. QHWRA = Quality Housing and Work Responsibility Act of 1998.

Exhibit 19

ELI Admissions Percentages by PHA Size Category, 2005

ELI Admissions Percentage	PHA Size Category (Number of Section 8 Units)									
	0 to 100	101 to 250	251 to 500	501 to 750	751 to 1,000	1,001 to 1,500	1,501 to 2,000	2,001 to 3,000	3,001 to 5,000	> 5,000
<= 50	20.31	9.06	3.43	2.70	3.31	2.05	1.20	0.00	0.00	1.52
50–55	0.77	1.24	1.14	1.35	1.65	2.05	2.41	0.00	1.61	1.52
56–60	3.29	4.26	5.26	4.05	2.48	1.37	4.82	1.32	3.23	0.00
61–65	1.93	5.33	6.41	4.95	6.61	4.11	2.41	5.26	1.61	7.58
66–70	7.93	9.06	10.30	5.86	7.44	8.22	7.23	7.89	6.45	4.55
71–75	8.12	17.05	12.36	13.06	19.01	17.12	13.25	14.47	9.68	6.06
76–80	5.42	12.08	14.19	19.37	15.70	19.86	18.07	15.79	25.81	18.18
81–85	6.58	8.35	15.33	23.42	9.09	20.55	27.71	26.32	19.35	24.24
86–90	9.86	11.01	12.81	14.86	16.53	15.75	13.25	15.79	17.74	24.24
91–95	3.09	5.33	7.09	4.50	8.26	4.11	4.82	9.21	12.90	6.06
96–99	0.00	1.42	1.60	0.90	3.31	1.37	2.41	2.63	1.61	1.52
100	32.69	15.81	10.07	4.95	6.61	3.42	2.41	1.32	0.00	4.55

ELI = extremely low-income. PHA = public housing agency.

Examining the full distribution of ELI admissions percentages by PHA size category reveals a few interesting facts. First, we find that, although a larger number of smaller PHAs admitted less than 50 percent of households that were ELI, an even larger number admitted 100 percent of ELI households. Thus, the distribution of admissions among small PHAs is highly skewed. As PHA size increases, the distribution becomes less skewed, with a central tendency that is generally increasing over the PHA size distribution. This trend suggests that small PHAs are generally admitting either many more ELI households than is required or are falling well short of meeting federal goals, whereas most larger PHAs exhibit an increasing tendency toward higher ELI admissions. Further research is required to determine the reasons for this skewed distribution among small PHAs.

Section 6. Summary of Findings and Policy Implications

This article examines trends in the admission of new households to the Housing Choice Voucher Program since 1997 to determine if the income-targeting provisions of the Quality Housing and Work Responsibility Act have had any effect on the composition of those households enrolled in the HCV Program. The following paragraphs summarize the major findings from the study:

- The nation as a whole was already meeting the 75-percent ELI target before the enactment of QHWRA and has continued to meet the goal since. Furthermore, most PHAs were in compliance with the income-targeting goals of QHWRA during the 1997-through-2005 period. Despite these promising trends, a large number of PHAs are still not in compliance with the goals of QHWRA. The fact that nearly 40 percent of PHAs are not in compliance is a serous concern, which points to a need to either change policy or step up enforcement.
- On average, larger PHAs are more likely to comply with the goals of QHWRA than are small PHAs. Despite this overall trend, nearly one-third of PHAs with fewer than 100 units admitted 100 percent of ELI households in 2000. As PHA size increases, the average QHRWA compliance rate increases and the distribution of compliance becomes less skewed.
- Despite the relatively lower median family incomes found in rural areas, rural PHAs have made substantial strides in meeting the goals of QHWRA. Although rural PHAs are still less likely to comply with the goals of QHWRA than are PHAs located in central-city or suburban areas, rural PHAs have seen the largest gains in QHWRA compliance since 1997.
- Although rural PHAs complying with the goals of QHWRA admit families that are more likely to rely on nonwage income, this phenomenon does not seem to be related to the timing of QHWRA provisions.
- A trend toward increased HCV participation among Hispanic households has become apparent since the enactment of QHWRA. This trend is not observed for other non-White racial groups, however. In areas with high ELI thresholds, a marked decline has been recorded in the representation of African Americans among new admissions.
- A general trend toward smaller family sizes and older household heads has emerged among all new HCV admissions. The decline in family size and increase in the age of the household head are most dramatic in areas with low ELI thresholds.

- A trend toward fewer ELI female-headed households with children has become apparent among new HCV admissions. Given that the decline in ELI female-headed families is larger than the overall decline in female-headed family new admissions, and given that the loss of female-headed families is largest in areas with low ELI thresholds, QHWRA may have contributed to fewer female-headed families being served through the HCV Program. It is not clear whether these trends reflect income-targeting provisions or the repeal of federal preferences, however.

These findings point to four policy recommendations:

1. **The 75-percent ELI admissions criterion is a reasonable target for ensuring that the nation's neediest families continue to receive the most assistance.** This article finds that the nation as a whole was already meeting the 75-percent ELI target before the enactment of QHWRA and has continued to meet the goal since then, even in areas where the housing needs of ELI renters are the highest. Thus, the 75-percent ELI admissions criterion is attainable by most PHAs and serves as a reasonable target for HCV admissions.

   The National Low Income Housing Coalition suggests that certain program modifications may be necessary to ensure that vouchers are effectively targeted to needy families in areas where median family incomes are low. The coalition also argues that 75 percent of vouchers should go to either ELI families or families below the federal poverty level, whichever is higher (National Low Income Housing Coalition, 2005b). This article finds that, despite the relatively lower median family incomes found in rural areas, which potentially limit a rural PHA's ability to effectively meet aggressive income-targeting goals, rural PHAs have made substantial strides in meeting the goals of QHWRA. Although rural PHAs are still less likely to comply with the goals of QHWRA than are central-city or suburban PHAs, rural PHAs have seen the largest gains in QHWRA compliance since 1997.

   Although rural PHAs complying with the goals of QHWRA admit families that are more likely to rely on nonwage income, this phenomenon does not seem to be related to the timing of QHWRA provisions. In fact, 1996 welfare reform legislation that limited the duration of welfare assistance likely played a larger role in shaping the income composition of new admissions than has QHWRA. Evidence of this trend comes from the fact that all new admissions, and not merely those earning ELI, increasingly rely on wage income and have become less likely over time to rely on welfare assistance.

2. **Increased technical assistance and/or funds for program monitoring should be provided to small PHAs to help them comply with the goals of QHWRA.** On average, QHWRA-compliant PHAs are much larger than noncompliant PHAs. It is possible that smaller PHAs lack the data and tracking systems needed to determine whether they are in compliance with the goals of QHWRA. Furthermore, smaller PHAs may not be fully aware of the new requirement or may be putting other goals, such as achieving family self-sufficiency, above ELI goals. Increased funding for technical assistance to small PHAs or cost sharing arrangements with larger PHAs are possible strategies for addressing this problem. Additional compliance monitoring by HUD may also be necessary to ensure that ELI goals are not being compromised by the increased flexibility provided to PHAs in setting local admissions criteria.

3. **Increased monitoring of the changing demographic composition of new HCV admissions is warranted. To facilitate this effort, PHA agency plans should include an evaluation of trends in the composition of new admissions and propose local strategies for ensuring that the needs of all ELI families are being adequately met.** With the repeal of federal preference requirements, local PHAs have begun to exercise more discretion in selecting households for participation in the HCV Program. Some agencies now choose to provide direct assistance to those facing the greatest economic hardships while others focus on households moving to self-sufficiency. Still others focus on "hard to house" individuals, who tend to be elderly or disabled. Given that federal targets for new admissions are now expressed in terms of minimum income targets rather than household composition targets, PHAs may be focusing more carefully on meeting the new federal goals, possibly at the expense of monitoring changes in other household characteristics and need categories. Some evidence of this change in focus comes from Devine et al. (2000), who found that only 11.7 percent of PHAs rely on the former federal hardship preferences when prioritizing housing assistance allocations. In fact, 29 percent rely on no preference criteria at all and instead allocate assistance solely on the basis of an applicant's order of appearance on a waiting list.

   The findings of this study suggest that steps should be taken to ensure that the needs of minority families and female-headed households with children are still being adequately met in the HCV Program, particularly given that minority households and female-headed families with children are disproportionately concentrated in the ELI bracket and are thus eligible for the most assistance.

   At a minimum, increased monitoring of the changing demographic composition of new HCV admissions is warranted. PHA agency plans should include an emphasis on trends in the composition of new admissions and propose local strategies for ensuring that the needs of all ELI families are being adequately met. These findings also call for a reexamination of the degree of discretionary authority that local PHAs exercise when admitting tenants. A new federal target for families relying on nonwage income and households supporting children may help ensure that the needs of the nation's neediest families are being adequately met.

4. **A better understanding is urgently needed about why some PHAs are not complying with the income-targeting requirements of QHWRA.** Future research should examine trends in public housing admissions together with HCV admissions to see whether individual PHAs have in fact increased their total admissions of non-ELI households over time. It would also be useful to examine data before 1997 to compare income targeting achieved through federal preferences with income targeting achieved after the suspension of federal preferences. Finally, further research is needed to understand why small PHAs are having trouble complying with the law and, in particular, why some PHAs are admitting well more ELI households than the law requires while others are falling well short of meeting federal goals. One suggestion is to conduct telephone surveys of small noncompliant PHAs to learn more about the reasons why they are not complying with the ELI admissions requirement. Another strategy is to obtain such information through smaller focus groups consisting of small PHA representatives.

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Job Access in Disadvantaged Neighborhoods in Cleveland, 1980–2000: Implications for Spatial Mismatch and Association With Crime Patterns

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Abstract

Various social ills in disadvantaged neighborhoods may be attributed to lack of job access. This study uses two distinctive measures to examine the issue: the job proximity index measures the physical distances between residence and job, and the job accessibility index measures residents' ability to reach jobs that also may be affected by availability of transportation means and job competition intensity. This research in Cleveland, Ohio, indicates that disadvantaged neighborhoods actually enjoyed better job proximity or at least that residents were located no farther away from jobs than others. These neighborhoods suffered from poorer job accessibility, however, because of their relatively lower levels of automobile ownership and the more intensive job competition in these high-density residential areas. Job accessibility alone was negatively associated with crime rates in Cleveland throughout the study period (1980–2000). When socioeconomic covariates were controlled for, the relationship remained significant in 1980, became weaker in 1990, and was not statistically significant in 2000.

Introduction

Many researchers recognize that lack of employment opportunities in disadvantaged neighborhoods (that is, mostly inner-city poor neighborhoods with high concentrations of minority residents) has profound impacts, ranging from social disorders to criminal behavior; but researchers disagree on the causes of this employment shortfall. Whether the problem is a *proximity factor* (that is, spatial mismatch between residence and employment location) or a *nonproximity factor* (for example, lack of transportation means, socioeconomic disadvantage, discrimination in housing and job markets) leads to different policy remedies. This research evaluates job access in Cleveland, Ohio, over a 20-year time span (1980–2000) and examines its implications for the spatial mismatch hypothesis and association with crime patterns.

Specifically, the research addresses the following two sets of questions:

1. Are disadvantaged neighborhoods located farther away from the jobs? Do they suffer from poorer job access? Have the patterns changed over time?

2. Is job access associated with crime patterns? Is the relationship different between economic crimes and violent crimes? Does the relationship remain significant after controlling for other socioeconomic covariates? Has it changed over time?

Kain (1968) proposes the original *spatial mismatch* hypothesis that predominantly Black central-city neighborhoods are increasingly isolated from job locations because of persistent employment suburbanization and residential segregation. Wilson (1987) also attributes various social ills, including high levels of crime in some inner-city neighborhoods, to the residents' lack of job access. Although Wilson seeks to explain the particularly high levels of social dislocation in many urban Black communities, his approach is not race specific (Krivo and Peterson, 1996). In fact, Sampson and Wilson (1995: 41) note that the sources of crime are "remarkably invariant across race and rooted instead in the structural differences among communities." For this reason, this project examines the spatial mismatch hypothesis by assessing whether job access in disadvantaged neighborhoods in general, instead of minority neighborhoods per se, is less favorable than in other neighborhoods.

Two important concepts need to be differentiated on the issue of job access. *Job proximity* refers to average distance from a job to a residential location and captures the spatial separation between residence and job. *Job accessibility* measures a person's ability to overcome the spatial and nonspatial barriers to employment and may be affected by transportation means, road networks, congestion, and competition intensity for jobs among resident workers. Job proximity is a spatial issue, and job accessibility involves nonspatial factors. Some recent studies suggest that disadvantaged neighborhoods are actually physically closer to jobs (for example, Shen, 1998; Boardman and Field, 2002; Wang, 2003), but residents still experience more commuting time because of their higher dependency on public transit; this situation reflects the so-called "automobile mismatch" (Taylor and Ong, 1995). The job accessibility measure used in this research takes advantage of recent advances in accessibility measures (for example, Luo and Wang, 2003; Wang and Luo, 2005) and accounts for both the spatial and nonspatial barriers mentioned above.

Most theories of crime assert, or at least imply, an inverse relationship between legal and illegal employment. *Strain* theories (for example, Agnew, 1985) contend that crime results from the inability to achieve desired goals, such as monetary success, through conventional means, such as legitimate employment. *Control* theories (for example, Hirschi, 1969) emphasize the "stake in conformity," which suggests that individuals unemployed or with less desirable employment have less to lose by engaging in crime. *Rational-choice* theories (for example, Cornish and Clarke, 1986) and *economic* theories (for example, Becker, 1968) suggest that people make rational choices to engage in a legal or illegal activity by assessing the cost, benefit, and risk associated with it. Labor market variables should affect individuals' decisions to engage or not engage in crimes, particularly property crimes. Research along this line has focused on the relationship between unemployment and crime rates (for example, Chiricos, 1987). Most previous research, however, uses large areas such as the whole nation, an entire state, or an entire metropolitan area to identify job markets and often relies on time series data. Data for such large units are a crude tool for identifying the link between unemployment and crime (Levitt, 2001), and more variation may be *within* such units than *between* them. Recent work has made significant advancements by analyzing the relationship between *local job market* and crime. For example, drawing on the dual labor market theory, Wadsworth (2000) shows that parents' jobs in the primary or secondary sector influence children's bonds to conformity and levels of delinquency; Bellair and Roscigno (2000) find strong effects of low-wage, service-sector concentration and unemployment on adolescent delinquency.

One danger of linking the rates of unemployment and crime is the implication that crimes were committed by the unemployed alone. Despite high crime rates among the unemployed, only one-third of arrestees were unemployed at the time of their arrest (U.S. Department of Justice, 1997), as were one-third of prison inmates (Beck et al., 1993). Not all earnings from a job are retained, and wages less the commuting costs (both nominal costs and value of time spent on the road) yield the net benefits from a job. In addition to having an adverse effect on employment prospects, poor job access has high monetary and psychological costs for workers already in the labor force and increases their willingness to risk losing their jobs through involvement in deviant or criminal behavior. In Sullivan (1989), a youth interviewee explicitly indicated his frustration with commuting and how it affected his decision to quit his job. Similarly, Anderson (1999: 110–111) notes that the relocation of many Philadelphia jobs to nearby cities necessitates long travel times via public transportation, making the underground economy (for example, drug trade) "a way of life in numerous inner-city communities." To overcome the barrier of physical distance, residents must gain access to jobs either through relocation or by using whatever transportation modes are available to them. For many minority, low-income, and less advantaged residents, relocating to gain better access to job markets is not a feasible alternative. Local family and friendship ties, residential segregation in the housing market, gender and racial discrimination in the job market, imperfect information available to job seekers, and other factors tend to minimize employment-based relocation. Research suggests that income and housing costs place considerable economic constraints on residential mobility (Cadwallader, 1996). Most moves take place between areas of similar socioeconomic characteristics, and socioeconomic status is positively related to mobility rate (Cadwallader, 1981).

This study measures crime at the census tract level, not at the individual level, so we cannot confidently assert that any areal relationships we find are reflective of individual relationships between labor market variables and crime, commonly known as the "ecological fallacy" (Robinson, 1950;

King, 1997). Specifically, finding a relationship between job access and crime rates at the census tract level does not necessarily imply that the individuals who have the worst access to jobs are the ones committing the crimes. Although this implication may be the case, it is also possible that poor job access may be one feature of communities with weak levels of social control and that this lack of social control facilitates the commission of crimes (Gibbons, 1992), regardless of whether individual offenders are employed or not. Either way, we hypothesize a negative relationship between job access and crime. An earlier study (Wang and Minor, 2002) reveals a negative relationship between job access and crime rates in Cleveland in 1990, but that study is limited to simple bivariate regressions and calls for more rigorous work controlling for covariates. Extending the work to 2000 is also important as it offers an opportunity to examine the possible impacts of the Personal Responsibility and Work Opportunity Reconciliation Act (often called the "Welfare Reform Act") of 1996. Although the regression models in this study are to explain intraurban variation of crime rates by job access, it is also possible that crime rates may also affect job access (for example, crime deters employers from locating in certain areas). Possible simultaneity between job access and crime will be explored in future research.

Contributions of this research are summarized as follows:

1. Two distinctive measures, job proximity and job accessibility, are used to identify whether lack of job access is caused by spatial (physical distances from jobs) or nonspatial (for example, availability of transportation means and job competition intensity) factors.
2. The spatial mismatch hypothesis is tested by assessing whether poorer job access is experienced by disadvantaged neighborhoods in general, based on a composite factor accounting for multiple demographic and socioeconomic variables not simply minority populations per se.
3. The relationship between job access and crime rates is examined over time, and spatial regression is used to control for spatial autocorrelation.

Data Sources and Study Area

Cleveland, Ohio, was chosen as the study area because multiple-indicator and multiple-year data, particularly crime data at the small geographic unit (that is, census tracts), are available. Because the study focuses on the nonagricultural job market, the central contiguous urbanized area in the metropolitan areas of Cleveland and Lorain defines the boundary for the job market. The crime data, however, are available only for the city of Cleveland.

The data needed for defining job access are obtained from the 1980 Urban Transportation Planning Package (UTPP) and the 1990 and 2000 Census Transportation Planning Package (CTPP). The 1980 UTPP data were generously provided by Jean-Michel Guldmann at the City and Regional Planning Section of the Ohio State University (originally obtained from the Northeast Ohio Areawide Coordinating Agency [NOACA]). Both the 1990 and 2000 CTPP data were downloaded from the Bureau of Transportation Statistics website (www.bts.gov). Hereafter, all three data sets are referred to simply as the "CTPP data." The CTPP data were compiled by NOACA, Cleveland's metropolitan planning organization. Both the 1980 and 1990 data are available at the traffic analysis zone (TAZ) level, and the 2000 data are available at the census tract level. TAZ is a geographic unit

even smaller than a census tract. Because the boundaries of TAZs do not completely match those of census tracts, we use the simplest and most widely used *areal weighting interpolator* (Goodchild and Lam, 1980) to apportion the attribute value from TAZs to census tracts according to the areal proportion. The choice of areal interpolation is not critical for this research because both of our job access measures (proximity and accessibility) are based on surrounding attributes and tend to be similar among nearby tracts. Because crime data and other socioeconomic covariates all are at the census tract level, measures for job access in both 1980 and 1990 are also converted to the census tract level. The job accessibility in 2000 is measured directly at the census tract level. Exhibit 1 summarizes these data sources.

Exhibit 1

Data Sources Used for Defining Job Access

Data Sets	Contents	Geographic Unit
1980 UTPP Part 1	Residential data	TAZ
1980 UTPP Part 3	Workplace data	TAZ
1980 UTPP Part 4	Commuting data	TAZ
1990 CTPP Urban Element Part 1	Residential data	TAZ
1990 CTPP Urban Element Part 2	Workplace data	TAZ
1990 CTPP Urban Element Part 3	Commuting data	TAZ
2000 CTPP Urban Element Part 1	Residential data	Census tracts
2000 CTPP Urban Element Part 2	Workplace data	Census tracts
2000 CTPP Urban Element Part 3	Commuting data	Census tracts

CTPP = Census Transportation Planning Package. TAZ = traffic analysis zone. UTPP = Urban Transportation Planning Package.

The 1990 or 2000 CTPP Part 1 (or 1980 UTPP Part 1) is similar to traditional census data by area of residence with demographic and socioeconomic variables. The 1990 or 2000 CTPP Part 2 (or 1980 UTPP Part 3) provides data by area of work (unique among all census products) and has the number of jobs and breakdowns of wage groups. The 1990 or 2000 CTPP Part 3 (or 1980 UTPP Part 4) provides very detailed journey-to-work information, such as the number of commuters from one TAZ (or census tract) to another TAZ (or census tract) by a specific mode (for example, drive alone, carpool, ride public bus) and the average commuting time between them. Information about resident workers (the "demand side" of the job market) is obtained from Part 1 (CTPP for 1990 and 2000 and UTPP for 1980), information about jobs (the "supply side" of the job market) from Part 2 in 1990 and 2000 CTPP (Part 3 in 1980 UTPP), and the linkage between them (commuting trips) from Part 3 in 1990 and 2000 CTPP (Part 4 in 1980 UTPP). Most TAZ boundaries remain the same from 1980 to 1990, except for a few TAZs created in 1990 in newly urbanized areas. Therefore, the job access analysis in 1980 and 1990 is based on one spatial layer of TAZs. The analysis in 2000 is directly based on the spatial layer of census tracts.

The data needed for defining socioeconomic covariates are from the decennial census. The 1980 census data are extracted from the *CensusCD 1980* by GeoLytics, Inc. The 1990 data are based on the 1990 census STF1 and STF3 files. The 2000 data are based on the 2000 census SF1 and SF3 files.

