Public Service Expenditures as Compensating Differentials in U.S. Metropolitan Areas: Housing Values and Rents[1]

Robyn K. Welch
Burgis Associates, Inc.

John I. Carruthers[2]
U.S. Department of Housing and Urban Development
University of Washington

Brigitte S. Waldorf
Purdue University

This article reflects the views of the authors and does not necessarily reflect the views of the authors' respective institutions.

Abstract

The research presented in this article is motivated by four questions: Do public service expenditures help explain interregional variation in the cost of housing? What types of spending make the most difference? How does the effect of these expenditures on housing values compare to their effect on rents? Finally, do these effects change over time? These questions are investigated through an econometric analysis of housing values and rents in a national data set of metropolitan counties. A two-equation model is estimated using seemingly unrelated regression to enable contemporaneous correlation across the error terms. The initial model, containing per household total direct spending, is used to develop coefficients that are restricted in subsequent models so that alternative service expenditures and different time lags can be tested while holding all else constant. The findings suggest that police protection makes the most difference for owners and renters alike, with education and fire protection, respectively, being close seconds. Homeowners place greater weight on expenditures that affect exchange value, while renters place greater weight on factors that affect use value; and certain services have a more enduring effect than others. This article adds to the existing body of knowledge by linking a broad spectrum of public goods and services to the place-to-place cost of

Abstract (continued)

housing. Future research should focus on the connections between intermediate and final outputs from an interregional perspective and, as an extension, how they relate to the pace of economic growth and other measures of regional well-being.

Introduction

A great deal of research in the field of urban and regional economics focuses on *intraregional* variation in housing values and rents. Most of these studies draw on hedonic price models to examine the marginal influence of various structural characteristics, neighborhood attributes, proximity to the central business district and/or metropolitan subcenters, and the capitalization of nonmarket goods, including public services and environmental amenities, on housing costs. Meanwhile, comparatively less research has been done on *interregional* variation in housing values and rents—especially regarding public services. Although extensive empirical evidence shows that natural amenities have a substantive influence on migration flows and that compensating differentials account for interregional housing price and wage differences, very little is known about the specific role of public service expenditures. The issue, which was first examined more than a decade ago, is an important one because, unlike a particular region's inherent endowment of natural amenities, public service expenditures may be directly influenced by public policy (Gyourko and Tracy, 1989, 1991). Does public spending matter from an interregional perspective? Which types of expenditures make the most difference? How does the effect of these expenditures on housing values compare to their effect on rents? Finally, do these effects change over time?

This article investigates these questions through an econometric analysis involving a national data set of metropolitan counties. Following the introduction, the article is organized into three main sections. First, the background discussion explains how and why public services are capitalized into housing values and briefly reviews previous research on migration, household welfare, and compensating differentials. Second, the empirical analysis constructs a series of econometric models for examining how different types of public services affect interregional variation in median housing values and rents. In the first step, a two-equation system is estimated using seemingly unrelated regression (SUR) to enable contemporaneous correlation across the error terms. The initial model, containing per household total direct spending, is used to develop coefficients that are restricted in subsequent models so that alternative service expenditures and different time lags can be tested while holding all else constant. This research design enables observation of how 11 individual measures of public spending—capital facilities, education, fire protection, housing and community development, libraries, natural resources, parks, police protection, roadways, sewerage, and trash collection—affect the cost of housing at the county level and provides evidence of how their influence changes over time. Finally, the results of the analysis are used to derive a set of policy-relevant conclusions and directions for future research.

Background

The Capitalization of Public Services

The meaning of capitalization in the context of public services is straightforward: the value of a given property is defined as the fully discounted stream of future benefits and costs that are expected to accrue to the owner or user, including *nontraded* amenities and disamenities. Nontraded amenities are those that are not produced, sold, purchased, or consumed in the traditional sense but, instead, are attached to a commodity (such as a house) that is. For example, it is well known that, other things being equal, buyers and renters alike expect to pay a premium for housing located in high-quality school districts. A casual reading of the real estate section of nearly any local newspaper bears this out, with owners commonly advertising such benefits as a partial justification for the asking sales price or rent. It should be clear, however, that an individual acting on their own has little or no control over the quality of local school districts and other public services that may affect the value of his or her property. In this sense, such benefits are attached to the actual commodity being traded—the house—due to its location; therefore, the benefits end up being reflected in the sales price or rental amount of the house without being purchased directly.