The 1980–89 crime data are available at the census tract level from the National Archive of Criminal Justice Data associated with a study conducted by Harrell and Gouvis (1995, 1994). The data set was originally prepared by the Center on Urban Poverty and Community Development at the Case Western Reserve University. Harrell and Gouvis deleted 11 tracts that had fewer than 100 residents each (considered nonresidential or institutional) and that also lacked corresponding socioeconomic variables from census data, leaving 193 observations. Crime variables include rates for auto thefts, burglaries, homicides, rapes, robberies, drug sales or possession, and delinquency filings in juvenile court for each year during the 1980–89 period. Rates for larceny and arson are missing for some years and are not covered in this study. Drug-related crimes are usually separated from either economic or violent crimes and are not covered in this study. Rates for aggravated assaults are available for 1989 but not for 1980. All rates are numbers of crime per 1,000 residents. Except for the measure of delinquency (not covered by this study), all other measures came from the Federal Bureau of Investigation's (FBI's) Uniform Crime Reports (UCR). This study uses the 1989 crime rates to match the job access and other socioeconomic variables in 1990 (hereafter simply referred to as 1990 data). Because the 1990 census data (including both the CTPP and standard census data) actually record 1989 year-end data, this approach seems a reasonable assumption.

Crime data for 2000 are downloaded from the Northeast Ohio Community and Neighborhood Data for Organizing (NEO CANDO) (previously Cleveland Area Network for Data and Organizing or CAN DO) website at http://neocando.case.edu. The crime rates in 2000 within the city of Cleveland are also recorded at the census-tract level but are grouped into slightly different categories. The property (economic) crimes include burglary, larceny theft, auto theft, and arson; the violent crimes include homicide, rape, robbery, aggravated assault, nonaggravated assault, and domestic violence assault. For comparisons over time, this study covers homicide, rape, aggravated assault, robbery, burglary, and auto theft in 2000.

Three issues on crime data deserve some discussion. First, one may argue that the FBI UCR data considerably underreport the actual number of incidents; however, they probably provide a more reliable indicator of crime trends than victimization survey data do (Gove et al., 1985; Steffensmeier and Harer, 1999). The second issue concerns using census tracts as the unit of analysis (for example, lack of uniform area or population sizes; see Brantingham and Brantingham [1984]). We use census tracts merely because of availability of data. Finally, by using the census tract in which the crime occurred as a proxy for the location of the offender's residence, we are in effect making the incorrect assumption that all crime trips were intrazonal. Based on the well-established finding of distance decay in crime trips (for example, Van Koppen and De Keijser, 1997; Rengert, Piquero, and Jones, 1999), the stronger the distance decay function is, the better our proxy measure of the offender's residence is.

The spatial or Geographic Information System (GIS) data of the study area came from two sources. Because the 1980–89 crime data are based on the 1980 census tracts, we used the 1980 census tract boundaries from the *CensusCD 1980* by GeoLytics, Inc. Other GIS data came from the data CDs from the Environmental Systems Research Institute (ESRI), Inc., including (1) the TAZ layer, (2) the layers for urbanized areas (1990 and 2000), (3) the layers for census tracts (1990 and 2000), and (4) the layers for road network (1990 and 2000). We checked the 1980 road network in Cleveland (Rand McNally, 1982) and found little difference from the 1990 road network based on the Census Bureau's TIGER file.

Measuring Job Proximity and Job Accessibility

In addition to the major job concentration in downtown Cleveland, jobs are scattered regionwide and are concentrated throughout several suburban job centers, such as the Lorain downtown and the southeast office and service center. One cannot use the classic Mills-Muth monocentric model (Mills, 1972; Muth, 1969) that all employment is concentrated in the central business district to characterize the urban structure and the individual's access to the job market. Adequate measures of job access need to account for all jobs across the whole study area.

Measuring Job Proximity

To examine whether disadvantaged neighborhoods are located farther away from jobs than are other neighborhoods, the first task of this research is to measure job proximity based on a *gravity model*. In the classic Newton's gravity model, the gravity force between two objects is proportional to each mass but inversely related to the distance squared between them. Here, the influence of jobs at j on resident location i is positively related to the number of jobs there (J_j) but inversely related to the distance or travel time between them (d_{ij}). The distance decay effect is captured by a general exponent term (commonly referred to as "distance friction coefficient") β, instead of 2 in Newton's model. See Wang (2006) for more discussion on various gravity models. Based on the gravity notion, the probability or the portion of resident workers at a tract i taking jobs at a tract j is determined by the influence of jobs at j among the influences of all jobs at various locations:

$$P_{ij} = \frac{J_j / d_{ij}^{\beta}}{\sum_{k=1}^{n} J_k / d_{ik}^{\beta}}, \tag{1}$$

where P_{ij} is the probability (portion) of workers at i taking jobs at j, J is the number of jobs in a tract, β is the distance friction, and n is the total number of job locations. Here, "tract" is a general term to refer to TAZ in 1980 and 1990 or census tract in 2000. Because we are interested in the physical distance between residence and job, d_{ij} can be simply measured by the straight-line aerial distance between tracts i and j. Based on the journey-to-work data, the distance friction coefficient β is estimated by a simple gravity model such as $T_{ij} = aW_i J_j d_{ij}^{-\beta}$, where T_{ij} is the number of commuters between origin i with W_i workers and destination j with J_j jobs. In this study area, the β value varied from $\beta = 0.78$ in 1980, to $\beta = 0.74$ in 1990, and to $\beta = 0.23$ in 2000, confirming the historical trend of a declining β value over time as observed in other studies (Fotheringham and O'Kelly, 1989). A study by Fotheringham (1980) reported that the β value ranged from 0.1 to 2.2 across the continental United States.

Job proximity for tract i (D_i) is defined as the average of distances between this tract (as origin) and all job sites (as destinations) weighted by the probability P_{ij}:

$$D_i = \sum_{j=1}^{n} P_{ij} d_{ij}. \tag{2}$$

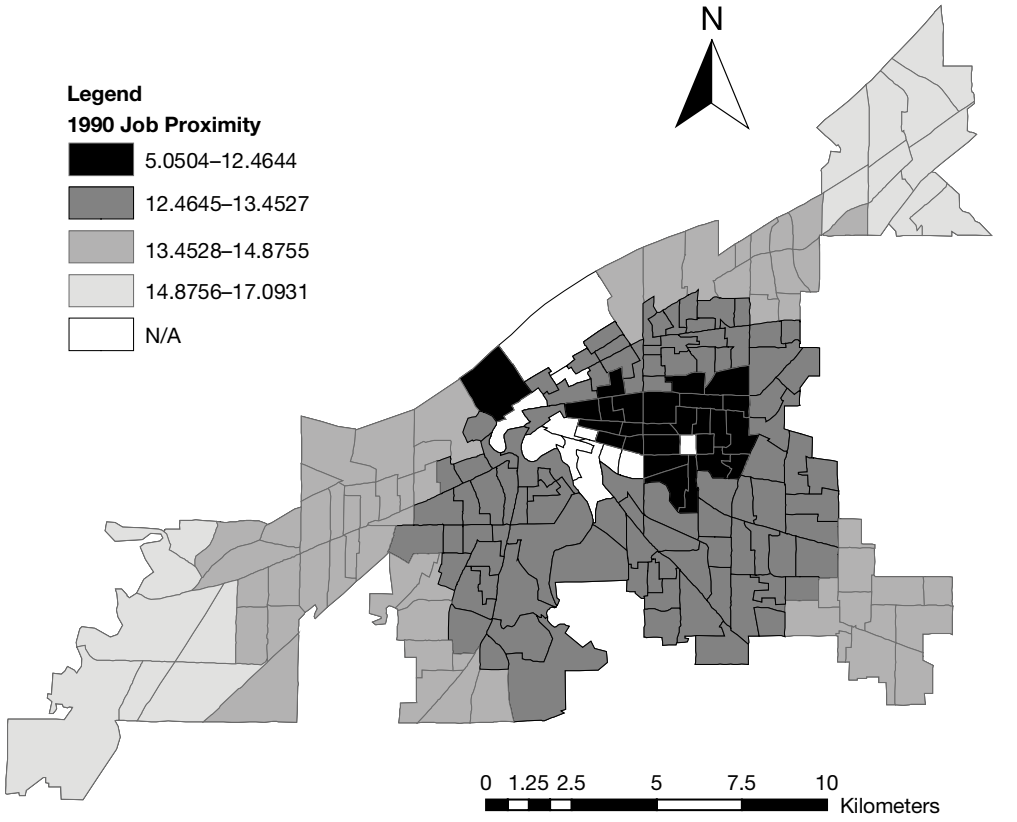
In essence, equation (2) measures how far a residential location is from all jobs. It is a measure superior to the simple average distance from jobs because it values a nearby job more than a remote one.

It may also be interpreted as "predicted commuting distance," given the job distribution patterns (see Wang, 2003). This job proximity index represents, perhaps, the commonly perceived location advantage in the job market without accounting for transportation means or nonspatial factors. The higher the values of job proximity, the farther residents live from the jobs.

As an example, exhibit 2 shows the variation of job proximity in the city of Cleveland in 1990. It exhibits a concentric pattern with the best proximity near the downtown area and increases in the D_i value outwards.

Exhibit 2

Job Proximity in Cleveland in 1990



N/A = not available (no/few residents).

Estimating Travel Times

One important task of implementing the job accessibility measure is to estimate travel times between tracts. The journey-to-work data part in CTPP provides the actual travel times between tracts. Measuring job accessibility, however, requires the input of travel times between all possible origin-destination tracts. Note that accessibility is based on an individual's potential, not necessarily

realized, links to jobs. The following discussion addresses how travel times by personal vehicles are estimated.

The first step is to use GIS network modeling techniques to simulate the shortest freeflow travel times through a network composed of all roads (down to neighborhood roads), where speed limits serve as travel impedance values. The simulated travel times (d_0) are preliminary and are between the centroids of tracts.

The next step uses a regression to improve the GIS-based estimated time d_0 by accounting for congestions at both the residential (origin) and workplace (destination) tracts. The dependent variable is the actual travel time d by auto drivers. The explanatory variables include d_0, density of resident workers at the origin tract (DEN_{wk}), and density of jobs at the destination tract (DEN_{jb}) per km^2. For example, the regression in 2000 yields the following model:

$$d = 8.3076 + 0.8011\ d_0 + 0.00169\ DEN_{wk} + 0.000167\ DEN_{jb}$$

where all three explanatory variables are statistically significant at 0.001 and have expected signs. This simple approach considers possible congestions only at the two ends of a trip. Considering traffic congestions during the whole trip would require more detail of road network coding (for example, lane capacity, traffic signal system, residential demographics, and business types). Advanced traffic simulation software considers how the traffic speed interacts with the volume on each segment of the road network and individual travelers optimize the travel time on a trip. That approach is not feasible for this research.

The constant term in the above regression model (that is, 8.30 in the 2000 model) may reflect the intrazonal travel time (including the time a commuter spends on starting the car at the beginning of the trip, finding a parking space at the end of the trip, and walking to the office). The coefficients of density variables may appear small; however, a tract with a residential density of 2,000 workers/km^2 adds 3.4 minutes to the trip, and a tract with a job density of 20,000 jobs/km^2 adds 3.3 minutes to the trip. Such additions are too significant to be neglected.

The final step is to use the regression model to improve the estimated travel time by private vehicles, denoted by d_r.

The regression for public transit following a similar procedure has less fitting power because the model is based on the general road network instead of the actual bus routes (data not available to us). The congestion effects are not significant for public transit. In fact, high-density residential or job areas usually have better access to public transportation and, consequently, offset the congestion effects. For this study, we use a simple regression to estimate travel times by public transit. The dependent variable is reported travel times by public transit d_p, and the only explanatory variable is the above estimated travel time d_r. The following is the regression result for 2000:

$$d_p = 28.0416 + 1.1745 d_r$$

where the constant term includes the time a commuter spends walking from his/her home to a bus stop and from a bus stop to his/her workplace and, thus, is considerably higher.

Measuring Job Accessibility

The job proximity index measures the average distance from jobs at a residential location but does not account for transportation means or competition among resident workers. A better measure is the job accessibility index.

Consider a simple but primitive measure of job accessibility such as

$$A_i = \sum_{j=1}^{n} J_j \, d_{ij}^{-\beta}, \tag{3}$$

where A_i is the job accessibility at location i, J_j is the number of jobs in location j, d_{ij} is now the travel time between them, β is the friction coefficient, and n is the total number of job locations.

One limitation of equation (3) is that it considers only the supply side of jobs and not the demand side—the competition for available jobs among workers. By incorporating the demand side, the job accessibility measure can be redefined (Shen, 1998) as

$$A_i = \sum_{j=1}^{n} \frac{J_j \, d_{ij}^{-\beta}}{V_j}, \text{ where } V_j = \sum_{k=1}^{m} W_k \, d_{kj}^{-\beta} \tag{4}$$

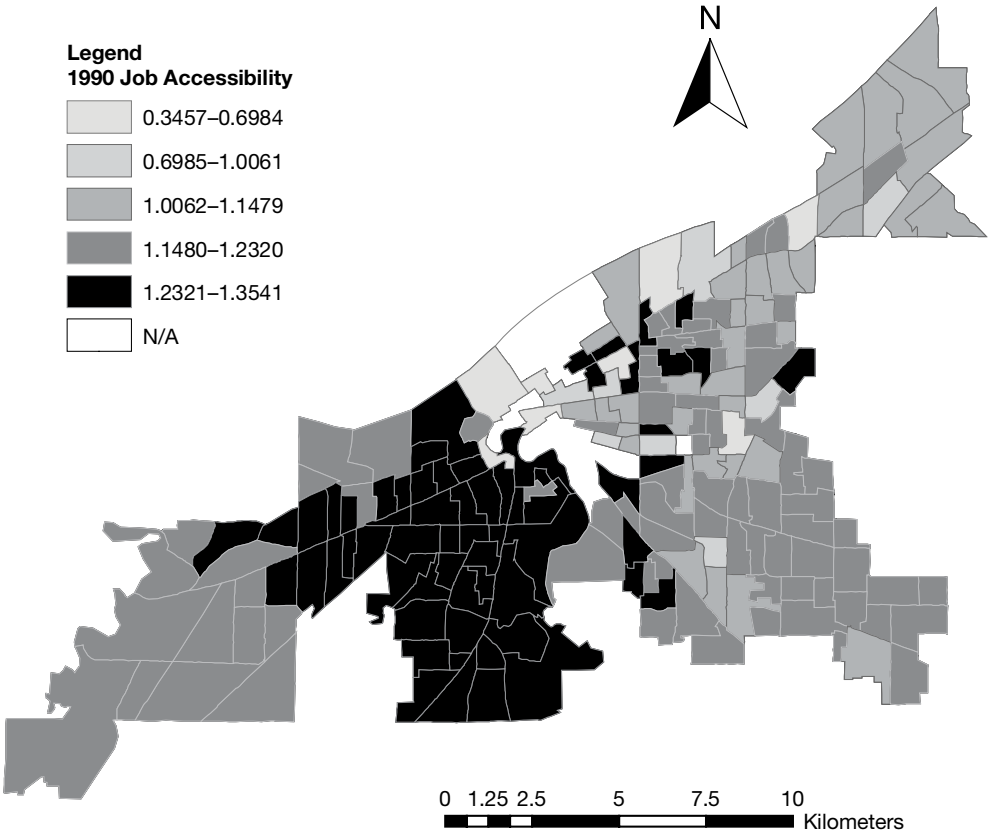
This new index rescales the accessibility to a job location j (j = 1, 2, …, n) by the location's job competition intensity (V_j), and V_j is measured by this job location's proximity to all workers (W_k, k = 1, 2, …, m). The number of job locations n does not have to be identical to the number of resident worker locations m.

Equation (4) is the generic form of job accessibility. Vehicle availability limits a person's choices of transportation modes, and public transit is much slower than travel by personal vehicle. Resident workers by various travel modes (for example, drive alone vs. ride public transit) have different values of job accessibility. It is assumed that workers without vehicles have to rely on public transit. Based on the 1980 UTPP data in Cleveland, it takes 95.3 percent more time for a person to travel by bus than to drive alone in his/her personal vehicle. Based on the 1990 and 2000 CTPP data, it took 110.4 percent more time by bus in 1990 and 117.7 percent more time in 2000. The final job accessibility is the weighted average of workers by personal vehicle and by bus based on the UTPP or CTPP data (Wang and Minor, 2002). The higher the values of job accessibility, the better access a person has to the overall job market.

For example, exhibit 3 shows the overall job accessibility pattern in the city of Cleveland in 1990. Because of limited space in this article, except in the section Results and Discussion, only the 1990 analysis (including measuring job proximity and job accessibility and consolidating socioeconomic covariates) is presented as exemplary work. Many inner-city tracts, although near the major job concentration of downtown Cleveland, suffer the worst job accessibility. The poor job accessibility of these inner-city areas is attributed to (1) poor vehicle availability (and thus relying on much slower public transportation), (2) traffic congestion in high-density residential areas, and (3) stiff competition for jobs with nearby resident workers. In comparison to exhibit 2, tracts on the southwest side enjoy better job accessibility for high vehicle availability and easy access to the highway network.

Exhibit 3

Job Accessibility in Cleveland in l990



N/A = not available (no/few residents).

Consolidating Socioeconomic Variables

Analysis of socioeconomic variables serves three purposes. First, the literature on accessibility indicates that accessibility is affected by both spatial and nonspatial factors. The *spatial (proximity) factor* is determined by the distribution of supplies and demands (jobs and resident workers in the case of job access) and the transportation network that connects them; the *nonspatial (nonproximity) factors* include socioeconomic and demographic characteristics of residents (Joseph and Phillips, 1984). To a large extent, the job accessibility index in equation (4) captures the spatial factor, although it is also affected by vehicle availability (a nonspatial factor). The analysis of socioeconomic variables helps us understand the nonproximity factors that also affect an individual's accessibility to jobs. Second, socioeconomic variables are consolidated for developing a more comprehensive index to identify disadvantaged neighborhoods. Finally, socioeconomic variables serve as covariates in regression analysis of possible association between job access and crime patterns.

The selection of socioeconomic covariates is based on a literature survey. For instance, Land, McCall, and Cohen (1990) and Morenoff, Sampson, and Raudenbush (2001) identify various community structural characteristics that possibly affect neighborhood crime levels. Specifically, this research considers nine covariates within the following three aspects:

1. Concentrated disadvantage: *Black residents, families below the poverty line, female-headed households with children under 18, unemployment,* and *mean family income*. Previous studies have shown that it is difficult to separate the influence of the percentage of Black from the other components of the disadvantage scale (Sampson and Wilson, 1995; Krivo and Peterson, 1996).
2. Residential instability: *residents who moved in the last 5 years* and *renter-occupied homes*.
3. Educational attainment and density: *residents without high-school diploma* and *households with an average of more than one person per room*.

All variables, except mean family income, are measured in percentages. Socioeconomic variables are often correlated, and factor analysis (FA) is used to consolidate them and uncover underlying dimensions. Additional benefits of FA include (1) consolidated factors that are independent from each other and thus make it easy to interpret regression results and (2) explained variances associated with factors that clearly indicate the relative importance of individual factors. Principal components analysis (PCA) is often used as an initial step of FA to help determine how many factors to include in the analysis. Eigenvalues generated from PCA provide a basis for judging which components (factors) are important and which are not and, thus, deciding how many components to retain. By reviewing the PCA results in 1980, 1990, and 2000, it is decided that four components (factors) are retained. This decision is based on the *scree graph* in each year. A scree graph plots eigenvalues against component number (Hamilton, 1992). In this study, each scree graph levels off after component 4, indicating that components 5 through 9 account for relatively little additional variance. The four factors account for 85.8 percent of total variance of the original nine variables in 1980, 81.8 percent in 1990, and 84.8 percent in 2000. In each year, the first component is by far the dominant factor (accounting for more than 50 percent of the variance captured by the four factors).

After deciding on the number of factors (four), the FA is used to consolidate the nine socioeconomic variables. The FA here used the popular Varimax rotation technique to maximize the loadings of a variable on one factor and minimize the loadings on all others. For example, the rotated factor pattern in 1990 is presented in exhibit 4. The factor patterns in 1980 and 2000 are similar to exhibit 4. Analyses in all 3 years indicate that factors 1 and 2 capture those variables of socioeconomic disadvantages (Black residents, female-headed households with children under 18, residents without high-school diploma, unemployment, mean family income, families below the poverty line); variables such as renter-occupied homes and residents who moved in the last 5 years are primarily loaded onto factor 3; and the density variable (households with an average of more than one person per room) is loaded onto factor 4. Therefore, we may label factor 1 as "primary indicator of concentrated disadvantages," factor 2 as "secondary indicator of concentrated disadvantages," factor 3 as "residential mobility," and factor 4 as "density." Scores of the primary indicator of concentrated disadvantages are mapped in exhibit 5 in the city of Cleveland in 1990. The higher the score, the more disadvantaged a neighborhood is.