Location is particularly important to the process of capitalization because of spatial variation in the availability of various attributes. In the case of natural features, such as views or microclimates, quality is affected by topography, the character of the surrounding built environment, and numerous other factors. Likewise, benefits related to public services vary across space, usually as a result of differences in offerings among jurisdictions. What emerges is an underlying price landscape that reflects how housing values and rents differ from place to place based on the level of utility (disutility) people receive from location-specific, nontraded amenities (disamenities), some of which are controlled by local governments. In other words, within real estate markets a relative value exists above and beyond the value of the property itself, a significant part of which is attributable to public service expenditures.

The primary point of departure for understanding how capitalization works is Tiebout's (1956) well-known public choice theory, which equates people's locational decisions within large, politically fragmented metropolitan areas to a shopping trip, in which the people select among numerous jurisdictions that offer different combinations of public services. In this way, people *vote with their feet*, maximizing their utility subject to a budgetary constraint, by locating in communities that offer the best combination of benefits for the lowest possible price. Here, the price involved is the cost of purchasing a home or paying rent and, for homebuyers, the ongoing cost of paying property tax. Property taxes are negatively capitalized because they raise the cost of holding a house over time and, in doing so, lower the amount that people, including landlords, are willing to pay for it (Rothenberg et al., 1989). In this way, the property tax represents a key component of the stream of anticipated costs associated with the ownership of homes and/or rental properties. Nevertheless, if a public service is efficiently provided, its benefits and costs should roughly offset one another via capitalization. This prospect was born out by Oates (1969) in one of the earliest—and, to this day, one of the most powerful—tests of the Tiebout Hypothesis, which illustrates that per capita spending on public schools raises housing values even as the property tax lowers them.

More recently, researchers have refined the theory of capitalization by examining the specific role it plays in local public finance and by developing further and more detailed empirical evidence that capitalization takes place. In particular, capitalization has been shown to arise as a result of movers bidding up the price of housing with desirable attributes; given that all households may eventually move, existing households' preferences for tax-service combinations are identical in longrun equilibrium (Yinger, 1982). Meanwhile, the median voter rule ensures that homeowners, who represent the most politically active bloc of residents (DiPasquale and Glaeser, 1999), exert pressure on their local governments in an effort to secure the value of their assets (Fischel, 2001). So, at any given time, a homeowner's ideal level of public spending reflects a combination of his or her own preferences and those of prospective buyers (Brueckner and Joo, 1991). In short, by voting, people work to ensure that their communities provide public services in a way that maximizes the exchange value of their homes.[3]

Using hedonic price models is by far the most common method of measuring the effects of capitalization on the exchange value of housing within regions. For example, using variations of this general framework, numerous recent studies illustrate that the quality of public school systems has a significant effect on residential property values: Haurin and Brasington (1996) find that housing sales prices increase 0.5 percent per every 1-percent increase in the pass rate of ninth grade proficiency exams; Bogart and Cromwell (1997, 2000) find significant variation in housing values, ranging between $186 and $2,171, depending on school quality, and that disruption, as a result of redistricting, lowers home sales prices by nearly 10 percent; and Downes and Zabel (2002) find that homeowners are more concerned with schools' final outputs, such as test scores, than with intermediate output, such as spending. Further, within regions, the capitalization of school quality is stronger in smaller communities, because the costs and benefits are spread over fewer people (Brasington, 2001; Hoyt, 1999), and in communities that are closer to the central business district, where the supply of housing is relatively inelastic (Brasington, 2002). These and other studies illustrate that the capitalization of public services has a measurable impact on real estate markets within regions but, from a wider view, the question remains: How do service expenditures affect interregional variation in housing values and rents?