Exhibit 4

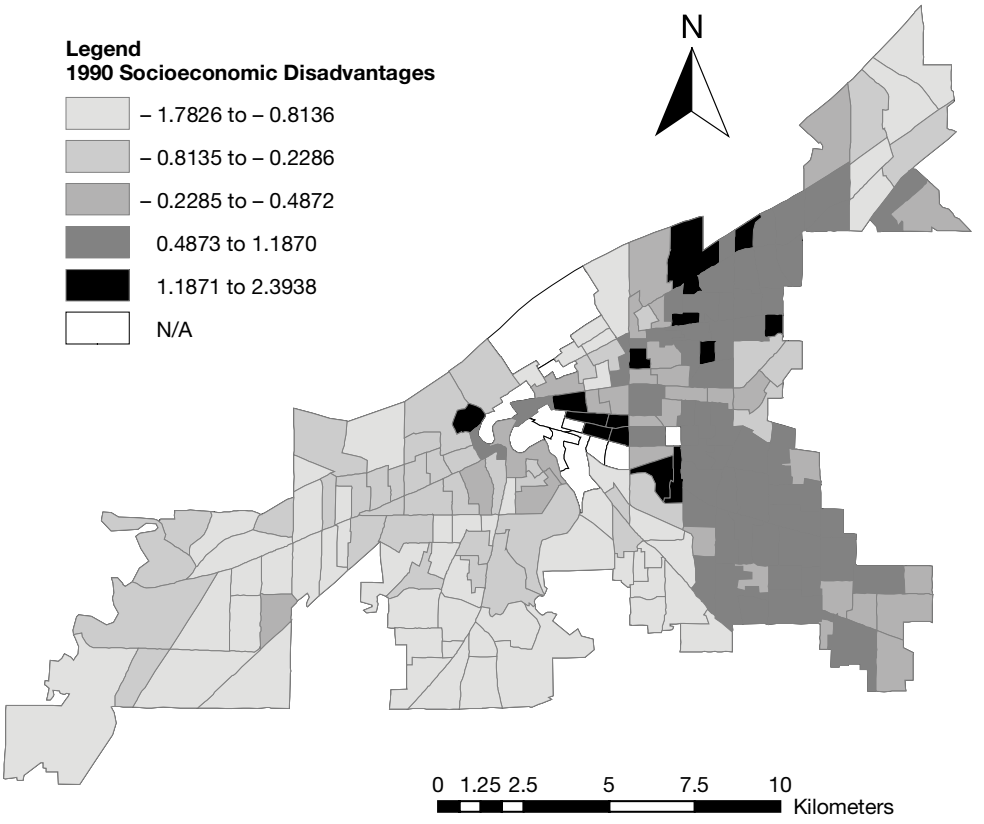
Factor Pattern of Socioeconomic Covariates in 1990

Variable	Factor 1: socioeconomic disadvantage 1	Factor 2: socioeconomic disadvantage 2	Factor 3: neighborhood instability	Factor 4: crowdedness
Blacks	**0.4561**	– 0.1743	– 0.2357	0.1484
Female-headed households	**0.3833**	– 0.2138	0.1378	– 0.2590
Unemployment	**0.3075**	– 0.0305	– 0.0612	0.0507
Residents without high-school diploma	– 0.2329	**0.6589**	– 0.2216	0.1816
Mean family income	0.0570	**– 0.3680**	– 0.0731	0.1645
Families below poverty	0.1390	**0.1955**	0.1102	0.0109
Renter-occupied homes	0.0433	0.1114	**0.3411**	0.1252
Residents moved in last 5 years	– 0.0942	– 0.1435	**0.6285**	– 0.0686
Households with >one person/ room	– 0.0098	0.0659	– 0.0336	**0.8971**

Note: Bold numbers indicate the highest loading of each variable on one of the four factors.

Exhibit 5

Primary Indicator of Concentrated Disadvantages in Cleveland in 1990



N/A = not available (no/few residents).

Results and Discussion

This research considers the following two sets of substantive questions:

1. Are disadvantaged neighborhoods located farther away from the jobs? Do they suffer from poorer job accessibility? Have the patterns changed over time?

2. Is job access associated with crime patterns? Does the relationship remain significant after controlling for other socioeconomic covariates? Is the relationship different between economic crimes and violent crimes? Has it changed over time?

Answers to the first set of questions shed light on the spatial mismatch hypothesis. The second set of questions addresses the effects of job accessibility on crime patterns. Although the measures of job access are based on the contiguous urbanized region as explained previously, all regression analyses in this section are limited to the city of Cleveland, where crime data are available. Only census tracts with valid socioeconomic variables are included. Tracts with no census information for defining the socioeconomic variables (generally tracts with few residents) are excluded. Such exclusion leads to 193 tracts for the analyses in 1980 and 1990 and 212 tracts for the analysis in 2000.

Measures of Job Access Versus Primary Indicator of Concentrated Disadvantages

Simple bivariate regressions are used to examine the relationship between both measures of job access (job proximity and job accessibility) and the primary indicator of concentrated disadvantages (that is, scores of factor 1). Only the most important factor (that is, the primary indicator of concentrated disadvantages) is chosen because it accounts for the majority of the variance from the original set of variables. The regression results are presented in exhibit 6. Because the factor scores from factor analysis are standardized with a mean of zero (0), the constant terms in the bivariate regressions on job proximity (or job accessibility) by the factor scores are also the average values of job proximity (or job accessibility). Exhibit 6 indicates that the average job proximity increased from 12.02 km in 1980, to 13.40 km in 1990, and to 14.21 km in 2000—about an increment of 1 km every decade during 1980–2000. In other words, on average, resident workers in the city moved farther away from their jobs over the study period, consistent with the national trend of decentralization of jobs and residents. The coefficients of factor 1 on job proximity and corresponding *t*-values show that job proximity was negatively associated with the primary indicator of concentrated disadvantages in both 1980 and 1990 (and statistically significant), but the relationship got weaker over time (smaller *t*-value in 1990 than in 1980) and was no longer significant in 2000 (and the sign was even reversed). That is to say, resident workers in neighborhoods with more socioeconomic disadvantages enjoyed better proximity to jobs (closer to the job market in terms of physical distances) in 1980 and 1990, but such an advantage faded over time and no longer existed in 2000.

Job accessibility better measures an individual's potential to access jobs by accounting for the actual road network, possible congestion in high-density areas, availability of personal vehicles, and the intensity of competition for jobs. From exhibit 6, the job accessibility was clearly negatively related to the primary indicator of concentrated disadvantages. In other words, resident workers in more

Exhibit 6

Regressions on Job Proximity and Accessibility by Primary Indicator of Concentrated Disadvantages, 1980–2000

	Job Proximity			Job Accessibility		
	1980 (*n*=193)	1990 (*n*=193)	2000 (*n*=212)	1980 (*n*=193)	1990 (*n*=193)	2000 (*n*=212)
Constant	12.0169 (169.79)***	13.4019 (160.73)***	14.2144 (42.41)***	1.0790 (99.34)***	1.1629 (96.67)***	1.0779 (734.00)***
Factor 1	– 0.7117 (– 9.82)***	– 0.2344 (– 2.55)*	0.3335 (0.64)	– 0.0319 (– 2.86)**	– 0.0395 (– 2.97)**	– 0.0145 (– 9.87)***
R^2	0.335	0.033	0.002	0.041	0.044	0.317

*Notes: P*P* p < *.05; P**P* p < *.01; P***P* p < *.001;* t*-values in parentheses.*

socioeconomically disadvantaged areas suffered from poorer job access. The relationship was statistically significant in 1980 and 1990 and became highly correlated in 2000 (with a correlation coefficient of 0.563). Better job proximity in disadvantaged neighborhoods was not able to be converted into better job accessibility in 1980 and 1990. When no advantage in job proximity for residents of these neighborhoods was observed in 2000, their disadvantages in job accessibility became more evident.

Association Between Job Accessibility and Crime Rates

To address the question of whether the variation in crime rates and the variation in job accessibility are related to each other, the analysis begins with simple ordinary least squares (OLS) bivariate regressions between crime rates and job accessibility at the census tract level. In analyzing crime rates, a common practice is to measure the dependent variable by the logarithmic transformation of rates to better resemble a normal distribution (see Land, McCall, and Cohen, 1990). One (1) is added to the rates to avoid taking a logarithm of 0. The choice of adding 1 (instead of 0.2, 0.5, or others) is arbitrary and may bias the coefficient estimates. Different additive constants, however, have minimal consequence for significance testing as standard errors grow proportionally with the coefficients and thus leave the *t* values unchanged (Osgood, 2000). In addition, adding 1 ensures that $log(r+1) = 0$ for $r = 0$.

Exhibit 7 presents the regression results using both the total crime rate and its logarithmic transformation in each year as the dependent variable. Regressions on specific crimes yield similar results. In all cases, job accessibility is negatively correlated with crime rates. The relationship is statistically significant but has become weaker over time.

To control for socioeconomic covariates, the four factor scores are added as explanatory variables in the OLS regressions on various crime rates. Because of limited space, only the analysis results in 1980 are presented. Exhibit 8 shows the OLS regressions on crime rates; exhibit 9 shows the OLS regressions on logarithms of crime rates. As with exhibit 7, the results on crime rates and their logarithmic transformations are generally consistent with each other. In the following discussion, only regressions using logarithms of crime rates will be presented.

One likely problem of intraurban data is the positive spatial autocorrelation (or spatial dependence) among observations, which occurs when attributes of nearby areas are more similar than those of distant ones. The presence of spatial dependence, in which the dependent variable is correlated with the dependent variable of nearby observations, results in inconsistent and inefficient estimators by OLS. This problem can be corrected by spatial regression models that are implemented by the maximum likelihood estimation techniques (Smirnov and Anselin, 2001). One commonly used spatial regression model is a *spatial lag model*. The model includes the mean of the dependent variable in neighboring areas (that is, *spatial lag*) as an extra explanatory variable (for example, Anselin, 1988). The model can be written as

$$y = p\, y_{-1} + b\, x + e,$$

where y is the rate of a particular crime (or all crimes), y_{-1} is its spatial lag, x is employment access, and e is the random error. Spatial statistical software GeoDa, a free package developed by Luc Anselin and his colleagues (www.geoda.uiuc.edu), is used to estimate the above spatial lag model.

Exhibit 10 shows the spatial regression results on the 1980 crime rates based on GeoDa. In all spatial regressions on crime (except for rape), the coefficients and significance levels of spatially lagged crime rates indicate strong positive spatial autocorrelation. This observation indicates that census tracts with high crime rates tend to be bordered by other census tracts with high crime rates. The presence of spatial autocorrelation confirms the necessity of using spatial regressions over OLS regressions. The results from spatial regressions, however, are generally consistent with those from the OLS regressions in exhibit 9 in terms of signs of coefficients and statistical significance levels for explanatory variables.

For the 1990 and 2000 crime rates, the spatial regression results are summarized in exhibits 11 and 12, respectively.

Exhibit 7

Regressions on Total Crime Rates by Job Accessibility, 1980–2000

	Crime Rates			Logarithms of Crime Rates		
	1980 (*n*=193)	**1990 (*n*=193)**	**2000 (*n*=212)**	**1980 (*n*=193)**	**1990 (*n*=193)**	**2000 (*n*=212)**
Constant	850.92 (9.29)***	352.20 (11.36)***	595.50 (2.62)**	6.7130 (20.59)***	6.0217 (20.51)***	8.5612 (9.60)***
Job accessibility	– 687.48 (– 8.19)***	– 230.35 (– 8.74)***	– 473.51 (– 2.24)*	– 2.2507 (– 7.53)***	– 1.5477 (– 6.20)***	– 6.1443 (– 4.11)***
R^2	0.260	0.286	0.023	0.229	0.168	0.074

*Notes: * p < .05; ** p < .01; *** p < .001; t-values in parentheses.*

Exhibit 8

OLS Regressions on Crime Rates in 1980

	Homicide	Rape	Robbery	Burglary	Auto Theft	All Crimes
Constant	2.3594 (4.70)***	10.0168 (6.62)***	177.67 (8.63)***	257.22 (7.02)***	488.36 (8.44)***	945.59 (8.69)***
Job accessibility	– 1.5940 (– 3.47)***	– 7.6653 (– 5.53)***	– 146.16 (– 7.75)***	– 198.08 (– 5.90)***	– 14.18 (– 7.82)***	– 774.76 (– 7.78)***
Factor 1	0.2962 (4.89)***	0.6025 (3.3)**	10.57 (4.26)***	7.34 (1.66)	7.00 (1.00)	27.07 (2.07)*
Factor 2	0.0286 (0.43)	– 0.2272 (– 1.12)	– 0.12 (– 0.04)	– 2.37 (– 0.48)	– 3.23 (– 0.42)	– 6.64 (– 0.46)
Factor 3	0.0968 (1.66)	– 0.0655 (– 0.37)	– 5.44 (– 2.27)**	– 13.09 (– 3.07)**	– 27.93 (– 4.15)***	– 46.54 (– 3.68)***
Factor 4	0.1346 (2.14)*	0.8179 (4.32)***	4.34 (1.68)	16.14 (3.52)***	15.43 (2.13)*	37.30 (2.74)**
R^2	0.243	0.291	0.374	0.254	0.317	0.337

OLS = ordinary least squares.

*Notes: P*P p < .05; P**P p < .01; P***P p < .001; t-values in parentheses;* n = *193.*

Exhibit 9

OLS Regressions on Logarithms of Crime Rates in 1980

	Homicide	Rape	Robbery	Burglary	Auto Theft	All Crimes
Constant	0.9339 (3.97)***	2.1462 (7.05)***	4.2941 (10.92)***	4.7875 (15.86)***	5.8080 (13.95)***	6.2548 (18.77)***
Job accessibility	– 0.5049 (– 2.34)*	– 1.2699 (– 4.55)***	– 1.7158 (– 4.76)***	– 1.1738 (– 4.25)***	– 2.4989 (– 6.55)***	– 1.8311 (– 6.00)***
Factor 1	0.1531 (5.40)***	0.2292 (6.25)***	0.5861 (12.36)***	0.2393 (6.58)***	0.2619 (5.22)***	0.3284 (8.18)***
Factor 2	0.0311 (0.99)	0.0023 (0.06)	– 0.0949 (– 1.80)	– 0.0467 (– 1.15)	– 0.0446 (– 0.80)	– 0.0524 (– 1.17)
Factor 3	0.0838 (3.06)**	0.1342 (3.79)***	0.0896 (1.96)	– 0.0127 (– 0.36)	– 0.1308 (– 2.70)**	– 0.0312 (– 0.81)
Factor 4	0.0795 (2.70)**	0.1521 (3.99)**	0.2056 (4.17)***	0.1780 (4.71)***	0.1453 (2.79)**	0.1755 (4.21)***
R^2	0.265	0.394	0.589	0.374	0.374	0.472

OLS = ordinary least squares.

*Notes: P*P p < .05; P**P p < .01; P***P p < .001; t-values in parentheses;* n = *193.*

Exhibit 10

Spatial Regressions on Logarithms of Crime Rates in 1980

	Homicide	Rape	Robbery	Burglary	Auto Theft	All Crimes
Spatial lag	0.2094	– 0.0720	0.3224	0.3599	0.4700	0.4092
	(2.27)*	(– 0.75)	(4.25)***	(4.47)***	(6.53)***	(5.52)***
Constant	0.7246	2.1290	3.3616	3.3896	3.7823	4.2501
	(3.32)***	(7.08)***	(8.19)***	(8.22)***	(8.34)***	(9.15)***
Job accessibility	– 0.3917	– 1.2136	– 1.5842	– 1.0529	– 1.9743	– 1.5947
	(– 2.00)*	(– 4.62)***	(– 4.98)***	(– 4.30)***	(– 6.00)***	(– 5.93)***
Factor 1	0.1248	0.2510	0.4110	0.1555	0.1497	0.1999
	(4.16)***	(6.01)***	(6.87)***	(3.99)***	(3.00)**	(4.52)***
Factor 2	0.0287	0.0050	– 0.0756	– 0.0349	– 0.0316	– 0.0367
	(0.95)	(0.12)	(– 1.54)	(– 0.93)	(– 0.63)	(– 0.89)
Factor 3	0.0719	0.1452	0.0501	– 0.0126	– 0.1062	– 0.0342
	(2.63)**	(3.89)***	(1.16)	(– 0.39)	(– 2.42)*	(– 0.96)
Factor 4	0.0687	0.1569	0.1643	0.1524	0.1086	0.1414
	(2.40)*	(4.07)***	(3.51)***	(4.26)***	(2.29)*	(3.62)***
Sq. Corr.	0.286	0.385	0.633	0.447	0.513	0.559

*Notes: P*P* p < *.05; P**P* p < *.01; P***P* p < *.001; z-values in parentheses;* n = *193.*

Exhibit 11

Spatial Regressions on Logarithms of Crime Rates in 1990

	Homicide	Rape	Aggravated Assault	Robbery	Burglary	Auto Theft	All Crimes
Spatial lag	– 0.1070	0.2800	0.3317	0.3476	0.3744	0.4868	0.2939
	(– 1.07)	(3.58)***	(5.12)***	(4.46)***	(4.73)***	(6.83)***	(4.21)***
Constant	0.7835	1.2080	1.3600	1.9811	2.2245	2.4911	3.6620
	(4.13)***	(4.46)***	(5.29)***	(4.87)***	(6.73)***	(6.53)***	(9.59)***
Job accessibility	– 0.4341	– 0.4786	– 0.1131	– 0.5481	– 0.2419	– 0.8429	– 0.5760
	(– 2.69)**	(– 2.16)*	(– 0.57)	(– 1.75)	(– 1.29)	(– 3.33)***	(– 2.96)**
Factor 1	0.1422	0.2581	0.3661	0.2845	0.0459	0.0142	0.2336
	(5.19)***	(6.36)***	(9.18)***	(5.18)***	(1.54)	(0.36)	(6.61)***
Factor 2	0.0865	0.1860	0.2780	0.2108	0.1534	0.1095	0.2386
	(3.70)***	(5.43)***	(8.38)***	(4.38)***	(5.23)***	(2.92)**	(7.49)***
Factor 3	– 0.0088	0.0751	0.0932	0.1475	0.0787	0.1303	0.1346
	(– 0.38)	(2.34)*	(3.23)**	(3.19)**	(2.79)**	(3.38)***	(4.54)***
Factor 4	0.0020	0.0987	0.1016	0.1092	0.0915	0.1141	0.1488
	(0.08)	(2.85)**	(3.26)**	(2.23)*	(3.14)***	(2.92)**	(4.86)***
Sq. Corr.	0.240	0.542	0.728	0.514	0.446	0.505	0.674

*Notes: P*P* p < *.05; P**P* p < *.01; P***P* p < *.001; z-values in parentheses;* n = *193.*

Exhibit 12

Spatial Regressions on Logarithms of Crime Rates in 2000

	Homicide	Rape	Aggravated Assault	Robbery	Burglary	Auto Theft	All Crimes
Spatial lag	– 0.0110	0.1096	0.3339	0.3370	0.3036	0.4435	0.4556
	(– 0.11)	(1.17)	(4.54)***	(4.31)***	(3.74)***	(6.30)***	(6.75)***
Constant	14.8854	0.8039	– 1.8101	1.1781	0.7071	0.0681	0.0702
	(2.10)*	(0.12)	(– 0.55)	(0.38)	(0.38)	(0.04)	(0.04)
Job accessibility	– 12.8840	2.6824	5.3635	2.7860	4.0795	3.6878	4.3991
	(– 1.96)*	(0.42)	(1.74)	(0.96)	(2.34)*	(2.12)*	(2.83)**
Factor 1	0.0894	0.6486	0.4429	0.2673	0.0824	0.1253	0.1321
	(0.59)	(4.25)***	(5.62)***	(3.80)***	(2.07)*	(3.09)**	(3.64)***
Factor 2	0.1337	0.0130	0.1985	0.1975	0.0970	0.1737	0.1975
	(1.05)	(0.11)	(3.19)**	(3.37)***	(2.80)**	(4.74)***	(5.79)***
Factor 3	– 0.2068	0.2108	0.4356	0.3120	0.2345	0.2105	0.1978
	(– 1.60)	(1.67)	(6.58)***	(5.21)***	(6.43)***	(5.80)***	(5.94)***
Factor 4	0.1950	0.3017	0.1149	0.0047	0.0118	– 0.0340	0.0097
	(1.67)	(2.67)**	(2.07)*	(0.09)	(0.38)	(– 1.11)	(0.35)
Sq. Corr.	0.071	0.187	0.506	0.397	0.336	0.472	0.541

*Notes: P*P p < .05; P**P p < .01; P***P p < .001; z-values in parentheses;* n = *212.*

Based on exhibits 8 through 10, we consider the effects of two methodological decisions:

1. *Does it matter whether we use crime rates or logarithms of crime rates as the dependent variable?*

   Not really. The regression results are, in general, consistent with each other in terms of statistical significance levels of explanatory variables. Nevertheless, the models using the logarithms of crime rates tend to yield better R^2. From a statistical analysis point, it is perhaps more appropriate to use the logarithmic transformation of crime rates if the crime counts (for example, homicide and rape) in small areas (such as census tracts) are low and the rates are often skewed toward the left. Otherwise, it is convenient to simply use the crime rates.

2. *Does it matter whether we use OLS regressions or spatial regressions?*

   Yes. The presence of spatial dependence necessitates the usage of spatial regressions. In our case, the OLS and spatial regressions are generally consistent with each other. The application of spatial regressions usually needs the knowledge of GIS and calls for usage of special software of spatial statistics. One may use OLS regressions for preliminary analysis when access to spatial regression analysis is not available.

The analysis now focuses on exhibits 10 through 12, all based on spatial regressions on logarithms of crime rates. The following discussion summarizes the findings to address the substantive questions raised earlier.

1. *Is there a relationship between job access and crime rates in Cleveland?*

   Yes, with more at the beginning of the study period, but getting weaker over time. In 1980, coefficients for job accessibility in all crime models were negative, as expected, and were statistically significant. In 1990, the coefficients remained negative but were significant in only four models (homicide, rape, auto theft, and all crime). In 2000, the coefficient was negative and significant in only the model for homicide; in others, the coefficients became positive and even significant in the models for burglary, auto theft, and all crime. Although the simple bivariate regressions between job accessibility and crime rates in exhibit 7 show that areas with poorer job access indeed were correlated with higher crime rates, the relationship got weaker over time and became not significant or even reversed (in some cases) when socioeconomic covariates were controlled for.

   Two factors may have played some roles in explaining this observation. First, the correlation between job accessibility and crime rates indeed became weaker as evidenced in the declining R^2 values over time in the bivariate regression models shown in exhibit 7 (for example, $R^2 = 0.260$ in 1980, 0.286 in 1990, and 0.023 in 2000 in the crime rate models; $R^2 = 0.229$ in 1980, 0.168 in 1990, and 0.074 in 2000 in the logarithmic models). Second, the correlation between job accessibility and primary indicator of concentrated disadvantages became stronger over time ($R^2 = 0.041$ in 1980, 0.044 in 1990, and 0.317 in 2000), and, therefore, more explanation power of crime rates was captured by the socioeconomic covariates in multivariate regressions. This observation highlights the dominant effect of socioeconomic disadvantages on crime patterns, and increasingly so over time. By 2000, poorer job accessibility became so closely associated with disadvantaged neighborhoods that it may be regarded as just another indicator of socioeconomic disadvantages. Early analysis on the job proximity pattern (for example, increasing spatial separation between job and residence and disappearing job proximity for disadvantaged neighborhoods) may explain part of the puzzle; however, this finding also calls for more indepth analysis on the possible changed roles of job access over time. What has contributed to the change? Was it the change of land use pattern, automobile ownership, transportation network, or others? Did the 1996 Welfare Reform Act play any role?