Household Welfare and Compensating Differentials

Just as amenities are positively capitalized into property markets at the intraregional scale, they positively affect household welfare at the interregional scale. An observable outcome of this influence is that, other things being equal, people are willing to pay more for housing and accept lower wages to live in attractive places; conversely, people pay less for housing and demand higher wages in areas offering a comparatively lower quality of life (Mulligan, Carruthers, and Cahill, 2004). This behavior is owed to *compensating differentials*, factors that enhance the utility people receive from living in a given area and, therefore, raise the level of costs they are willing to incur and wages they are willing to forgo to stay there. Just like housing, places are a package deal, composed of different combinations of desirable and undesirable characteristics, all of which affect the cost of living in them. In the same way that cities exhibit an underlying value landscape attributable to location-specific amenities, so, too, do wider geographical areas, all the way up to the national and, possibly, international levels.

Porell (1982) and Graves (1983) advanced early empirical evidence of the value of location-specific amenities in analyses demonstrating that quality-of-life factors have a significant influence on interregional migration flows. These and subsequent studies suggest that the effect of location-specific amenities is so strong that migration models specified without them may suffer from omitted variable bias (Knaap and Graves, 1989; Clark and Cosgrove, 1991; Clark and Hunter, 1992). Recent research has born this prospect out, revealing, for example, that improvements in air quality positively affect population growth (Kahn, 2000); recreational opportunities have a significant effect on people's locational choice (Deller at al., 2001; Colwell, Dehring, and Turnball, 2002; Florida, 2002); places with warm, dry climates attract disproportionate shares of population growth (Glaeser and Shapiro, 2003); and incomplete compensation may be responsible for in-migration to high-amenity regions (Clark et al., 2003). Just as people choose environmentally attractive locations, they move away from locations in which the quality of life has deteriorated. Factors that contribute to this include rapid population growth, underinvestment in infrastructure, traffic congestion, and air pollution (Gabriel, Mattey, and Wascher, In press).

In addition to influencing where people choose to live, quality-of-life factors measurably affect wages and housing prices. In a groundbreaking theoretical and empirical analysis, Roback (1982) finds that disamenities, including crime, heat, snow, and poor weather, raise wages and, to some extent, lower rents. Likewise, Henderson (1982) finds that amenities (disamenities) are negatively (positively) capitalized into wages, an effect that is robust across three alternative measures of the dependent variable and among different occupations. Each of these findings is consistent with the theory that compensating differentials mediate the place-to-place cost of living. Further research has reinforced this theory, illustrating that (1) climatic, urban, and environmental characteristics all affect wages and rents (Hoehn, Berger, and Blomquist, 1987; Blomquist, Berger, and Hoehn, 1988; Clark and Kahn, 1989); (2) the effects are consistent for commercial, residential, and mixed-use communities (Voith, 1991); and (3) people exhibit a measurable willingness to pay to live in areas with mild climates (Cragg and Kahn, 1997, 1999). Together, these and other related studies demonstrate that, in addition to influencing where people choose to live, natural amenities act as compensating differentials by shaping the financial tradeoffs people face in their decisionmaking processes.

Finally, through an extension of Roback's (1982) quality-of-life framework, public services have also been revealed to act as compensating differentials. More specifically, in a pair of articles, Gyourko and Tracy (1989, 1991) find that differences in locally produced amenities, including police, health, and fire services, positively influence rents and negatively influence wages; the cost of paying for amenities (via various taxes) has an offsetting effect by lowering people's willingness to pay for housing and causing them to demand higher wages; and each of these factors contributes directly to an interregional quality-of-life ranking. Overall, the evidence suggests that fiscal conditions—which are directly influenced by public policy—have almost as large of an effect as natural amenities. Nevertheless, the role of public spending patterns as compensating differentials has not been directly addressed since Gyourko and Tracy first called attention to it more than a decade ago.

This lack of attention is a significant shortcoming, given the strength of public services' influence. For example, drawing on a national data set of metropolitan counties (described in the following

section), exhibits 1a and 1b illustrate that per household total direct spending by itself may account for as much as 13 percent of the interregional variation in both housing values and rents. Although this and previous evidence signal that public spending matters from an interregional perspective, what types of expenditures make the most difference, how their individual effects differ between ownership and rental markets, and whether their influence changes over time remain unknown. These questions are explored in the following empirical analysis.