2. *Are socioeconomic disadvantages associated with higher crime rates?*

   Yes. The primary indicator of concentrated disadvantages (factor 1) was positively associated with crime rates with the highest statistical significance in most cases. The secondary indicator of socioeconomic disadvantages (factor 2) was not significant in 1980 models but was significant in most of the 1990 and 2000 models. The other factors were of less importance because they accounted for less variance of the original set of socioeconomic variables.

3. *Do the relationships differ by type of crime?*

   Yes. Previous research has shown a pattern of stronger relationships between unemployment and property crimes than between unemployment and violent crimes (Chiricos, 1987). Following the classification by the FBI in the UCRs, auto theft and burglary are property offenses or economic crimes, and homicide, rape, aggravated assault, and robbery are violent crimes. The coefficients and corresponding *z*-values for job accessibility were generally larger in models of economic crimes than those in models of violent crimes in 1980 and 1990. This observation

seems to support the theory that job access is more relevant in explaining economic crimes than violent crimes. Regression results in job accessibility in 2000 were puzzling and were discussed earlier: the coefficient was either negative (in the case of homicide) or not significant (rape, aggravated assault, robbery) in models of violent crimes but was positive in models of economic crimes. On the contrary, the coefficients and corresponding *z*-values for factor 1 (primary indicator of concentrated disadvantages) were generally smaller in models of economic crimes than those in models of violent crimes throughout the study period 1980–2000. Those results seem to suggest that socioeconomic disadvantages affect violent crimes more than economic crimes. In all 3 years, models for homicide have the lowest R^2. The models for rape have lower R^2 in both 1980 and 2000 but relatively higher R^2 (0.50) in 1990. In both 1990 and 2000 (data not available in 1980), the models for aggravated assault have the highest R^2.

4. Have the relationships changed over time?

Overall, more stability than change in relationship seems to exist between socioeconomic covariates and crime rates over time. The role of job access, however, has become less important in affecting crime rates over time.

Summary and Public Policy Implications

This section briefly summarizes major findings and discusses possible policy implications.

Principal Findings

Neighborhoods with more socioeconomic disadvantages tended to enjoy better job proximity (that is, closer to jobs in terms of physical distance) in 1980 and 1990 but gradually lost the advantage over time and no longer had it in 2000. Better job proximity was not converted into better job accessibility, however, because many resident workers in those neighborhoods had limited transportation mobility with relatively lower levels of automobile ownership and the competition for jobs was intense among high-density residential areas. In fact, resident workers in disadvantaged neighborhoods suffered from poorer job access throughout the study period 1980–2000, and the negative correlation between job accessibility and the primary indicator of concentrated disadvantages was strong in 2000.

The job accessibility alone was negatively associated with crime rates in Cleveland throughout the study period (1980–2000). When socioeconomic covariates were controlled for, the relationship remained significant in 1980, became weaker in 1990, and was not important in 2000. This trend, on the one side, indicates a less important role played by job accessibility in affecting crime patterns over time. At the same time, stronger correlation between job accessibility and primary indicator of concentrated disadvantages over time implies that more explaining power of crime rates has been captured by the socioeconomic covariates, highlighting the dominant effect of socioeconomic disadvantages on crime patterns. Poor job access leads to difficulties in job search or job retention and, consequently, to poverty and socioeconomic disadvantages. On the other side, socioeconomic disadvantages reduce a person's mobility by limiting both residential choices and vehicle availability and, thus, impair job accessibility. Although we cannot determine which direction of the causal effects is more important than the other, the research suggests that poor

job access represents another indicator of socioeconomic disadvantages and, collectively, explains intraurban variations of crime rates.

Theoretical Implications

The findings seem compatible with contemporary versions of social disorganization theory (for example, Bursik and Grasmick, 1993; Wilson, 1996, 1987) or the social stress theory (Brown, 1980; Rose and McClain, 1990). Socioeconomic disadvantages or social stressors, whether they are poverty, unemployment, or lack of access to jobs, form "an unfavorable perception of the social environment and its dynamics," and thus are explicitly linked to social problems, including crime (Brown, 1980). Data used for this study, however, are ecological in nature and do not justify a conclusion that individuals living in disadvantaged neighborhoods with poor job access are the individuals who commit crimes (Robinson, 1950). Rather, it may simply be that communities with poor job access are communities with larger numbers of people who are discouraged, disengaged, desperate, or otherwise lacking the social bonds that restrain criminality (Allan and Steffensmeier, 1989).

Policy Implications

This research demonstrates that being closer to jobs in physical distances does not necessarily transfer into an advantage in job access. Access is a transportation issue as well as a mobility issue. Both may be handicapped by socioeconomic disadvantages. "The best welfare-reform plan was jobs. The best housing plan was jobs. The best educational plan was jobs" (Raines, 2003: 81). To solve the complex web among socioeconomic disadvantages, job access, and crimes, the best hope is perhaps to focus on job access. Jobs are important, but jobs make a difference *only when the jobs are accessible*. As indicated by this research, the benefit of better job access goes beyond alleviating poverty; it also helps curtail crimes. Two policy remedies have been attempted to reduce the spatial mismatch: (1) relocating low-income and minority residents to suburbia where some claimed to have more entry-level or low-wage jobs (particularly in retail services) than in central cities, and (2) creating new jobs in disadvantaged communities. The first approach has led to very limited success because the public transportation service in suburbia is often inadequate and thus handicaps the job access of these relocated residents, most of whom are transit dependent. The second approach includes the Enterprise Zone (EZ) Program, which provides special incentives to encourage business investment and promote the creation of new jobs in economically distressed areas. For EZ companies, incentives include extension of operating loss carry-forward, tax credits, preference points in bidding for state contracts, and others. Although the factors representing concentrations of socioeconomic disadvantages are already included in the current EZ Program, it is also important to consider depletion of jobs and lack of job access in the designations. For a sustainable EZ Program, policymakers may also consider programs that specifically address the transportation needs of prospective employees in the areas, as discussed in the following paragraph.

If job proximity for disadvantaged inner-city neighborhoods is not a major issue, public policy should be focused on overcoming other barriers. Recent studies in developing transportation alternatives for welfare recipients moving to work shed light on improving job accessibility for lower income residents. Some researchers suggest programs of *encouraging automobile ownership* (Wachs and Taylor, 1998) through subsidies for purchasing autos and insurances; however, the

high cost (more than $6,000 per client in one typical program) makes such programs infeasible on a large scale (Sawicki and Moody, 2000). More researchers favor solutions from *public transportation improvements* (Bania, Leete, and Coulton, 2001). Existing fixed-route transit systems suffer from many drawbacks, such as the inability to provide access to human services (child care and health care), confined service areas, and inflexible schedules. Proposed programs include extending the reach of public transit by using small buses to carry people outside the public transit service area and providing transportation via small buses from local neighborhood collection centers to employment clusters (Sawicki and Moody, 2000). Studies in Portland, Oregon, and Atlanta, Georgia, showed that better access to public transit significantly improves average rates of labor participation (Sanchez, 1999). Others (Roder and Scrivner, 2005) found that provision of transportation services for inner-city job seekers to access suburban jobs had little effect in improving the employment and earnings. In the latter case, lengthy commutes by participants in the Bridges to Work demonstration projects (more than half had one-way commutes of more than 45 minutes) may explain partially the less-than-promising outcome.

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Homeowner Age and House Price Appreciation

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Abstract

Do the houses of elderly homeowners appreciate at the same rate as the average house in their local market? As the population ages and retirees plan their financial future, homeowners need to project accurately the value of their single largest asset—their house. The federal government is also concerned about the financial welfare of its elderly citizens and the solvency of the insurance for reverse mortgages. Using Health and Retirement Study data, we find that the houses of elderly (75 years old or older) homeowners appreciate 1 percentage point less per year in real terms than the houses of middle-aged (50 to 74 years old) homeowners. These estimates are smaller than the findings of Davidoff (2004), who used the American Housing Survey to show a 3-percentage-point slower house appreciation rate for homeowners aged 75 or older relative to that of all other homeowners. Using census microdata in nonlongitudinal form (1990 and 2000), we find 2.4-percentage-point slower real house appreciation for elderly homeowners. Houses of elderly homeowners thus appreciate in real terms at a 1- to 3-percentage-point discount relative to their local markets.

Introduction

Do the houses of elderly homeowners appreciate at the same rate as the average house in their local market? The answer matters most directly to elderly homeowners making long-range financial plans. For most elderly homeowners, and especially for low-wealth homeowners, their house is

their largest asset. It would be logical to assume that the house would appreciate at the long-run average house price appreciation rate (5.9 percent per year in nominal terms minus 4.1 percent for inflation equals 1.8 percent in real terms).[1] Despite this assumption, elderly homeowners might have lower house appreciation rates because they spend less money on remodeling and maintenance. Most people know of an old person who has lived in the same house for many years and done little to update the property. Does this anecdotal evidence represent an outlier or should elderly homeowners expect lower house price appreciation?

Elderly homeowners are not the only ones concerned about their house values and financial planning. Certainly their children have a vested interest in providing for their parents. Local governments rely on property taxes linked to house values. Towns with a high proportion of elderly homeowners have to provide sufficient social services, particularly for seniors who prefer to stay in their own homes. Both the families and their local governments want to preserve the older properties as a source of affordable housing for the next generation of homebuyers. Finally, the federal government cares about elderly homeowners and their house values. In particular, the Federal Housing Administration insures Home Equity Conversion Mortgages (HECMs), which enable elderly homeowners to convert their house equity into cash. The homeowners do not need to pay off the reverse mortgage until they move or permanently leave their home; at that point, the house is sold to pay off the loan. The long-run viability of the HECM insurance fund depends on projected house values exceeding loan balances. Given the potentially long time horizon of 20 years or more before the loan is paid, what should government officials assume about future house price appreciation?

Using data from Growing Older in America: The Health and Retirement Study (HRS), we find that the houses of elderly (75 years or older) homeowners appreciate in constant dollars at a rate 1.0 to 1.2 percentage points less per year than the houses of middle-aged (50 to 74 years old) homeowners. This discount in house price appreciation for age is smaller than the 3-percentage-point discount estimated in Davidoff (2004) using American Housing Survey (AHS) data. Our HRS estimate compares house value appreciation for elderly homeowners with that of middle-aged homeowners for a period of 10 years or less, while Davidoff's (2004) AHS estimates contrast house value appreciation for elderly homeowners with that for *all* homeowners and follows the homeownership period for up to 16 years. After adjusting the HRS estimates for the 0.4-percentage-point gap between middle-aged homeowners and all homeowners, our best estimate for the elderly discount in house value appreciation is 1.4 to 1.6 percentage points relative to all homeowners.

Both the HRS and AHS data sets are longitudinal. Longitudinal data sets enable us to control for fixed personal and property-specific effects and provide the best way to track the change in house values without the confounding effects of the changing composition of households and properties. The appreciation rate can also be tracked using the Census Bureau's Public Use Microdata Sample (PUMS). PUMS has a disadvantage in that it consists of two independent cross-sections, 1990 and 2000, which were aggregated by age group and metropolitan statistical area (MSA). PUMS data have large samples and better controls for building age and length of tenure than those that

[1] The 5.9-percent annual house price appreciation rate comes from the Office of Federal Housing Enterprise Oversight (OFHEO) national House Price Index from the first quarter of 1975 to the first quarter of 2005. The inflation rate of 4.1 percent is calculated from the Consumer Price Index excluding shelter expenses for the same period.

are available in the HRS data. PUMS data indicate that the house prices of homeowners 75 years old and older appreciate 2.4 percentage points more slowly per year than do those of younger homeowners.

Thus, two independent studies, this one and Davidoff's (2004), analyzing three separate data sets—HRS, AHS, and PUMS—show a negative and significant relationship between age and house value appreciation. The elderly discount from the HRS is about half the discount from the AHS or PUMS, but even that smaller difference could be critical in the long run to homeowners, lenders, and insurance funds (see exhibit 5 in the second section following this introduction).

The remainder of the article is divided into four sections. The first section provides a brief review of the literature on elderly housing decisions. The second section presents the HRS data used for analysis and ends with estimations of house value appreciation using HRS/Assets and Health Dynamics Among the Oldest Old (AHEAD) Study data and comparisons with recent findings by Davidoff (2004) using the AHS data. The third section provides a benchmark from the Census Bureau's PUMS data by comparing appreciation rates between 1990 and 2000. A final section summarizes the findings in light of six alternative "stories," each of which may contain some partial truth.[2]

Literature Review

Several authors have addressed the issue of elderly wealth. Venti and Wise (2001a, 2001b) have used HRS/AHEAD data to find that equity-rich, low-income households tend to reduce equity when they sell. People with substantial amounts of nonhousing wealth shift their assets into housing, whereas people with limited nonhousing wealth rebalance their portfolio by reducing the housing equity share. Overall, housing equity increases until about age 75 and then declines by about 1.76 percent per year. Homeowners with intact households rarely move or refinance to take equity out of their house. The equity decline among older homeowners is driven primarily by 7.84 percent of households experiencing a health shock (either a death or move to a nursing home) to their family status.

The life-cycle model (Hurd, 1990) predicts that wealth will be "decumulated" as people age, but the uncertainty about the amount of time until death leads people to spend down nonhousing wealth first and hang onto their house as long as possible. In fact, the results confirm that nonhousing wealth is spent down faster and earlier than home equity. Owned housing is not just an investment; it also provides a stream of real consumption and precautionary savings against unexpected costs, especially health costs (Heiss, Hurd, and Borsch-Supan, 2003).

Goodman and Thibodeau (1997, 1995) found that the largest reduction in house value from depreciation occurs in the first 10 years of the building's life before tapering off to 0 when the building reaches age 20 and slightly increasing in years 20 to 40, presumably due to remodeling. (See also Harding, Rosenthal, and Sirmans, 2007.) The findings by Goodman and Thibodeau (1997, 1995) suggest that old buildings do not suffer greater depreciation as the homeowner

[2] The full report, *The Relationship Between Homeowner Age and House Price Appreciation*, which includes policy implications and statistical appendixes, is available on the Abt Associates Inc. website (http://www.abtassociates.com/reports/HP_Aging_Final.pdf).

ages, but the extremely aged homeowners were probably a small share of the sample. Even more consistent in their findings than the rate of depreciation is the widening variance in house values as buildings age. The range of house values for an old building is usually much wider than for a new house. Part of this age-related heteroskedasticity is due to home improvement projects, including additions and remodeling. Capozza, Israelsen, and Thomson (2005) refer to the "atypicality" of a house that has acquired unusual features as it has aged. Appraisers may have a difficult time finding comparable houses in the neighborhood and therefore discount the appraised value. Older homeowners often have not updated the style of their house for 10 to 20 years, and, as a result, the house becomes atypical relative to other houses on the market. The dated styles lower demand and increase the search time for a suitable buyer, leading to discounts for atypical houses. These findings directly support the fifth explanation for elderly discounts: the higher variance of older house values is a leading cause of lower appreciation rates for older homeowners.

The most relevant predecessor to this article is by Davidoff (2004). He used the panel of national AHS data from 1985 to 2001 both to measure the house price appreciation of homes owned by the elderly and to link maintenance spending to homeowner age. He found that elderly homeowners spend less on maintenance. Homeowners who are more than 75 years old spend $270 less on routine maintenance than do younger homeowners of similar homes and spend $1,100 less on all home improvements. Older homeowners also realize lower house price appreciation by about 3 percent per year than do younger homeowners for similar homes in similar markets during 1985 to 2001.

Most of the house value data that are publicly available use information reported by the homeowners. How reliable are the self-reported house values by elderly homeowners? Using the national AHS (1985 to 1987), Goodman and Ittner (1992) found that the average homeowner overvalues his or her house by 6 percent, with an average absolute error rate of 14 percent. DiPasquale and Somerville (1995) used the AHS data to compare the rate of appreciation in house prices based on transaction units with the entire stock. They found that units with longer tenure had lower house values and lower appreciation.

Kiel and Zabel (1999) used confidential metropolitan AHS data merged with census tract-level information for the neighborhood around each unit. They found that recent buyers report house values that are 8.4 percent higher than the eventual sales price, whereas homeowners with longer tenure overvalue their houses by only 3.3 percent.[3] Kiel and Zabel (1999) estimated that the self-reports were, on average, 5.1 percent too high, but the upward bias was not related to the characteristics of the house, occupants (except for tenure), or neighborhood. Also, the upward bias on homeowners' valuations seems to decline with the length of tenure. When Kiel and Zabel (1999) controlled for maintenance or remodeling, the difference between value and sales price fell by 1 percentage point.

[3] Fisher and Williams (2006) offer one explanation for high estimates of recent buyers. Basing their analysis on Consumer Expenditure Survey data, they found a spike in additions and maintenance spending in the first 3 years of ownership.

The Health and Retirement Study Data and Models

The HRS/AHEAD[4] is a particularly useful data source for investigating the relationship between a homeowner's age and the rate of house value appreciation. Many studies, particularly longitudinal ones, have very little coverage of the elderly population because this segment is out of the labor force and has previously represented a small share of the population. The HRS/AHEAD, however, focuses on the near-retirement and elderly populations and surveys them roughly every 2 years. The survey includes variables on family structure, living arrangements, retirement decisions, financial state, and health status. As a source on housing data, it has not been used nearly as much as the AHS. The HRS/AHEAD provides opportunities to corroborate findings from other studies and further their analyses on elderly health and wealth issues.

The HRS tracks the same households as they enter retirement and experience the health challenges of aging. HRS began with a longitudinal sample of more than 12,600 people in 7,600 households who were born in the period from 1931 through 1941; the people in this sample were 51 to 61 years old when the initial survey occurred in 1992. Followup surveys of the same households were conducted in even years until 1998, when HRS was merged with AHEAD. AHEAD surveyed 7,447 people in about 6,000 households in which one member was born before 1923; that is, one member of the household was 70 years old or older when the initial survey was conducted in 1993. A followup survey was conducted in 1995. Both HRS and AHEAD oversampled African Americans, Hispanics, and Florida residents.[5] In 1998, two new birth cohorts were added: Children of the Depression Age (CODA), born between 1924 and 1930, and War Babies (WBs), born between 1942 and 1947. Moreover, additions from new relationships and remarriages are made in each followup survey. Therefore, the current HRS/AHEAD/CODA/WBs sample exceeds 22,000 people and 14,000 households; more than 18,000 people in more than 12,000 households were interviewed in 2002.

Sample Selection

To select our sample, we used the HRS tracker and region files prepared in 2002 in conjunction with the core HRS/AHEAD survey files of each even year from 1992 through 2002 and the years 1993 and 1995. We identified nearly 12,000 households that owned a single-family, nonfarm, nonmobile,[6] noncondominium primary home in at least 1 survey year from 1992 through 2002. House values were self-reported by the financial respondent in each wave. About 9,500 of those households were observed in at least 2 survey years in the same primary home, providing two different snapshots of house values and other mutable characteristics of the same home and the same homeowners at two distinct points in time. Because our unit of analysis is a primary home and because some households are observed in more than one distinct primary home between 1992 and

[4] The Health and Retirement Study (HRS) merged with the Assets and Health Dynamics Among the Oldest Old (AHEAD) Study in 1998; now the studies are collectively referred to as HRS/AHEAD or simply HRS.

[5] In part, because of this oversampling by race and location, weights are used throughout the analysis. If weights were insufficient to restore the representativeness of the data, it is possible that the lower house price appreciation found in the Health and Retirement Study results are linked to the sampling.

[6] The Health and Retirement Study uses the term "mobile homes," which we interpret as essentially synonymous with manufactured housing. To be consistent with the survey coding, however, we refer to mobile homes in this article.

2002, the number of unique single-family, nonfarm, nonmobile, noncondominium owned primary homes observed in at least 2 different survey years is 10,129.[7] After imputation for missing data and the conversion of dollar amounts to 2002 dollars using the seasonally unadjusted Consumer Price Index excluding shelter expenses for all urban consumers, we calculated the compound annual growth rate (CAGR) of house values.

Description of HRS Data

Demographic characteristics are available from both the core survey files and the tracker file. As recommended by HRS, we used the data from the tracker file as much as possible. To obtain person information at the household level, we used the characteristics of the financial respondent.[8] When the financial respondent could not be identified or when the household did not participate in the financial section of the surveys in the wave we were interested in, we used the characteristics of the family respondent. We obtained fixed characteristics such as the date of birth, gender, race, and ethnicity of the financial respondent or the family respondent from the tracker file. Some demographic characteristics, such as whether respondents are in a nursing home and their coupled status, change over time. In many instances, we used the characteristics from the end year, also available from the tracker file. We also obtained the household weights from the tracker file.

In exhibit 1, we summarize demographic characteristics of homeowners. It should be noted that some homeowners who are represented in multiple homes are counted multiple times in our sample of unique homes. No household appears more than three times and 88 percent of households appear only once, as shown by the home sequence number in exhibit A-1 (see the appendix at the end of the article). Almost all family respondents are financial respondents; that is, they answered the financial sections of the survey.

We selected 75 years of age as our breakpoint for analysis because Venti and Wise (2001a, 2001b) show that housing equity increases for homeowners until about age 75 and then declines. At both the starting year and the ending year, only a few family respondents for the HRS/WBs group were 75 years old or older and almost no family respondents for the AHEAD/CODA group were younger than 65. The percentages of homeowners who were 75 years old or older in the start year are almost 0 for the HRS/WBs group and 36 for the AHEAD/CODA group; this comparison grows even more pronounced in the end year. Even though some overlap occurs in the near-elderly age group of 65 to 74 years between the HRS/WBs and AHEAD/CODA groups, tabulating the characteristics of the HRS/WBs group with those of the AHEAD/CODA group provides a good way to compare the middle-aged or near-retirement family respondents with the elderly family respondents.

Besides homeowner age, the main distinctions in exhibit 1 between the middle-aged (HRS/WBs) and the elderly (AHEAD/CODA) respondents are as follows:

[7] We extracted values from the waves when the home was first and last observed and called them starting and ending house values. Even though the Health and Retirement Study survey wave years are 1992, 1993, 1994, 1995, 1996, 1998, 2000, and 2002, actual interview years range from 1991 to 2003. We call the actual interview years of first and last observation as our start (interview) years and end (interview) years, respectively. Dollar adjustments to 2002 dollars are made on the basis of interview years, not wave years. See the appendix for more details.

[8] The financial respondent is the person responsible for overseeing the financial matters of the elderly person, often the elderly person himself or herself and usually the same person as the family respondent. If the financial respondent information was missing, the family respondent information (some other person from the same family) was substituted.

- More HRS/WBs group households than AHEAD/CODA group households are couples (71.5 compared with 41.2 percent).
- Fewer HRS/WBs group households than AHEAD/CODA group households are headed by females (47.9 compared with 61.8 percent).
- Fewer HRS/WBs group households than AHEAD/CODA group households are headed by Whites (89.0 compared with 93.4 percent).

The younger cohort is more likely to live in the South Atlantic Census Division (22.3 percent compared with 18.3) and have much shorter average tenure (15.8 years compared with 26.0). In terms of financial and health characteristics, the younger cohort is more likely to own a second home (15.2 percent compared with 8.8) but has lower average liquid assets ($179,559 compared with $192,241) and lower medical expenses ($2,055 compared with $2,837). HRS does not include direct measurement of maintenance expenditures, but home improvements or major additions are reported in exhibit 2. The younger cohort has a higher percentage of home improvements (26.9 percent compared with 19.2) and a higher average biannual home improvement cost ($4,084 compared with $2,826). Even though the older households have more liquid assets, they spend less on home improvements and perhaps also on maintenance, which is not itself reported. House price appreciation (measured by the CAGR in constant 2002 dollars) is shown in exhibit 2. The distributions of growth rates range widely, but the average CAGR is significantly higher for the younger cohort than for the elderly (2.28 percent compared with 1.52). Without a regression adjustment, the average house price appreciation is about 0.75 percentage point lower for the elderly homeowners.

Exhibit 1

Demographic Characteristics of Owners of Primary Homes (1 of 2)

Demographic Characteristics[a]	HRS/WBs Respondents		AHEAD/CODA Respondents		All Respondents	
	Number	Percent	Number	Percent	Number	Percent
Respondent type**						
Financial	5,403	99.4	2,461	99.9	7,864	99.6
Family	36	0.6	3	0.1	39	0.4
Age in start year**						
54 or younger	2,198	46.7	10	0.5	2,208	32.3
55–64	2,907	48.0	44	2.6	2,951	33.8
65–74	325	5.1	1,466	60.7	1,791	22.5
75–84	9	0.2	802	31.6	811	10.0
85 or older	0	0.0	142	4.6	142	1.5
*Average age***	5,439	55.4	2,464	73.8	7,903	61.1
Median age[b]	5,439	56.0	2,464	73.0	7,903	59.0
Age in end year**						
54 or younger	506	11.5	3	0.1	509	7.9
55–64	2,968	59.3	16	1.1	2,984	41.2
65–74	1,847	27.1	477	20.4	2,324	25.0
75–84	116	2.0	1,487	61.0	1,603	20.4
85 or older	2	0.0	481	17.4	483	5.5
*Average age***	5,439	61.0	2,464	79.1	7,903	66.7
Median age[b]	5,439	62.0	2,464	79.0	7,903	66.0

Exhibit 1

Demographic Characteristics of Owners of Primary Homes (2 of 2)

Demographic Characteristics[a]	HRS/WBs Respondents		AHEAD/CODA Respondents		All Respondents	
	Number	Percent	Number	Percent	Number	Percent
Years homeowner is age 75 or older between start and end years**						
0	5,357	98.5	665	28.1	6,022	76.5
1–5	74	1.4	1,151	46.4	1,225	15.4
6–10	8	0.1	648	25.5	656	8.1
*Average years***	5,439	0.0	2,464	3.3	7,903	1
Median years[b]	5,439	0.0	2,464	3.0	7,903	0.0
Coupled or partnered in end year**	3,843	71.5	1,028	41.2	4,871	62.0
In nursing home in end year**[c]	18	0.3	74	2.8	92	1.1
Female**	2,772	47.9	1,509	61.8	4,281	52.2
Race**						
White/Caucasian	4,504	89.0	2,226	93.4	6,730	90.4
African American	742	7.6	206	5.4	948	6.9
Other	176	3.2	27	1.0	203	2.5
Unknown	17	0.2	5	0.2	22	0.2
Ethnicity**						
Mexican Hispanic	253	3.5	65	1.5	318	2.9
Other Hispanic	127	1.6	36	1.1	163	1.4
Non-Hispanic	5,042	94.8	2,359	97.3	7,401	95.5
Unknown	17	0.2	4	0.2	21	0.2

AHEAD = Assets and Health Dynamics Among the Oldest Old Study. CODA = Children of the Depression Age. HRS = Health and Retirement Study. WBs = War Babies.

**Indicates significance at the 5-percent level.*

***Indicates that the differences between the HRS/WB and AHEAD/CODA groups are statistically significant at the 1-percent level. χ^2 tests were conducted for cross-tabulation comparisons and t-tests were performed for average comparisons. The observation level of the sample in this article is a primary home. Some households have as many as three primary homes in the survey period from 1992 through 2002. Only single-family, nonfarm, nonmobile, and noncondominium owned primary homes are considered in the sample, which is also confined to homes with nonimputed and nonmissing house values reported by respondents in both start and end years. The sample sizes and medians presented in this exhibit are unweighted, but the percentages and averages reported are weighted using household weights provided by HRS/AHEAD to make inference on the U.S. population of the same age, gender, and race/ethnicity profile as that of the HRS/AHEAD sample. All dollar amounts are adjusted to 2002 using the nonseasonally adjusted Consumer Price Index excluding shelter expenses.*

[a] From the tracker and region files, characteristics of the financial respondent for each wave was obtained. Where there were no financial respondents, characteristics of the family respondent were obtained. Where the information on respondent type was unavailable, characteristics of the oldest respondent were obtained. Information on homes, such as house values, were obtained from the year-specific HRS/AHEAD survey data files.

[b] Medians are calculated without weights and no statistical tests for significance of the difference between the HRS/WBs and AHEAD/CODA groups were conducted.

[c] This variable captures whether the respondent or his or her spouse/partner was in a nursing home in the end year.

Source: 1992 to 2002 HRS/AHEAD

Exhibit 2

Home Improvement and House Price Appreciation

	HRS/WBs Respondents		AHEAD/CODA Respondents		All Respondents	
	Number	Percent*	Number	Percent*	Number	Percent*
Home Improvement or Major Addition[a]						
Reported in end year**						
Yes	1,388	26.9	463	19.2	1,851	24.5
No	4,039	72.9	1,995	80.6	6,034	75.3
Unknown	12	0.2	6	0.2	18	0.2
Average biannual home improvement costs	5,392	$4,084	2,442	$2,826	7,834	$3,691
Median biannual home improvement costs	5,392	$ 0	2,442	$ 0	7,834	$ 0
House Price Appreciation						
CAGR[b] of primary home**						
– 10.00% or less	173	2.8	116	4.6	289	3.3
– 10.01% to – 5.00%	271	4.8	135	5.5	406	5.0
– 5.01% to – 3.00%	222	3.9	130	4.9	352	4.2
– 3.01% to – 1.00%	848	14.8	484	19.2	1,332	16.2
– 1.01% to 0.00%	511	8.8	192	7.9	703	8.6
0.01% to 1.00%	507	8.8	219	9.1	726	8.9
1.01% to 3.00%	1,057	18.6	370	15.0	1,427	17.5
3.01% to 5.00%	680	12.9	275	11.5	955	12.5
5.01% to 10.00%	742	15.5	311	12.9	1,053	14.7
10.01% or more	428	9.1	232	9.5	660	9.2
*Average CAGR of primary home***	5,439	2.28	2,464	1.52	7,903	2.04
Median CAGR of primary home[c]	5,439	1.30	2,464	0.73	7,903	1.19

AHEAD = Assets and Health Dynamics Among the Oldest Old Study. CAGR = compound annual growth rate. CODA = Children of the Depression Age. HRS = Health and Retirement Study. WBs = War Babies.

** Values in this column are in percent unless designated by a dollar sign.*

*** Indicates that the differences between the HRS/WB and AHEAD/CODA groups are statistically significant at the 1-percent level. χ^2 tests were conducted for cross-tabulation comparisons and t-tests were performed for average comparisons. The observation level of the sample in this article is a primary home. Some households have as many as three primary homes in the survey period from 1992 through 2002. Only single-family, nonfarm, nonmobile, and noncondominium owned primary homes are considered in the sample, which is also confined to homes with nonimputed and nonmissing house values reported by respondents in both start and end years. The sample sizes and medians presented in this exhibit are unweighted, but the percentages and averages reported are weighted using household weights provided by HRS/AHEAD to make inference on the U.S. population of the same age, gender, and race/ethnicity profile as that of the HRS/AHEAD sample. All dollar amounts are adjusted to 2002 using the nonseasonally adjusted Consumer Price Index excluding shelter expenses.*

[a] From the tracker and region files, characteristics of the financial respondent for each wave were obtained. Where there were no financial respondents, characteristics of the family respondent were obtained. Where the information on respondent type was unavailable, characteristics of the oldest respondent were obtained. Information on homes, such as house values, was obtained from the year-specific HRS/AHEAD survey data files.

[b] CAGR = (FV/PV)1/n – 1, where PV is the beginning value, FV is the ending value, and n is the number of intervening years. This measure is very similar to ln(FV/PV)/n, which assumes continous compounding. We prefer CAGR because most house price growth rates, like interest rate growth rates, are reported in annual growth rates.

[c] Medians are calculated without weights and no statistical tests for significance of the difference between the younger and older groups were conducted.

Source: 1992 to 2002 HRS/AHEAD

Estimation of House Value Appreciation Using HRS Data

In the previous section, we presented the HRS data and compared the HRS/WBs and AHEAD/CODA cohorts, which have different age profiles. To isolate the age effect on home value appreciation and control for other effects, such as demographic, tenure, geographic location, wealth, and cognition, we perform ordinary least squares regression analyses. In our regressions, as in the tabulations, we use weights provided by HRS to make inference on the U.S. population of the same gender and age profile as the HRS sample. We use the survey regression commands in Stata® to correctly estimate coefficients and standard errors for survey data because HRS contains survey data with 52 strata.[9]

The first two columns of exhibit 3 replicate two models from Davidoff (2004) using the HRS data. Because his final models control for building age and square footage, two variables that are not available in HRS, we are able to replicate only two of his simpler models. In the first model, Davidoff (2004) regresses the natural log of resale value divided by the 1985 value on the number of years between 1985 and the resale year. Other control variables in the regression are an indicator variable for the homeowner being 75 years old or older with interactions by MSA, and resale year indicator variables. He shows that, for each additional year the homeowner is 75 years old or older, the total appreciation of the house price between 1985 and the resale year decreases by 2.3 percentage points. In his second model, Davidoff (2004) divides the log growth rate by the number of years from 1985 to the year sold. The annualized growth rate is regressed on an indicator variable designating whether the homeowner was 75 years old or older in 1985 and the interactions of the MSA and resale year indicator variables. This AHS regression shows that the homes of homeowners who are 75 years old or older appreciate 2.2 percentage points less per year than the homes of younger homeowners. We present Davidoff's (2004) regression in exhibit 3 in columns (1) and (2).

Columns (3) and (4) present our replication of the AHS models using HRS data. Given that we did not have resale value or year sold, we substituted self-reported house values in the start year and the end year. In addition, instead of MSAs, we have census divisions as our location covariates.[10] The dependent variables are calculated as the natural logs of end value divided by start value and we annualized the ratio by dividing by the number of elapsed years.

The coefficients for the HRS models are smaller than those for the AHS models. The HRS coefficients show that, for each additional year the homeowner is 75 years old or older, the total appreciation of the house value decreases by 0.7 percentage point and that homes of homeowners who are 75 years old or older appreciate 1.1 percentage points less per year than do homes of middle-aged homeowners. Given that our sample has almost no homeowners younger than 45 in the start year and 35 percent of homeowners in the AHS sample are younger than 45, our lower coefficients are not surprising. The elderly homeowners will have smaller differences in house value appreciation

[9] Unweighted regressions yielded nearly identical results.

[10] The census division fixed effects control for differences in average appreciation rates by division, but they do not capture the variation among metropolitan statistical areas (MSAs) within the division. If elderly homeowners disproportionately live in MSAs with low house appreciation but the model omits controls for that MSA, it is possible that the lower appreciation of the MSA will be transferred to the coefficient on the elderly homeowners. In fact, the Public Use Microdata Sample models presented in the text and the exhibits show that the negative coefficient on elderly homeowners is even greater at the MSA level.

Exhibit 3

Comparison of HRS/AHEAD Regressions With AHS Regressions

	AHS[a]		HRS/AHEAD[b]			
	(1)	(2)	(3)	(4)	(5)	(6)
	$\ln \frac{\text{Resale Value}}{\text{1985 Value}}$	$\ln \frac{\text{Resale Value}}{\text{1985 Value}}$	$\ln \frac{\text{End Value}}{\text{Start Value}}$	$\ln \frac{\text{End Value}}{\text{Start Value}}$	CAGR	CAGR
		Year Sold – 1985		End – Start Year		
Years age 75 or older between start and end years[c]	– 0.023 (0.009)*		– 0.0074 (0.0018)**		– 0.0023 (0.0003)**	
Age 75 or older in start year[d]		– 0.022 (0.016)		– 0.0107 (0.0029)**		– 0.0103 (0.0028)**
Constant	0.167 (0.013)**	0.026 (0.004)**	0.239 (0.055)**	0.043 (0.013)**	0.047 (0.015)**	0.046 (0.015)**
Fixed effects	MSA x year sold	MSA x year sold	Division x end year	Division x end year	Division x end year	Division x end year
N	2,781	2,757	7,309	7,309	7,309	7,309
R^2	0.36	0.30	0.08	0.07	0.06	0.06

AHEAD = Assets and Health Dynamics Among the Oldest Old Study. AHS = American Housing Survey. CAGR = compound annual growth rate. HRS = Health and Retirement Study. MSA = metropolitan statistical area.

***Indicates significance at the 1-percent level.*

[a] AHS results are from Davidoff (2004).

[b] The observation level of the sample in this report is a primary home. Some households have as many as three primary homes in the survey period from 1992 through 2002. Only single-family, nonfarm, nonmobile, and noncondominium owned primary homes are considered in the sample, which is also confined to homes with nonimputed and nonmissing house values reported by respondents in both start and end years. CAGR, the dependent variable, is a measure similar to annualized difference in natural logs of end and start values in (4). Results are weighted to make inference on the U.S. population of the same age, gender, and race/ethnicity profile as that of the HRS/AHEAD sample using household weights provided by HRS. All dollar amounts are adjusted to 2002 using the nonseasonally adjusted Consumer Price Index excluding shelter expenses.

[c] Davidoff (2004) calls this variable YEARSa75. His start year is 1985 and end year is the actual year when the home was sold.

[d] Davidoff (2004) calls this variable a75. His start year is 1985.

Source: 1992 to 2002 HRS/AHEAD

when compared with the appreciation rates of the near-elderly and the middle-aged homeowners than when compared with the appreciation rates of the general population of homeowners.[11]

Given that house value appreciation can have both location and time variations, some differences in the magnitude of AHS and HRS coefficients can be expected because HRS has a different and

Exhibit 4

Regressions of Compound Annual Growth Rates of House Values

Covariate	(11)		(14)		(16)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Respondent older than 74 years in start year	– 0.0121	0.0028**	– 0.0097	0.0029**	– 0.0098	0.0029**
Interval between end and start years			– 0.0027	0.0004**	– 0.0027	0.0004**
Suburban location of home			– 0.0060	0.0023**	– 0.0060	0.0023**
Rural location of home			– 0.0062	0.0024**	– 0.0063	0.0024**
Liquid assets indicator			0.0082	0.0038*	0.0082	0.0038*
TICS score less than 5					– 0.0060	0.0078
TICS score missing					0.0039	0.0047
Mexican-Hispanic respondent			– 0.0117	0.0060	– 0.0117	0.0060
Other Hispanic respondent			– 0.0057	0.0069	– 0.0056	0.0069
Constant	0.0218	0.0010**	0.0607	0.0159**	0.0603	0.0156**
Fixed effects		None		Division x end year		Division x end year
Other covariates		None		Yes		Yes
N		7,903		7,903		7,903
R^2		0.00		0.08		0.08

AHEAD = Assets and Health Dynamics Among the Oldest Old Study. CAGR = compound annual growth rate. HRS = Health and Retirement Study. TICS = Telephone Interview for Cognitive Status.

** Indicates significance at the 5-percent level.*

*** Indicates significance at the 1-percent level. The observation level of the sample in this report is a primary home. Some households have as many as three primary homes in the survey period from 1992 through 2002. Only single-family, nonfarm, nonmobile, and noncondominium owned primary homes are considered in the sample, which is also confined to homes with nonimputed and nonmissing house values reported by respondents in both start and end years. CAGR, the dependent variable, is a measure similar to annualized difference in natural logs of end and start values. Results are weighted to make inference on the U.S. population of the same age, gender, and race/ethnicity profile as that of the HRS/AHEAD sample using household weights provided by HRS. All dollar amounts are adjusted to 2002 using the nonseasonally adjusted Consumer Price Index excluding shelter.*

Source: 1992 to 2002 HRS/AHEAD

[11] In addition, the American Housing Survey (AHS) maximum observation period for a home is 16 years, between 1985 and 2001, while the Health and Retirement Study (HRS) maximum observation period is 10 years, between 1992 and 2002. A large number of homes in the HRS are observed for shorter periods than 10 years and owners may not adjust their perceptions of house values in shorter time horizons (HRS) as much as in longer time horizons (AHS).

shorter timeframe, and its geographic breakdown is not as detailed. The inability of the census division indicator variables to pick up location variation as much as the MSA indicator variables shows up as a lower R-squared in the HRS models compared with the AHS models.

Instead of the log difference of house values, we prefer to use the CAGR of house values. The log difference assumes continuous compounding; CAGR, on the other hand, reports annual growth rate similar to that of interest rates and is suitable for house value growth rates. Despite these differences, the two measures are more alike than different in terms of computation.[12] In regression models (5) and (6), we used CAGR of house values as the dependent variable and the similarity of annualized log difference and CAGR becomes evident by comparing the coefficients of the age indicator variable in regression models (4) and (6). They are essentially the same.

Regression model (6) serves as the HRS foundation model for further specification testing. In exhibit 4, we estimate the same regression without the interactions between the end years and census division indicator variables in regression model (11). The two coefficients are very close but the R-squared of regression model (11) is practically 0. The interaction indicator variables do not influence the age effect but explain some location variations to make the regression a better fit. As more covariates were added to the model, the coefficient of age decreased very slightly in magnitude but its significance remained strong. The Telephone Interview for Cognitive Status (TICS)[13] score did not have a significant coefficient and the coefficient on age barely changed from -0.0097 to -0.0098. The 1.0-percentage-point decrease in annual house value appreciation rate for elderly homeowners is a lower bound of the estimate. The upper bound is a 1.2-percentage-point decrease in CAGR, as shown in regression model (11).

Other significant covariates in the regressions included the interval between the start year and the end year, the suburban and rural location of a home compared with an urban location, the presence of liquid assets, the TICS score, and the homeowner's being Mexican Hispanic. The longer the interval between the start year and the end year, the lower the annual house appreciation is. Suburban and rural homes have lower annual appreciation than do urban homes, presumably because urban land values are appreciating more rapidly. Homes owned by individuals possessing liquid assets have higher annual appreciation. The significance of the Mexican-Hispanic indicator variable is consistent across models while no other demographic variable is significant. Homes with Mexican-Hispanic homeowners apparently have lower annual appreciation. This control variable may be picking up a neighborhood effect that the census division variables are not able to pick up.

A graphical representation of how lower appreciation rates affect the values of homes over 20 years is shown in exhibit 5. The homeowner types include the following:

[12] If a house value is $100,000 for 1992 and $250,000 for 2002, in real terms, the compound annual growth rate is 9.6 percent, while the annualized log difference is 9.2 percent, and the log difference is 91.6 percent. Compare those rates to a crude percentage change of 150 percent and a percentage change per year of 11. Each approach measures the same change from $100,000 to $250,000, but the 9.6 percent for the compound annual growth rate emphasizes the effect of simple annual interest compounding over time.

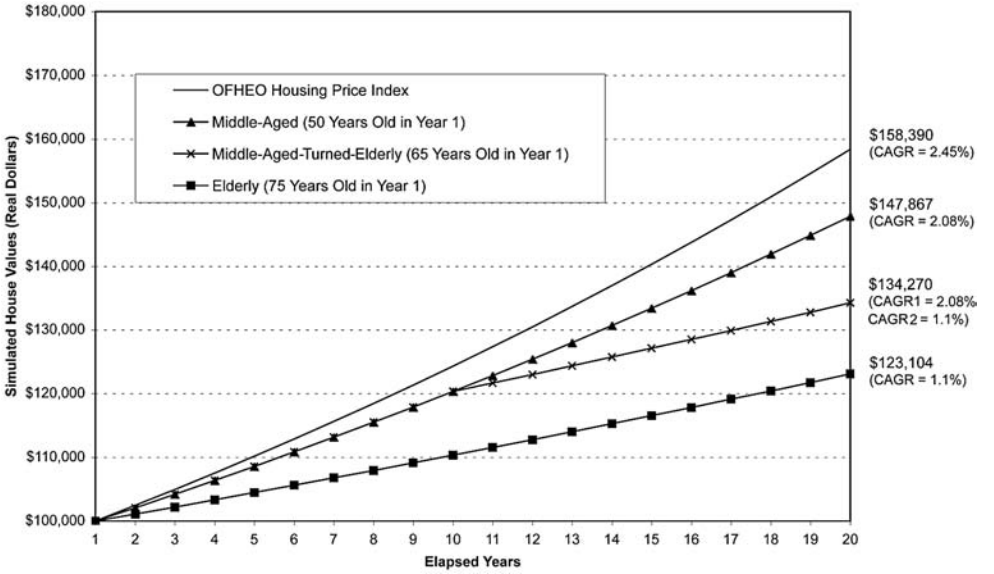
[13] The TICS score is a standard multidimensional measure of cognitive function, including mental acuity and memory. The values range from 1 to 10 with higher scores meaning better cognitive functioning.

- An average-aged U.S. homeowner who has house price appreciation that matches the Office of Federal Housing Enterprise Oversight [OFHEO] House Price Index).[14]
- A middle-aged homeowner who first measures the house price at age 50.
- A middle-aged-turned-elderly homeowner who begins measuring the house price at age 65 and continues tracking house price beyond age 75.
- An elderly homeowner who first measures the house price at age 75.

Exhibit 5 displays a simplified representation with smooth appreciation every year, but this representation is able to convert the appreciation rate differences into constant dollar amounts. We start off all four types of households in the first year with homes worth $100,000. The home owned by an elderly homeowner grows in appreciation at the rate of 1.1 percent every year, while the home owned by a middle-aged homeowner grows in appreciation at the rate of 2.08 percent per year. The home owned by a middle-aged-turned-elderly homeowner grows in appreciation at the rate of 2.08 percent per year until the homeowner reaches age 75; after that point, the home grows in appreciation at the rate of 1.1 percent per year. The average U.S. home, however, grows in appreciation at the rate of 2.45 percent per year. The annual house appreciation growth rate of 2.08 percent for the middle-aged group is lower than the annual house appreciation growth rate of 2.45 percent for the average U.S. homeowner.

Exhibit 5

Simulated Appreciation of House Values for Different Age Cohorts



CAGR = compound annual growth rate. OFHEO = Office of Federal Housing Enterprise Oversight.

[14] Office of Federal Housing Enterprise Oversight (OFHEO) appreciation rates assume no home improvements were made between the repeat sales. If the home improvement projects were known and controlled for, the index for a constant-quality home would be somewhat lower.

At the end of the 20th year, the home owned by an elderly homeowner is worth the least. This simulation assumes no differences in quality between the homes of the young and old. Typically, the newer homes of younger households were built more recently and include larger rooms with more amenities, but in this simulation we exclude those differences. In terms of house value, a home owned by a middle-aged-turned-elderly homeowner is worth less than that of a home owned by a middle-aged homeowner. A home owned by an average U.S. homeowner does the best. The difference in real dollar terms between a home owned by an elderly homeowner and a home owned by a middle-aged homeowner at the end of the 20th year is almost $25,000. The difference between a home owned by an elderly homeowner and a home owned by an average U.S. homeowner is more than $35,000. Our estimate of 1.0 to 1.2 percentage points lower appreciation per year for homes owned by elderly homeowners is smaller in magnitude than Davidoff's (2004) estimate of 3 percentage points per year, but the decrease in annual appreciation of even 1 percentage point is not at all trivial when considering a longer timeframe, as shown by our simulation in exhibit 5.

Census Public Use Microdata Sample Data and Models

Census Public Use Microdata Sample data provide another useful source for investigating the relationship between homeowner age and house value appreciation. Unlike HRS data, which are longitudinal samples for elderly and near-elderly households, census data provide cross-sections of the U.S. population every 10 years. The cross-sectional nature of the census data makes it necessary to summarize house values at a geographical level such as the MSA before matching 2 census years to calculate house value appreciation. Using the census data enables us to verify the general validity of our HRS results and to determine if the omission of building age and poor reporting of tenure in the HRS data biases the HRS estimates of house price appreciation.

The data for household heads are extracted from the 1-percent PUMS samples in 1990 and 2000. We calculated house price appreciation at the national, census division, and MSA levels using the PUMS geographical identifiers. While matching MSAs in 1990 and 2000, we excluded all MSAs that were defined differently in 1990 and 2000 and all nonmetropolitan areas. Exactly 105 MSAs had common boundaries in 1990 and 2000.[15] From the sample of noncommercial, noncondominium single-family detached houses, we drew two types of comparison samples.

The first sample consists of two types of households: the young cohort (50 to 59 years old in 1990 and 60 to 69 years old in 2000) and the old cohort (65 to 74 years old in 1990 and 75 to 84 years old in 2000). The second sample contains the households of the same age groups, but both groups are now restricted to only those household heads who had lived at their current address for at least 11 years in 1990 or at least 21 years in 2000. By restricting the sample to nonmovers, it is less likely that the appreciation rate calculated between the 2 census years represents a change in

[15] The metropolitan statistical areas (MSAs) excluded because of changes in boundaries were those that were growing rapidly in either population or size. If the boundary growth was due to "suburbanizing" elderly homeowners and those homeowners as movers did a better job of maintaining their property than the nonmovers, then the Public Use Microdata Sample regressions would underestimate the house price appreciation. If the growing cities tended to be places with high supply elasticity and more stable house prices, however, then exclusion of those cities might overestimate the house price appreciation. More analysis is needed to weigh the balance of these effects.

mobility (especially to new construction). Therefore, the second sample is called the sample with restricted tenure, while the first is called the sample with unrestricted tenure.

House Value and Appreciation by Age Categories

The HRS data—a longitudinal sample—follow the same households over 10 years. The census data are not longitudinal, but an age cohort can be created by the age of the household head. In this case, two samples are compared. Young homeowners were 50 to 59 years old in the 1990 sample and would be 60 to 69 years old in 2000. The old homeowners were 65 to 74 years old in the 1990 sample and would be 75 to 84 years old in the 2000. The PUMS is a 1-percent sample, so few of the 1990 households would also appear in the 2000 sample. We assume, however, that the medians from the included sample are a fair representation of the households had they been included in both samples. The restricted tenure sample further limits the cohorts by requiring the households to have not moved in the past 10 years in the 1990 sample and not moved for the past 20 years in the 2000 sample. In other words, the restricted tenure sample tracks the stayer cohort by excluding movers and newly constructed homes. The unrestricted tenure sample follows the same cohort by age but includes movers and new homes.

Median house values and appreciation rates for the cohorts in both the restricted and unrestricted tenure samples are shown in exhibit 6.[16] At the national level, the restricted tenure sample of stayers shows that the old cohort did 0.31 percentage point worse than the younger cohort did. By census division, the West South Central had the highest relative gain, or a 1.9-percentage-points difference, for the old cohort. The lower panel gives the results for the unrestricted tenure sample. The growth rate for the old cohort is the same (0.64 percent) as that for the restricted tenure sample, but the young cohort experienced almost no growth (0.03 percent). As a result, the relative gain for the old cohort is 0.62 percentage point.

PUMS Model Results

The tabulations of house value appreciation offer limited controls beyond age and place. A linear regression model can include other control variables for length of tenure, building age, unit size, demographics, and household income. The PUMS limitation of independent samples means that the unit-level values are aggregated to the MSA-by-age cohort level. We studied 105 MSAs and 2 age cohorts taken from the PUMS data, so the sample size is 210. Income has been divided by $10,000 (to make the regression coefficient larger), and the values are in year 2000 dollars. The main purpose of the regression is to test the hypothesis that elderly homeowners have a lower appreciation rate for their houses, particularly when the homeowner is 75 years old or older. A second purpose is to gauge the degree of bias that might be introduced in the HRS results from omitting building age or length of tenure. The PUMS data enable us to include controls for building age and length of tenure at the aggregate level. Therefore, by comparing specifications with and without those controls, we can see how much the coefficient on homeowner age is influenced by the omission of those correlated variables.

[16] The numerous repetitions in exhibit 6 between the restricted tenure and unrestricted tenure samples are not typographical errors. They are the consequence of imputing the house values to be the midpoint of reported categories and adjusting the top codes of $400,000 in 1990 and $500,000 in 2000 by a factor of 1.25. The national estimates are the weighted medians of individual house values and do not use the weighted medians for the divisions.

Exhibit 6

Median House Values and Appreciation by Census Division: Cohort Selection With and Without Restricted Tenure (1 of 2)

Geographic Area	1990			2000			CAGR[a]		
		Median House Value[b]			Median House Value		(A)	(B)	(B) Minus (A)
	Number	Young[c]	Old	Number	Young	Old	Young	Old	
		($)	($)		($)	($)	(%)	(%)	(%)
Restricted Tenure[d]									
National	122,098	102,300	89,100	81,385	112,500	95,000	0.95	0.64	– 0.31
Census Division									
New England	6,474	214,500	181,500	4,338	162,500	137,500	– 2.74	– 2.74	0.00
Middle Atlantic	18,859	148,500	125,400	12,446	137,500	112,500	– 0.77	– 1.08	– 0.31
East North Central	23,312	89,100	75,900	15,720	95,000	85,000	0.64	1.14	0.50
West North Central	9,712	82,500	62,700	6,946	85,000	75,000	0.30	1.81	1.51
South Atlantic	19,722	95,700	82,500	13,753	95,000	85,000	– 0.07	0.30	0.37
East South Central	8,294	69,300	62,700	5,889	75,000	75,000	0.79	1.81	1.01
West South Central	13,035	75,900	62,700	8,801	65,000	65,000	– 1.54	0.36	1.90
Mountain	5,306	95,700	89,100	3,675	112,500	112,500	1.63	2.36	0.73
Pacific	14,869	247,500	214,500	9,817	225,000	187,500	– 0.95	– 1.34	– 0.39

Exhibit 6

Median House Values and Appreciation by Census Division: Cohort Selection With and Without Restricted Tenure (2 of 2)

Geographic Area	1990			2000			CAGR[a]		
		Median House Value[b]			Median House Value		(A)	(B)	(B) Minus (A)
	Number	Young[c] ($)	Old ($)	Number	Young ($)	Old ($)	Young (%)	Old (%)	(%)
Unrestricted Tenure[d]									
National	164,242	112,200	89,100	135,675	112,500	95,000	0.03	0.64	0.62
Census Division									
New England	8,159	214,500	181,500	6,446	162,500	137,500	– 2.74	– 2.74	0.00
Middle Atlantic	23,063	181,500	125,400	17,398	137,500	112,500	– 2.74	– 1.08	1.66
East North Central	29,893	89,100	75,900	24,394	112,500	95,000	2.36	2.27	– 0.09
West North Central	13,096	82,500	62,700	11,531	95,000	75,000	1.42	1.81	0.39
South Atlantic	28,488	102,300	89,100	25,547	112,500	95,000	0.95	0.64	– 0.31
East South Central	11,172	75,900	62,700	9,768	85,000	75,000	1.14	1.81	0.67
West South Central	18,342	82,500	62,700	15,672	75,000	65,000	– 0.95	0.36	1.31
Mountain	8,011	102,300	95,700	7,892	137,500	112,500	3.00	1.63	– 1.37
Pacific	20,794	247,500	181,500	17,027	225,000	187,500	– 0.95	0.33	1.27

[a] CAGR is compound annual growth rate of median house values between 1990 and 2000 for each geographical entity. (B) minus (A) is the difference in CAGRs of the old and young cohorts.

[b] Median house values were calculated instead of mean house values because house values were topcoded. Median house values are in 2000 dollars.

[c] The young cohort consists of homeowners who were 50 to 59 years old in 1990 and 60 to 69 years old in 2000. The old cohort consists of homeowners who were 65 to 74 years old in 1990 and 75 to 84 years old in 2000.

[d] The sample with restricted tenure is confined to households that had been living at their current address for 11 years or longer in 1990 and 21 years or longer in 2000. The sample with unrestricted tenure can have any length of tenure.

Note: Sample sizes are the total for all age groups and are unweighted. The median house values and CAGRs are weighted by the household weight provided by the Integrated Public Use Microdata Series (IPUMS).

Source: 1990 and 2000 IPUMS

The full regression results for the restricted tenure sample are presented in the appendix. The primary focus is on the coefficient for homeowner age, which is summarized in exhibit 7. For the stayer sample (that is, the cohort with tenure restriction), the age coefficient for the full model is -0.032. This coefficient means that the houses of homeowners 75 years old or older who lived in the same house for at least 10 years had an annual appreciation rate that was 3.2 percentage points lower than that of houses owned by the younger cohort. Omitting the building age variables increases the elderly discount to -3.4 percentage points. On the other hand, omitting the length of tenure but including the building age reduces the discount to -2.7 percentage points. Omitting both tenure and building age reduces the discount to -2.5 percentage points. These findings suggest that the HRS results may be biased downward (toward 0) by omitting controls for length of tenure and building age that would capture the depreciation effect, but the size of the bias is modest. In fact, if the regression includes a simple specification of homeowner age, number of rooms, and household income, the estimated discount is -2.9 percentage points.

The same series of regressions were estimated on the cohort sample without tenure restriction (that is, the movers and stayers) and the results are shown on the right half of exhibit 7. As expected, the elderly discount is smaller when the sample includes movers and new construction, but the estimate is about -2.3 percentage points. This estimate is about twice as large as the HRS elderly discount even though the data come from approximately the same timeframe and age groups. The most important difference is that HRS is a longitudinal data set while PUMS has two independent cross-sections. A second, potentially important, difference is that HRS omits controls for length of tenure and building age. Despite these differences, the PUMS specifications that exclude those variables have relatively little impact on the elderly discount. The simplest specification of age, house size, and income produces the very same discount of -2.3 percentage points.

Exhibit 7

Discount to Elderly Homeowners (75 Years Old or Older) in House Price Appreciation

Controlling For	Stayers	Movers and Stayers
Tenure and building age	– 0.032	– 0.023
Tenure, not building age	– 0.034	– 0.025
Not tenure, building age	– 0.027	– 0.021
Not tenure, not building age	– 0.025	– 0.021

Note: Full results of these regressions appear in the appendix.
Source: 1990 and 2000 Census Public Use Microdata Sample

Discussion

The main conclusion from the HRS/AHEAD data is that elderly homeowners report lower house value appreciation than do middle-aged homeowners, as summarized in exhibit 8. Measured in constant dollars, houses owned by people 75 years old or older appreciate annually at rates 1.0 to 1.2 percentage points lower than those of houses owned by middle-aged people younger than 75. The larger discount corresponds to regressions that do not control for memory acuity and thus the age coefficient captures the combined effect. In comparison, using AHS data, Davidoff (2004)

Exhibit 8

Summary Comparison of House Price Appreciation Discounts for Elderly Homeowners

Model	Range of Discount (%)
Models on HRS data	– 1.0 to – 1.2
Models on AHS data	– 2.3 to – 3.6
PUMS models with tenure restriction	– 2.5 to – 3.4
PUMS models without tenure restriction	– 2.1 to – 2.5

AHS = American Housing Survey. HRS = Health and Retirement Study. PUMS = Public Use Microdata Sample.

estimated a discount for elderly homeowners of -2.3 to -3.6 percentage points. A similar regression model on aggregated PUMS data produced elderly discounts in the range of -2.1 to -3.4 percentage points. As we saw in exhibit 5, even the smallest of these annual differences will have cascading impacts on the elderly, their children, their communities, and the governmental and nongovernmental institutions that hold or insure their mortgages.

What accounts for the differences in these parameter estimates? Several differences in the data could account for the HRS age discount being smaller than the AHS age discount. The HRS data (including the AHEAD, War Babies, and Children of the Depression Age supplements) represent an older distribution of homeowners than that of the AHS. Based on the ending year, 25.9 percent of the HRS data consist of homeowners 75 years old and older; the comparable AHS figure is 10.7 percent. The higher concentration of elderly homeowners improves the precision of the HRS estimates, but the AHS may provide a better representation of the elderly discount relative to the overall population of homeowners. As shown in exhibit 5, the average house price appreciation for the overall population is 2.45 percent compared with 2.08 for middle-aged homeowners. Adding that difference (0.37 percentage point) to our estimate generates an elderly discount in the range of 1.4 to 1.6 percentage points relative to all homeowners and narrows the difference between the HRS and AHS results.

A second important distinction is that the spells measured by the HRS, 1992 to 2002 or less, are generally shorter than the spells measured by the AHS, 1985 to 2001. Not only is the span of survey years shorter for HRS, but a substantial portion of households in the HRS sample was first interviewed after 1992 or left the sample before 2002. The HRS models clearly show a negative coefficient on length of spell from beginning to end. It is possible that, if the HRS spells had been as long as the AHS spells on average, the age discount for the HRS would have been just as large as what Davidoff (2004) found in the AHS or we have estimated from the PUMS.

Assuming the findings of an elderly discount are correct, what could explain this phenomenon? Six alternatives have been considered in the literature. Two explanations suggest genuine behavioral differences:

1. Relative undermaintenance by elderly homeowners leads to accelerated property depreciation.

2. Movers maximize wealth with home improvements while stayers minimize expenditure.

Another four explanations tend to attribute the apparent discount to omitted variables and respondent error:

3. Elderly retirees move to elastic supply markets in the South and nonmetropolitan areas, where less appreciation occurs.
4. Homeowner age is correlated with length of tenure or building age.
5. Higher variance of house values is associated with older houses.
6. Self-reported house values are biased from homeowners being out of the housing market and being poorly informed about price trends.

Several plausible stories explain the lower house price appreciation for elderly homeowners. The explanation featured in Davidoff (2004) is that elderly homeowners undermaintain their property and thus their houses do not appreciate as quickly as those of the average homeowner. Unfortunately, HRS does not ask about maintenance spending per se, but supporting evidence from home improvement projects is present. Elderly homeowners are significantly less likely than middle-aged homeowners to do a home improvement or major addition (19.2 percent compared with 26.9). The average amount spent on home improvement projects is less for elderly homeowners than middle-aged homeowners ($2,826 compared with $4,084), but the difference is not statistically significant.[17] It is difficult to determine whether this difference in home improvement spending is enough to account for the lower house price appreciation. Nevertheless, lower home improvement spending by elderly homeowners fits the story that elderly homeowners invest less in, if not undermaintain, their housing relative to younger homeowners.

A significant portion of housing subsidies provided by HOME and Community Development Block Grant funding is devoted to rehabilitating homes owned by low- and moderate-income elderly people. Federal spending may in part offset the apparent undermaintenance by this homeownership group, preserving affordable housing both for elderly homeowners and the next generation.

Another measure of declining interest in housing investment is in the ownership of second homes. Only 8.8 percent of elderly homeowners have a second home compared with 15.2 of middle-aged homeowners. No significant difference in the average liquid assets exists between elderly and middle-aged homeowners. Elderly homeowners do have higher average out-of-pocket medical expenses than do middle-aged homeowners ($2,837 compared with $2,055), but the difference is not significant whether the $0 cases are or are not included in the averages. Also, medical expenses as a share of liquid assets are not higher for the elderly.[18] Thus, considering the available liquid assets, the difference in health spending on average does not seem to be enough to crowd out maintenance spending.

[17] The difference in nonzero home improvement spending (excluding the zeros from the averages) is also not significant. Fisher and Williams (2006) note that the incidence of maintenance is lower in the Consumer Expenditure Survey data than in the American Housing Survey (47 percent compared with 77), but the maintenance spending per year is nearly twice as large ($1,152 compared with $622).

[18] This unexpected result of lower medical expense relative to liquid assets of the elderly homeowners may be due to the higher rate of missing data for the elderly homeowners (26.3 percent compared with 19.7). It might also result from medical insurance reducing out-of-pocket expenses for medical care.

As homeowners age, they are less likely to move and they are less likely to have second homes. The regressions presented here compare the combination of movers and stayers with the stayers alone. Movers are motivated to keep their home in a marketable condition, but stayers may be more concerned with minimizing expense and enjoying "familiar surroundings as they have always been." If preferences shift away from housing investment, then elderly homeowners may permit their properties to depreciate as a way to extract housing equity without having to move. The PUMS results show that stayers (or the cohort with restricted tenure) have the largest elderly discounts in house value appreciation.

Another explanation is that retirees move to housing markets with elastic supply. To the extent that the South, West, and nonmetropolitan markets are more elastically supplied, this explanation is somewhat plausible. All the regressions in this article control for location to one degree or another; however, the regression-adjusted results are not consistent with this story; our results in exhibit 6 appear to show the homes of the elderly appreciating faster than those of others in the more elastic South Atlantic, East South Central, and West South Central census divisions.

The correlation of the homeowner's age with building age and length of tenure is supported in the PUMS data, but omitting those variables seems to have little effect on the size of the elderly discount. Basing calculations on those results, the omission of building age and tenure from the HRS models should not greatly affect the estimate of the elderly discount. Elderly homeowners are not making the investment to offset depreciation. Harding, Rosenthal, and Sirmans (2007) control for holding period and building age but not for homeowner age, which we have shown to be important. Adapting their estimation strategy, a logical extension of our research is to estimate maintenance spending while controlling for homeowner age and building age (using either AHS or Consumer Expenditure Survey data) and then estimate a repeat-sales model while controlling for imputed maintenance. This approach would control for the endogeneity of maintenance spending and incorporate the effect of the homeowner's age.

The TICS score did not have a significant coefficient or a significant effect on the age variables. We assumed that mental acuity and memory as measured by the TICS score would be correlated with market awareness, but there appears to be no relation. As measured in HRS, cognitive function problems do not affect a homeowner's estimate of house value. More experimentation with other cognitive function and health measures in HRS might identify a better measure for mental awareness related to house valuation.

Memory and mental acuity are important for distinguishing whether low house value appreciation by elderly homeowners is a real phenomenon or the result of downward biased estimations. Homeowners who have not purchased a house in more than 20 years may not realize how much their house has increased in value over that time. The evidence from Kiel and Zabel (1999) on the AHS data is that seasoned homeowners have relatively unbiased self-appraisals, but those results may not apply to the very aged. In our view, the "poor memory" explanation of low house value appreciation remains viable and requires more direct evidence before it can be refuted in favor of alternative explanations.

In summary, two independent studies analyzing three separate data sets—HRS, AHS, and PUMS—have shown a negative and significant relationship between homeowner age and house value

appreciation. The elderly discount from the HRS is about half the discount from the AHS or PUMS, however, and that difference is important to long-run planners, including elderly homeowners. We lack a definitive explanation for why elderly homes appreciate at a slower rate; several explanations warrant further investigation. Undermaintenance is a leading contender based on the reduction in home improvement spending, but the difference in spending is relatively modest and probably reported with error. The driving force may not be health spending or utilities crowding out maintenance but rather the preference of many elderly homeowners with long tenure to extract equity from their homes without selling them.

Appendix

Exhibit A-1

Regressions of House Price Appreciation on Cohorts of PUMS Data With Tenure Restriction (1 of 2)

Covariate	CAGR							
	(22)		(23)		(24)		(25)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Head older than 74 years in 1990	– 0.0324	0.0086**	– 0.0335	0.0084**	– 0.0267	0.0071**	– 0.0253	0.0059**
Tenure at home 21 through 30 years in 1990	– 0.0481	0.0327	– 0.0141	0.0232				
Tenure at home more than 30 years in 1990	0.0114	0.0277	0.0264	0.0206				
Building age 21 through 30 years in 1990	0.0574	0.0444			0.0429	0.0368		
Building age 31 through 40 years in 1990	0.0092	0.0368			0.0220	0.0268		
Building age 41 through 50 years in 1990	0.0687	0.0460			0.0000	0.0000		
Building age more than 50 years in 1990	0.0430	0.0340			0.0000	0.0000		
Fewer than 4 rooms in 1990	– 0.1778	0.1002	– 0.1936	0.0985	– 0.1757	0.1001	– 0.1988	0.0983*
6–8 rooms in 1990	– 0.0237	0.0222	– 0.0316	0.0208	– 0.0247	0.0219	– 0.0309	0.0208
More than 8 rooms in 1990	0.0638	0.0293*	0.0689	0.0281*	0.0669	0.0291*	0.0743	0.0279**
Married in 1990	– 0.0026	0.0977	– 0.0432	0.0923	– 0.0468	0.0956	– 0.0844	0.0889
Separated, divorced, or widowed in 1990	– 0.0142	0.1000	– 0.0524	0.0959	– 0.0538	0.0986	– 0.0920	0.0932
Non-Hispanic Black	– 0.0522	0.0241*	– 0.0423	0.0229	– 0.0485	0.0242*	– 0.0390	0.0227
Non-Hispanic other race	0.0079	0.0243	0.0038	0.0232	0.0112	0.0232	0.0091	0.0229
Mexican Hispanic	– 0.0795	0.0192**	– 0.0802	0.0191**	– 0.0788	0.0193**	– 0.0771	0.0189**
Other Hispanic	0.0678	0.0438	0.0767	0.0428	0.0678	0.0436	0.0754	0.0429
Household income in 1990	– 0.0911	0.0184**	– 0.0897	0.0162**	– 0.0946	0.0168**	– 0.0968	0.0156**

Exhibit A-1

Regressions of House Price Appreciation on Cohorts of PUMS Data With Tenure Restriction (2 of 2)

Covariate	CAGR							
	(22)		(23)		(24)		(25)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Middle Atlantic	0.0029	0.0060	0.0023	0.0059	0.0030	0.0060	0.0019	0.0059
East North Central	0.0355	0.0070**	0.0346	0.0068**	0.0347	0.0069**	0.0326	0.0067**
West North Central	0.0282	0.0085**	0.0262	0.0083**	0.0270	0.0084**	0.0239	0.0082**
South Atlantic	0.0225	0.0086**	0.0202	0.0080*	0.0224	0.0086**	0.0172	0.0074*
East South Central	0.0183	0.0099	0.0168	0.0094	0.0179	0.0099	0.0140	0.0091
West South Central	0.0207	0.0091*	0.0191	0.0086*	0.0202	0.0090*	0.0156	0.0079
Mountain	0.0357	0.0098**	0.0323	0.0092**	0.0352	0.0097**	0.0289	0.0084**
Pacific	0.0220	0.0074**	0.0218	0.0071**	0.0213	0.0071**	0.0190	0.0066**
Mixed division	– 0.0171	0.0386	– 0.0076	0.0381	– 0.0075	0.0385	– 0.0052	0.0381
Constant	0.0526	0.0964	0.1129	0.0886	0.1031	0.0937	0.1547	0.0852
N	210		210		210		210	
R^2	0.59		0.58		0.58		0.57	

CAGR = compound annual growth rate. PUMS = Public Use Microdata Sample.

** Indicates significance at the 5-percent level.*

*** Indicates significance at the 1-percent level. The observation level of the sample in this report is a matched metropolitan statistical area (MSA). Only noncommercial, noncondominium single-family detached houses are considered in the sample. CAGR, the dependent variable, is a measure similar to annualized difference in natural logs of end and start values. Results are weighted by the sum of weights at the MSA level. Median house values are adjusted to 2000 using the nonseasonally adjusted Consumer Price Index (CPI) excluding shelter expenses, and median household income is adjusted to 2000 using the nonseasonally adjusted CPI.*

Source: 1990 and 2000 Integrated Public Use Microdata Series

Exhibit A-2

Regressions of House Price Appreciation on Cohorts of PUMS Data Without Tenure Restriction (1 of 2)

Covariate	CAGR							
	(26)		(27)		(28)		(29)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Head older than 74 years in 1990	– 0.0230	0.0072**	– 0.0249	0.0070**	– 0.0209	0.0065**	– 0.0211	0.0059**
Tenure at home less than 11 years in 1990	– 0.0307	0.0551	– 0.0839	0.0395*				
Tenure at home 21 through 30 years in 1990	– 0.0587	0.0469	– 0.0425	0.0407				
Tenure at home more than 30 years in 1990	– 0.0085	0.0359	– 0.0293	0.0312				
Building age less than 11 years in 1990	– 0.0570	0.0631			– 0.0785	0.0489		
Building age 21 through 30 years in 1990	0.0632	0.0499			0.0240	0.0418		
Building age 31 through 40 years in 1990	– 0.0269	0.0402			– 0.0408	0.0360		
Building age 41 through 50 years in 1990	0.0484	0.0528			0.0255	0.0477		
Building age more than 50 years in 1990	0.0284	0.0372			0.0107	0.0332		
Fewer than 4 rooms in 1990	– 0.1244	0.1063	– 0.1296	0.1053	– 0.1237	0.1045	– 0.1556	0.1061
6–8 rooms in 1990	– 0.0100	0.0242	– 0.0185	0.0226	– 0.0118	0.0233	– 0.0065	0.0223
More than 8 rooms in 1990	0.0705	0.0293*	0.0822	0.0285**	0.0747	0.0282**	0.1120	0.0269**
Married in 1990	– 0.0036	0.1115	– 0.0566	0.1075	– 0.0467	0.1073	– 0.1238	0.1024
Separated, divorced, or widowed in 1990	0.0157	0.1186	– 0.0355	0.1154	– 0.0248	0.1149	– 0.0954	0.1120
Non-Hispanic Black	– 0.0504	0.0260	– 0.0448	0.0249	– 0.0463	0.0252	– 0.0265	0.0244
Non-Hispanic other race	0.0176	0.0268	0.0181	0.0259	0.0192	0.0257	0.0321	0.0257
Mexican Hispanic	– 0.0564	0.0211**	– 0.0640	0.0208**	– 0.0572	0.0209**	– 0.0611	0.0209**
Other Hispanic	0.0626	0.0393	0.0641	0.0392	0.0652	0.0387	0.0769	0.0393
Household income in 1990	– 0.0889	0.0180**	– 0.0932	0.0163**	– 0.0893	0.0165**	– 0.0977	0.0159**

Exhibit A-2

Regressions of House Price Appreciation on Cohorts of PUMS Data Without Tenure Restriction (2 of 2)

Covariate	CAGR							
	(22)		(23)		(24)		(25)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Middle Atlantic	0.0054	0.0063	0.0054	0.0063	0.0056	0.0062	0.0030	0.0063
East North Central	0.0358	0.0073**	0.0357	0.0071**	0.0361	0.0071**	0.0348	0.0071**
West North Central	0.0320	0.0086**	0.0302	0.0084**	0.0319	0.0085**	0.0289	0.0084**
South Atlantic	0.0278	0.0087**	0.0260	0.0082**	0.0282	0.0086**	0.0186	0.0076*
East South Central	0.0230	0.0101*	0.0233	0.0096*	0.0236	0.0099*	0.0178	0.0094
West South Central	0.0236	0.0093*	0.0225	0.0087**	0.0246	0.0092**	0.0196	0.0081*
Mountain	0.0456	0.0097**	0.0431	0.0090**	0.0459	0.0095**	0.0370	0.0084**
Pacific	0.0271	0.0076**	0.0259	0.0075**	0.0278	0.0074**	0.0231	0.0071**
Mixed division	– 0.0702	0.0373	– 0.0594	0.0372	– 0.0630	0.0369	– 0.0612	0.0377
Constant	0.0509	0.1106	0.1339	0.1022	0.0858	0.1069	0.1510	0.0997
N	210		210		210		210	
R^2	0.60		0.58		0.60		0.56	

CAGR = compound annual growth rate. PUMS = Public Use Microdata Sample.

** Indicates significance at the 5-percent level.*

*** Indicates significance at the 1-percent level. The observation level of the sample in this report is a matched metropolitan statistical area (MSA). Only noncommercial, noncondominium single-family detached houses are considered in the sample. CAGR, the dependent variable, is a measure similar to annualized difference in natural logs of end and start values. Results are weighted by the sum of weights at the MSA level. Median house values are adjusted to 2000 using nonseasonally adjusted Consumer Price Index (CPI) information minus shelter expenses, and median household income is adjusted to 2000 using nonseasonally adjusted CPI information.*

Source: 1990 and 2000 Integrated Public Use Microdata Series

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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.

Low-Income Housing Tax Credit **Qualified Census Tracts**

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Abstract

The Qualified Census Tract (QCT) provision of the Low-Income Housing Tax Credit statute encourages private developers to build low-income housing in low-income and high-poverty areas. This article discusses the legislative history of the QCT provision, explains the current designation methodology, and introduces several research issues concerning QCTs.

Introduction

The U.S. Department of Housing and Urban Development (HUD) designates Qualified Census Tracts (QCTs) for the Low-Income Housing Tax Credit (LIHTC) Program, which was created by the Tax Relief Act of 1986 as an incentive to increase the availability of low-income housing. LIHTC projects located in QCTs are eligible for up to 30 percent more tax credits than identical projects not in QCTs, which provides a strong incentive to locate projects funded with tax credits in the lowest income areas. As defined in Section 42 of the Internal Revenue Code, QCTs are areas where 50 percent or more of the households have incomes below 60 percent of the area median income

(AMI), or where the poverty rate is 25 percent or higher. Further, the statute restricts the total population of designated QCTs to 20 percent of area population.[1, 2]

The success of the LIHTC Program and the intuitive nature of the designation criteria have limited discussion on how QCTs are designated and their general effect within the LIHTC Program; however, the tax credit program and the households it aims to serve could greatly benefit from introspective research. This policy brief discusses the legislative history of the QCT provision and the current designation methodology before discussing research issues concerning QCTs.

Legislative History of the QCT

The Tax Relief Act of 1986, which created the LIHTC Program, did not include the bonus for projects in QCTs. QCTs and the similar concept of difficult development areas (DDAs) were added by amendments to the tax code in the Omnibus Budget Reconciliation Act of 1989. QCTs likely were intended to provide additional incentives for the rehabilitation or replacement of substandard rental housing in low-income areas. QCTs originally were defined using only the income criterion described above (that is, in areas where 50 percent or more of the households have incomes below 60 percent of AMI subject to the 20-percent population cap). In 2000, Congress passed the Community Renewal Tax Relief Act, which added the poverty-rate criterion. Any tract with a poverty rate of at least 25 percent became eligible for QCT status. The new poverty-rate criterion, which was first applied to the QCTs effective January 1, 2002 (*Federal Register,* 2001), increased the number of designated tracts from approximately 7,700 in 2001 to more than 9,900 in 2002. In practical terms, this change substantially expanded the number of sites eligible for higher levels of subsidy.

QCT Designation Methodology

Qualified Census Tracts are designated periodically as new decennial census data become available or as metropolitan area definitions change. The most recent update of QCTs, effective January 1, 2007 (*Federal Register,* 2006), reflects the recent change to 2000 Census-based metropolitan area definitions (OMB Bulletin, 2003) and the availability of new, more detailed 2000 Census income distribution tables. HUD obtained a special tabulation of 2000 Census household income data at the census-tract level that was more highly detailed than that published by the Census Bureau for general public use. HUD used these new data to more accurately determine the eligibility of census tracts for QCT designation. The current designation of QCTs also uses the new Office of Management and Budget (OMB) metropolitan area definitions without modification to evaluate how many census tracts can be designated under the population cap, but it uses the HUD-modified definitions and their associated AMIs for determining QCT eligibility.

[1] The reference area is the entire metropolitan area, as defined by the Office of Management and Budget, for urban tracts or the sum of nonmetropolitan counties in a state for rural tracts.

[2] In addition to playing an integral role in the Low-Income Housing Tax Credit (LIHTC) Program, the Small Business Reauthorization Act of 1997 created the Historically Underutilized Business Zone (HUBZone) Empowerment Contracting program to encourage development in economically distressed areas by providing more access to federal contracting opportunities. A business that is located in a HUBZone and that has at least 35 percent of its employees residing in the HUBZone is eligible for federal contracting preferences. By statute, a tract with Qualified Census Tract (QCT) status also receives HUBZone designation. Although only currently designated tracts are eligible for the boost in tax credits in the LIHTC Program, Congress engineered, for the HUBZone program, a series of grandfathering amendments so that the loss of QCT status does not affect a tract's continuing eligibility for HUBZone status.

HUD uses the HUD metro fair market rent area (HMFA)[3]-level area median gross incomes (AMGIs) to determine QCT eligibility because the QCT statute refers to the same section of the Internal Revenue Code that defines income for purposes of tenant eligibility and unit maximum rent.[4] According to Section 42, QCTs are determined as follows:

1. To be eligible for designation as a QCT, a census tract must have at least 50 percent of its households with incomes below 60 percent of the AMGI or have a poverty rate of 25 percent or more. In metropolitan areas, HUD calculates 60 percent of AMGI by multiplying by a factor of 0.6 the HMFA median family income for 1999, as estimated by HUD from 2000 Census data. Outside metropolitan areas, HUD calculates 60 percent of AMGI by multiplying by a factor of 0.6 the state-specific, nonmetropolitan balance median family income for 1999, as estimated by HUD.

2. For each census tract, the percentage of households below the 60-percent income standard (income criterion) was determined by (a) calculating the average household size of the census tract, (b) applying the income standard after adjusting it to match the average household size,[5] and (c) calculating the number of households with incomes below the income standard using a special tabulation of household income data from the 2000 Census that provides more detail than the data on household income distribution publicly released by the Census Bureau.

3. For each census tract, the poverty rate was determined by dividing the population with incomes below the poverty line by the population for whom poverty status has been determined.

4. QCTs are those census tracts in which 50 percent or more of the households meet the income criterion or in which 25 percent or more of the population is in poverty, such that the population of all census tracts that satisfy either one or both of these criteria does not exceed 20 percent of the total population of the respective area.

5. In areas where more than 20 percent of the population resides in eligible census tracts, census tracts are designated as QCTs in accordance with the following procedure:

   a. Eligible tracts are placed in one of two groups. The first group includes tracts that satisfy both the income and poverty criteria for QCTs. The second group includes tracts that satisfy either the income criterion or the poverty rate criterion, but not both.

[3] HUD metro fair market rent areas are entire Core Based Statistical Area (CBSA) metropolitan areas or subareas of CBSAs established to set fair market rents (FMRs) and income limits. See "Final Fair Market Rents for the Housing Choice Voucher Program and Moderate Rehabilitation Single Room Occupancy Program for Fiscal Year 2007": http://www.huduser.org/datasets/fmr/fmr2007f/FY2007F_FR_Preamble.pdf.

[4] By rule, the Internal Revenue Service sets these income limits according to HUD's very low-income limits, which in fiscal year 2006 and thereafter are established at the HUD metro fair market rent areas level. HUD uses the entire metropolitan statistical area (MSA), however, to determine how many eligible tracts can be designated under the 20-percent population cap because the statute states that MSAs should be treated as singular areas for this purpose.

[5] The tract average-household-size-adjusted income limit (TAHSAIL) is calculated by multiplying 60 percent of the area median gross income (AMGI60PC) by an adjustment of -10 percent for every person less than 4, and +8 percent for every person more than 4, with a minimum of 1 person per household and a maximum of 8. Thus, if tract average household size is 1, then TAHSAIL = 0.70 * AMGI60PC; if tract average household size is 2.5, then TAHSAIL = 0.85 * AMGI60PC; if tract average household size is 4, then TAHSAIL = 1.00 * AMGI60PC; and if tract average household size is 8, then TAHSAIL = 1.32 * AMGI60PC.

b. Tracts in the first group are ranked from lowest to highest on the income criterion. Then, tracts in the first group are ranked from lowest to highest on the poverty rate criterion. The two ranks are averaged to yield a combined rank. The tracts are then sorted on the combined rank, with the census tract with the highest combined rank placed at the top of the sorted list. If two or more tracts tie, more populous tracts are ranked above less populous ones.

c. Tracts in the second group are ranked from lowest to highest on the income criterion. Then, tracts in the second group are ranked from lowest to highest on the poverty rate criterion. The two ranks are then averaged to yield a combined rank. The tracts are then sorted on the combined rank, with the census tract with the highest combined rank placed at the top of the sorted list. If two or more tracts tie, more populous tracts are ranked above less populous ones.

d. The ranked first group is stacked on top of the ranked second group to yield a single, concatenated, ranked list of eligible census tracts.

e. Working down the single, concatenated, ranked list of eligible tracts, census tracts are designated until the designation of an additional tract would cause the 20-percent limit to be exceeded. If a census tract is not designated because doing so would raise the percentage above 20 percent, subsequent census tracts are then considered to determine if one or more census tracts with smaller populations could be designated without exceeding the 20-percent limit.

Practical Issues in QCT Designation

As mentioned earlier, Congress has acted to increase QCT eligibility only once, adding the poverty rate criterion in 1989. Changes that increase tract eligibility have no effect on the overall allocation of tax credits that each state receives,[6] but the changes do provide more choices of locations where the additional incentives are available for locating housing within low-income or high-poverty areas, or both. Under the current designation rules, developers continue to face two impediments to using the higher subsidy level to build low-income housing within low-income or high-poverty communities: (1) neighborhoods that straddle two census tracts and (2) the 20-percent population cap.

The Census Bureau defines tract boundaries using major natural and manmade geographic features such as roads, rail lines, rivers, and shorelines. Frequently, the neighborhoods centered on major thoroughfares are split by census tract boundaries, with one side of the street being in a QCT and the other side not. Current law allows the increase in basis to apply only to LIHTC-financed buildings located entirely within the boundaries of the census tracts designated by HUD as QCTs, even though the neighborhoods immediately adjacent to the boundaries of the QCTs may be indistinguishable from those within the QCT. In addition, properties where LIHTC projects are to be developed occasionally straddle QCT boundaries. This straddling can limit the size or location of LIHTC

[6] Increases in the number of designated Qualified Census Tracts (QCTs) may not be entirely revenue neutral. Some tax credits are issued automatically to affordable rental housing projects financed with tax-exempt private activity bonds under Section 142 of the Internal Revenue Code. Because private activity bond issuances are subject to annual volume caps, the low-income housing tax credit (LIHTC) associated with bond-financed rental housing is not subject to the annual state allocation caps on LIHTC. Therefore, if, as a result of an increase in QCTs, more bond-financed projects are done in QCTs with an associated increase in LIHTC issued, revenue collected by the U.S. Treasury will be reduced.

projects because developers must choose between either accepting a lower eligible basis by locating part of a project outside of a QCT or relocating to a different site, if one exists, in the eligible tract. Although a site straddling tract boundaries may be more desirable, and sometimes is the only option available, the loss in basis and tax credits may render the project financially infeasible.[7]

The population cap imposed in the LIHTC statute poses a larger restriction and a fundamental fairness issue. The QCT eligibility requirements limit the portion of each metropolitan area or nonmetropolitan balance within a state that may be designated as a QCT. Specifically, no more than 20 percent of the total population in each metropolitan area and nonmetropolitan part of each state may be designated QCTs; thus, only 88 percent of eligible tracts are currently designated QCTs. This limitation has a disproportionate effect across areas. In some metropolitan areas, all eligible tracts can be designated, even those that minimally satisfy the eligibility criteria; in other areas, eligible tracts with higher poverty rates or higher percentages of households with incomes below 60 percent of AMI, or both, cannot be designated. In census tracts affected by the cap, this restriction may reduce the capacity to finance affordable housing.

Research Issues

Despite the use of the QCT designation in the LIHTC Program for almost 20 years, research on the effect of designated census tracts in the program is lacking. The following three research questions regarding Qualified Census Tracts and the market for low-income housing warrant attention. The first two questions address whether QCTs reach the households and communities intended; the third question examines the effect on the households served.

1. *Are eligible tracts not designated because of the population cap underserved by the LIHTC?* In 2007, more than 1,500 tracts that qualified under the income or poverty rate criterion, or both, were not designated QCTs because of the 20-percent population cap. Many of these tracts far exceeded the eligibility thresholds. For example, almost 300 eligible but undesignated tracts exceeded the minimum thresholds for both the income and poverty rate criteria. Further, more than 500 eligible but undesignated tracts had a poverty rate greater than 35 percent, and more than 100 eligible but undesignated tracts had at least 65 percent of households with incomes below 60 percent of AMI; both of these levels far exceed the minimum thresholds. Thus, these tracts often have a higher poverty rate or a higher percentage of low-income households than designated tracts in other metropolitan or nonmetropolitan areas, but they do not qualify simply because their metropolitan area or nonmetropolitan region has a relatively high percentage of its population residing in tracts characterized by low incomes or high poverty rates, or both. When considering projects located in low-income, high-poverty rate tracts, do developers respond to the QCT incentive and primarily locate LIHTC projects in designated tracts, or do these undesignated, yet eligible tracts receive a similar level of LIHTC investment?

[7] This loss could be cured legislatively by allowing low-income housing tax credit-financed buildings on properties adjacent to a Qualified Census Tract (QCT) to be eligible for the increase in basis, which currently is afforded buildings located entirely within QCTs.

2. *Are QCTs the areas of greatest need for affordable housing?* Qualified Census Tracts have been a key component of the LIHTC Program since 1990. Their purpose is to provide additional incentive in directing private investment to areas with the greatest need for affordable rental housing. Congress defined these areas, as discussed earlier, by the income and poverty rate criteria. An area with a large percentage of low-income households relative to its metropolitan area or its nonmetropolitan region, or with a poverty rate exceeding 25 percent, is deemed as needing additional subsidy for rehabilitation or new construction of low-income housing. Research is lacking to support this presumed need or examine alternative measures. These criteria have the important characteristics of (a) being intuitive; that is, low-income residents need affordable housing, and these areas have the highest percentage of low-income residents; and (b) relying on readily available, uniform data covering the entire country at the census tract level. These criteria are strictly indicators of demand, however, and they do not incorporate supply-side measures. Because neither existing housing supply nor affordability are taken into consideration in the designation process, it is unclear if other, undesignated areas, which may have slightly higher income levels but a lower stock of affordable rental housing, might not have a greater need for low-income housing subsidy.

3. *What is the effect of directing additional low-income housing to the poorest areas, particularly within metropolitan areas?* The additional incentive to locate low-income housing into already low-income areas may have the perverse and self-reinforcing effect of concentrating low-income households in the lowest income and highest poverty neighborhoods, rather than providing low-income housing throughout a larger area. This effect is particularly important in urban areas, where metropolitan economies are continuing to experience a geographic expansion into the suburbs. Existing research has documented so-called "flight from blight," where businesses follow high-income households to the suburbs, leaving a pocket of poverty in inner cities without access to the newly relocated jobs. Quite often, low-income households depend on public transportation, which does not provide convenient access to suburban employers, if at all. Does providing additional subsidy for locating low-income housing to already low-income and high-poverty areas limit the ability of these households to obtain new employment or, more generally, to pull themselves out of poverty? Do QCTs help revitalize neighborhoods or accelerate their decline by artificially encouraging the concentration of poverty?

Conclusion

The 30-percent boost in LIHTCs associated with QCTs has helped finance more than one-fourth of all LIHTC projects and approximately one-third of projects in recent years. In 2004, the latest year for which data are available, 34.2 percent of LIHTC projects and 40.5 percent of LIHTC units were located in a QCT.

Researchers can help improve our understanding of the effects of the LIHTC, the largest affordable housing production subsidy in the United States, by more closely examining this facet of the program.

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Additional Reading

To further investigate Qualified Census Tracts (QCTs), researchers can access useful information at the following three websites:

- HUD's QCT website: http://www.huduser.org/datasets/qct.html.
- QCT designation data (including detailed income distribution tables at the tract level) website: http://qct.huduser.org/tables/data_request.odb.
- HUD's low-income housing tax credit database: http://lihtc.huduser.org.

Data Shop

Data Shop, a department of Cityscape, presents short articles or notes on the uses of data in housing and urban research. Through this department, PD&R introduces readers to new and overlooked data sources and to improved techniques in using well-known data. The emphasis is on sources and methods that analysts can use in their own work. Researchers often run into knotty data problems involving data interpretation or manipulation that must be solved before a project can proceed, but they seldom get to focus in detail on the solutions to such problems. If you have an idea for an applied, data-centric note of no more than 3,000 words, please send a one-paragraph abstract to David.A.Vandenbroucke@hud.gov for consideration.

The CHAS Data: Obtaining Estimates of Housing Market Affordability

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Abstract

The U.S. Department of Housing and Urban Development's (HUD's) Comprehensive Housing Affordability Strategy (CHAS) data provide vital information on housing affordability measures. This article presents potential uses of the CHAS data, as well as limitations of the data. Researchers should explore the benefits of using CHAS data to examine the role of affordable housing market structure on the persistence of urban issues.

Introduction

Obtaining housing affordability supply-and-demand estimates is important for assessing structural features of metropolitan housing markets. Unfortunately, decennial census aggregate-level data do not provide adequate measures of this vital housing market feature. The U.S. Department of Housing and Urban Development's (HUD's) Comprehensive Housing Affordability Strategy (CHAS) data

address this limitation.[1] The data provide special tabulations of census data for selected household and housing unit variables. The variables provided in the data enable users to characterize the affordable housing market for renter-occupied and owner-occupied housing units across local jurisdictions. The publicly available data, widely used by public and nonprofit agencies, are currently underused in the academic arena. This article provides an overview of the CHAS data and the potential uses for exploring housing and housing-related issues in metropolitan regions.

The first section, Data Overview, briefly describes the CHAS data. The second section, Data Uses and Limitations, addresses how to use the data to obtain measures of housing market characteristics. The third section, Conclusions, summarizes the benefits of using the CHAS data to develop neighborhood viability and metropolitan housing market measures.

Data Overview

The CHAS data were created to help jurisdictions meet requirements of the National Affordable Housing Act (HOME Program) of 1991. The Act requires eligible jurisdictions to submit a Consolidated Plan that presents a comprehensive housing affordability strategy for their geographic coverage area. The publicly available decennial census data were insufficient to provide summary measures of the status of the local affordable housing market. The special tabulations provided through the CHAS data enabled local governments to not only characterize the current status of the local affordable housing market but also to complete their Consolidated Plan. Compliance is necessary for jurisdictions to access federal funding.

The National Affordable Housing Act[2] furthers HUD's goal of ensuring that Americans have access to an adequate supply of decent, affordable housing. The Act is not limited to rental housing. Funding, incentives, and policy initiatives further the national housing policy goal of improving access to affordable homeownership opportunities as well. Although the CHAS data provide tabulations for households of varying income ranges, the policy goals focus on the inadequate and diminishing supply of affordable housing for low-income families, particularly those in the very low-income range.[3] Federal funds to help jurisdictions provide safe, decent, affordable housing are available for participating jurisdictions (*Federal Register*, 2004).

Estimating Housing Unit Affordability

Analyses of affordable housing supply define affordable housing units as those for which households pay no more than 30 percent of their income on housing costs. The 30-percent threshold assures that households do not have an excessive rent burden and that they have income available

[1] For the 2000 data, see http://www.huduser.org/datasets/cp.html (accessed March 23, 2007). Data for 1990 are available through the State of the Cities Data Systems (SOCDS). SOCDS can be accessed through http://socds.huduser.org/index.html (accessed March 23, 2007).

[2] Title II (1990) 42 U.S.C. 12701.

[3] Income classifications are as follows: extremely low-income (households earning less than or equal to 30 percent of HUD Area Median Family Income [HAMFI]), very low-income (households earning less than or equal to 50 percent of HAMFI), and low-income (households earning less than or equal to 80 percent of HAMFI).

for nonhousing living expenses. This affordability threshold is also a payment standard used by HUD and the U.S. Department of Agriculture. The CHAS data follow this threshold standard.

CHAS data provide tabulations at the block group,[4] tract, county subdivision (that is, minor civil division), county, state, and national levels. The data use HUD-defined area median family income (HAMFI) classifications, selected housing-unit characteristics, and selected attributes of households residing in those units. Primary affordability variables are income range as a percentage of HAMFI and housing-unit affordability. The data also permit summary counts by household attributes such as race and Hispanic origin, poverty status, household type (elderly or family), presence of children, and college enrollment. The data also permit limited analyses of mobility or self-care limitations in elderly households. Housing-unit variables include tenure (renter-occupied or owner-occupied units), mortgage status, number of bedrooms (zero or one, two, or three or more), year structure was built, rent asked, and sales price asked. Tables also enable estimates of households by income range, occurrence of housing problems such as overcrowding (more than one person per room), housing cost burdens (paying in excess of 30 percent of income on housing costs), and limited housing quality measures (lack of complete plumbing or kitchen facilities).

A primary benefit of the CHAS data is that they contain special tabulations of census data categorized by household income (as a percentage of HAMFI) and housing affordability (as a percentage of HAMFI). These tabulations allow for consistent estimations of housing affordability and housing-cost burdens across several studies. Census Summary File (SF) income, rental, and housing value categories do not match with HUD-specified income limits and subsequent housing-affordability ranges. For example, consider a HUD income limit of $37,500 for a low-income family of four. The maximum affordable rent for this family, $892, falls within the census SF rental category of $750 to $999. In the absence of the special tabulations provided in the CHAS data, researchers would need to use potentially varying algorithms to estimate the number of households and housing units within desired affordability ranges. Although the Public Use Microdata Samples (PUMS) files alleviate this limitation, the files are limited in supporting analyses within metropolitan regions (that is, at lower levels of geography).

Data Uses and Limitations

Because of national housing policies, the CHAS data play a key role in the public and nonprofit sectors. The data also contain useful housing market measures that are relevant in the academic arena. Characterizing housing market affordability, particularly the relative mismatch between the supply of and demand for affordable housing units, is an important factor in studying metropolitan regions. Further, the extent to which households experience housing cost burdens is a key policy issue that warrants further research.

Selected Potential Analyses

The CHAS data include several key housing market variables that would support numerous analyses at varying geography levels. The multitude of potential analyses cannot be exhausted in

[4] Given the low level of geography, block group tabulations present a limited number of variables.

a brief data note. The discussion that follows highlights a few key analyses based on two primary variables: household income range and housing unit affordability. As noted previously, the CHAS data policies focus on affordable housing opportunities for low-income households. The CHAS data provide specially tabulated summaries for five income classifications: (1) less than or equal to 30 percent HAMFI, (2) 30.1 through 50 percent HAMFI, (3) 50.1 through 80 percent HAMFI, (4) 80.1 through 95 percent HAMFI, and (5) greater than 95 percent HAMFI. Rent affordability is based on gross rent (that is, including utilities). The data provide estimates of the number of rental housing units affordable to households with incomes at or below the range of the specified HAMFI. Owner affordability tables provide affordable housing value ranges for costs associated with house purchases at the time the census was conducted.[5]

As with the census SFs, users have limited access to variable interactions. Fortunately, the data provide tables with multiple variable cross-tabulations. On the one hand, these multiple cross-tabulations often result in tables with many cells within a geographic unit (ranging between 8 and 96). On the other hand, the purpose of the data ensures that relevant variable interactions have been included. For example, tables A1A and A1B provide housing-unit summary counts for owner-occupied and renter-occupied housing units, respectively. The tabulations include variables for whether the unit has at least one housing-unit problem for four problem measures: (1) a lack of complete plumbing facilities, (2) a lack of complete kitchen facilities, (3) overcrowding (more than one person per room), or (4) cost burdened (paying more than 30 percent of income on housing costs). The tabulation further characterizes the race and Hispanic origin of the housing unit occupants (eight categories), along with low-income classification (five categories) separately for units with at least one housing problem or no housing problems. The resultant 80 cells for each geographic unit, while cumbersome, permits multiple estimates that would be unavailable through the census SFs. By aggregating across relevant variables, users can obtain the racial distribution of cost-burdened households, race-specific homeownership rates among cost-burdened households, or race or income distributions of households residing in units with housing problems. Aggregating the table also allows for estimates of the propensity of housing-unit problems by race or the distribution of housing-unit problems across income classifications within racial classifications.

A user can compute additional housing market viability and inequality measures by comparing across subcategories (for example, ratios, percentage differences, and gaps). Clearly this list is not exhaustive, but it illustrates the richness of the data in characterizing housing market viability. Research on race and income disparities in housing market outcomes would be further enhanced through analysis of CHAS data.

Tables A10B and A10C give the estimated number of households and housing units by affordability range, number of bedrooms, and income range for owner-occupied and renter-occupied units, respectively. Owner-occupied housing tables differ slightly from renter-occupied housing tables in the lowest affordability category reported. Although renter-occupied housing tabulations provide the number of rental units affordable at the extremely low-income threshold, the lowest reported affordability range for owner-occupied tabulations is the very low-income threshold. Given the

[5] The affordability range assumes an interest rate of 7.9 percent and uses national averages for utilities, taxes, and homeowner's insurance. Owner affordability tables use a multiplier, 2.9, to determine the house value affordability threshold.

expected relatively low ownership propensity among extremely low-income households, this difference is not a significant limitation of the data. Including measures of unit size provides a more comprehensive depiction of the affordable housing market. For instance, the data permit estimates of housing problems not directly captured in the cross-tabulations, such as the potential lack of affordable housing supply for large families.

Estimating the supply of affordable housing units by tenure and the number of households at varying income levels is not the only use of the CHAS data. The data provide housing market features that, when appended to individual-level data with geographic identifiers, would enrich current research performed on these data. Future research should use the CHAS data to examine the effect of affordable housing market features on household-level tenure and household mobility outcomes. Restricted access versions of the American Housing Survey (AHS) and Panel Study of Income Dynamics contain geographic identifiers that would support hierarchical models explicitly acknowledging that these household outcomes occur within the context of place.

Limitations

This section highlights three primary limitations of the CHAS data: (1) aggregate tables, (2) estimate errors from rounding rules, and (3) inadequate measures of housing quality. The latter two limitations are best addressed through obtaining estimates at the highest level of aggregation for both geography and table components. The discussion includes ways to address housing quality limitations by incorporating estimates from an external data source. The rounding scheme, although not mitigated, should be considered when interpreting estimated housing-unit and population counts. As a consequence of the limitations, users should exercise caution when making comparisons between CHAS data and census SF data. In addition, the data do not give estimates for metropolitan statistical areas (MSAs). Users can use census tract or county-mapping files to aggregate the CHAS-provided geography to the MSA level. Finally, combining the CHAS data with the GeoLytics® Neighborhood Change Database allows for analysis of housing market affordability for within the context of changing housing market conditions.

Aggregate Tables. As noted, the summary tables present limited interactions. For instance, the user cannot determine which housing-unit problem is present from tables A1A and A1B; however, this limitation is one that is also present in the census SFs. Users of decennial census data acknowledge that individual data, such as the PUMS, provide the most flexibility in characterizing household and housing-unit conditions. Despite this limitation, the policies motivating the CHAS data make many useful variable interactions available. As such, variables contained in the data characterize numerous housing market viability measures. The user can analyze external data sources (for example, PUMS) to determine the extent to which omitted interactions are correlated with obtainable interactions through CHAS.

Rounding Rules. CHAS tabulations use a rounding scheme for most tables. The rounding scheme results in internal file discrepancies and in differences between CHAS and publicly available decennial census count data.[6] The total column for a particular table provides the total housing-unit

[6] According to CHAS documentation, the rounding scheme has three rules: 0 counts remain 0, values 1 through 7 are reported as 4 (the midpoint), and remaining values round to the nearest multiple of 5.

count without applying the rounding scheme. Thus, internal discrepancies result from differences between the summed values of the rounded cell counts (computed total) and the nonrounded total (provided total). Comparing these two totals is beneficial and demonstrates the effect of rounding. Because of rounding, the computed totals also will differ from population and housing-unit counts available through the SFs. A user should make similar comparisons to estimate the rounding effect.

One way of addressing the rounding limitation is to provide bounded estimates of housing units or population counts for specified variables (for example, rental housing units affordable to low-income households). For small geographic levels with small housing-unit counts (for example, tracts or block groups) the bounded-estimate method should be used with caution. A user is strongly encouraged to compare these estimates to the census SFs and weigh the costs of disaggregating to a low level of geography. Another way of addressing the limitation is to use the data to obtain distributions across categories. The example at the end of this section demonstrates that the percentage distribution of affordable housing units or low-income households generally offsets the overestimations and underestimations of the rounding scheme. A user could then apply the estimated distributions to either the provided CHAS table totals or the census SF totals.

Housing Quality. A third limitation of the CHAS data is the lack of adequate measures for housing quality. The two-fold definition for affordable housing requires that housing costs are within the household's ability to pay, while leaving sufficient financial resources for other pertinent living expenses, *and* that the unit is decent and safe. CHAS data can be used to determine the number of housing units at various affordability levels that have at least one housing problem. The data are limited in identifying housing quality separate from crowding and cost burdens. Generally, affordable housing studies assess decency or safety standards using housing adequacy measures provided in the AHS. The AHS combines several variables capturing physical problems to create an index of housing adequacy: adequate, moderately inadequate, or seriously inadequate. These variables include major plumbing, heating, or upkeep deficiencies, as well as the presence of peeling paint, leaks, or rats. Because the CHAS data are based on decennial census data, the tabulations do not include these important quality measures; and thus, CHAS indicators are not sufficient to estimate the number of housing units with moderate or severe deficiencies.

One way to address this limitation for higher geography levels (for example, MSAs) is to supplement the CHAS data with AHS estimates. The AHS is limited in addressing housing quality at lower geography levels (for example, counties or census tracts). The national AHS does not permit analysis at the county level. Metropolitan files, which could permit county-level analyses, often are not conducted within desired timeframes. The national AHS does allow metropolitan regional estimates of housing quality differentials by urban or rural status, household income range, and housing costs. The AHS estimates approximate the distribution of moderately or severely inadequate housing units by housing cost range. To account for housing quality, adjust supply estimates from the CHAS data using AHS estimates of housing adequacy for varying housing-cost affordability levels.

Example

The following example explores the use of CHAS data to characterize Pennsylvania's affordable housing market. Exhibit 1 provides an example for table A10C at the state level (Summary Level 040r)

and tract level (Summary Level 080r).[7] The table gives the number of renter-occupied housing units by household income range (five categories) and number of bedrooms (three categories: zero to one bedroom, two bedrooms, and three or more bedrooms) for four rental affordability levels (affordable for households in four income categories: less than or equal to 30 percent of HAMFI, 30.1 percent through 50 percent of HAMFI, 50.1 percent through 80 percent of HAMFI, or greater than 80 percent of HAMFI). The resulting table has $5 \times 3 \times 4 = 60$ cells for each jurisdiction.

The rounding scheme applied at the state level overestimates the number of housing units by five units. Disaggregating to the census tract level exacerbates the rounding errors with an underestimate of approximately 3,600 households or units. Although the differential in overall household and housing-unit counts is substantial, the distributions of housing units across affordability ranges and households across income ranges are comparable at the state and aggregated census tract levels.

In addition to demonstrating the rounding effect, exhibit 1 illustrates several useful affordability measures obtained through the CHAS data. Aggregating the data across the number of bedrooms permits analysis of household distributions across three housing-unit affordability outcomes: affordable housing occupancy, rent-burdened households, and households renting down. Affordable housing occupancy refers to households paying no more than 30 percent of income on housing costs. Rent-burdened households occupy housing units with costs in excess of the affordability threshold. Households renting down occupy housing units affordable at a lower affordability range. The last classification is pertinent in characterizing housing market affordability because those households further restrict the low-income affordable housing supply.

Conclusions

The previous discussion highlights ways to obtain useful distributions of housing market viability, such as housing cost burdens, the gap between affordable housing supply and demand, and the distribution of income levels within affordability ranges (for example, renting down). Current research on housing and urban issues would benefit from including the affordability measures available through this rich data. Future research should use CHAS data to examine the role of affordable housing market structure on the persistence of urban issues (for example, concentrated poverty, housing mobility differentials, and racial residential segregation).

The origins of CHAS data in the policy field should not hinder its use in academic scholarship. The data enable research contributions beyond assisting jurisdictions to prepare Consolidated Plans. The CHAS data provide an opportunity for bridging the gap between practitioner and academic research. Future research using the CHAS data should explore these linkages and ways to better inform and evaluate housing policy.

[7] Summary levels 040r and 080r indicate that the data cells provide rounded estimates.

Exhibit 1

Example of CHAS Housing Affordability Analysis and the Effect of the Rounding Scheme (1 of 2)

State Summary Level					Tract Summary Level				
Income Range	Affordability Threshold				Income Range	Affordability Threshold			
	Less than or equal to 30 percent	30.1 through 50 percent	50.1 through 80 percent	Greater than 80 percent		Less than or equal to 30 percent	30.1 through 50 percent	50.1 through 80 percent	Greater than 80 percent
≤ 30% HAMFI					≤ 30% HAMFI				
0 or 1 BR	62,820	53,190	34,965	7,715	0 or 1 BR	62,844	53,194	34,640	7,598
2 BR	33,735	40,375	22,605	3,075	2 BR	33,866	40,316	22,389	3,007
3 or more BR	34,795	27,480	12,235	1,635	3 or more BR	34,821	27,593	12,063	1,590
30.1 through 50% HAMFI					30.1 through 50% HAMFI				
0 or 1 BR	20,885	44,690	27,950	5,945	0 or 1 BR	20,926	44,653	27,810	5,901
2 BR	16,875	38,755	24,720	2,840	2 BR	16,984	38,720	24,548	2,793
3 or more BR	20,160	24,005	14,245	1,465	3 or more BR	20,083	24,093	14,123	1,406
50.1 through 80% HAMFI					50.1 through 80% HAMFI				
0 or 1 BR	9,260	43,825	42,855	7,935	0 or 1 BR	9,134	43,727	42,738	7,804
2 BR	14,265	51,400	44,415	4,605	2 BR	14,370	51,362	44,390	4,536
3 or more BR	21,005	32,010	24,450	2,545	3 or more BR	20,978	32,056	24,428	2,442
80.1 through 95% HAMFI					80.1 through 95% HAMFI				
0 or 1 BR	2,045	12,740	17,865	3,450	0 or 1 BR	1,964	12,465	17,656	3,351
2 BR	4,610	18,125	20,615	2,465	2 BR	4,738	18,052	20,486	2,343
3 or more BR	6,770	11,835	10,825	1,530	3 or more BR	6,974	11,841	10,613	1,451

Exhibit 1

Example of CHAS Housing Affordability Analysis and the Effect of the Rounding Scheme (2 of 2)

State Summary Level

Income Range	Affordability Threshold: Less than or equal to 30 percent	30.1 through 50 percent	50.1 through 80 percent	Greater than 80 percent
> 95% HAMFI				
0 or 1 BR	5,385	27,090	52,230	16,805
2 BR	12,150	47,585	84,650	19,820
3 or more BR	23,165	35,990	45,180	12,185
Total	287,925	509,095	479,805	94,015
Percent	21	37	35	7

Computed Total	1,370,840
Provided Total	1,370,835
Difference	5

Tract Summary Level

Income Range	Affordability Threshold: Less than or equal to 30 percent	30.1 through 50 percent	50.1 through 80 percent	Greater than 80 percent
> 95% HAMFI				
0 or 1 BR	5,360	27,040	52,214	16,684
2 BR	12,217	47,507	84,640	19,561
3 or more BR	22,931	35,879	45,113	12,095
Total	288,190	508,498	477,851	92,562
Percent	21	37	35	7

Computed Total	1,367,101
Provided Total	1,370,711
Difference	– 3,610

BR = bedroom.

CHAS = Comprehensive Housing Affordability Strategy.

HAMFI = HUD area median family income.

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Reference

Federal Register. 2004. "Department of Housing and Urban Development. 24 CFR Part 92, HOME Investment Partnerships Program; Amendments to Homeownership Affordability Requirements; Interim Rule." November 22. Vol. 69, no. 224: 68050–68052.