Exhibit 1a

Relationship Between Median Housing Value and per Household Total Direct Spending

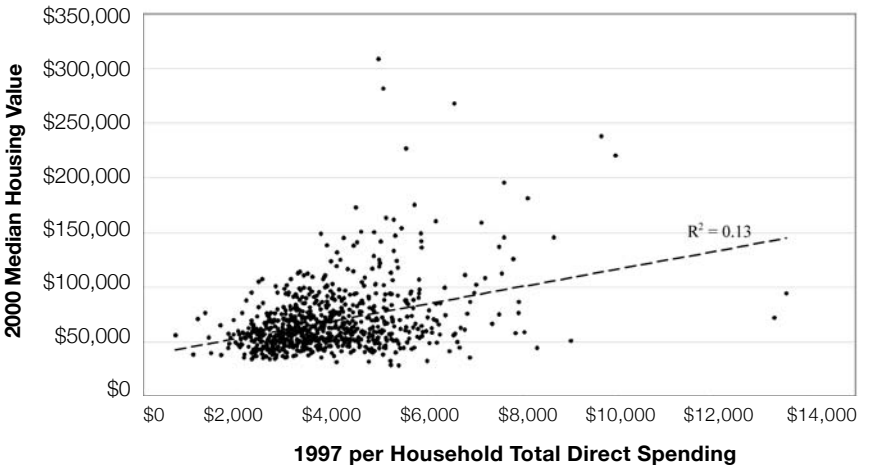
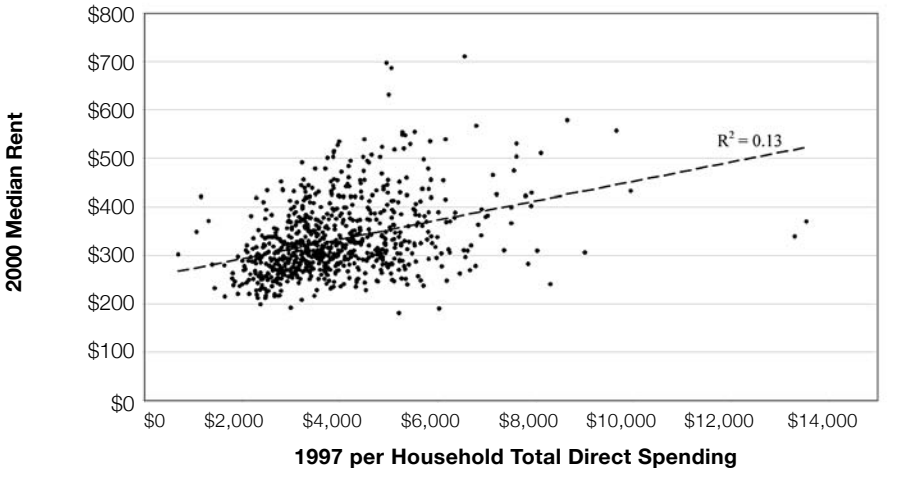


Exhibit 1b

Relationship Between Median Rent and per Household Total Direct Spending



Empirical Analysis

Econometric Framework

Whereas most (although not all) of the research reviewed in the preceding section focuses on individuals or households, the present analysis is concerned with aggregate measures of housing values: metropolitan counties are the unit of analysis, and the dependent variables are 2000 median housing value[4] and 2000 median rent. To enable correlation between the ownership and rental markets, the empirical model is specified as a pair of SUR equations (Zellner, 1962), where the dependent variables are functions of a set of appropriate explanatory variables, including public service expenditures. Ozanne and Thibodeau (1983), Izraeli (1987), and Potepan (1996) applied similar data and analytical frameworks to examine the sources of variation in metropolitan housing values during the 1970s and 1980s, but none of these studies deals specifically with the influence of public services.

The core hypothesis of the analysis is this: public spending is expected to positively influence both dependent variables by contributing to metropolitan areas' quality of life and, therefore, the relative costs people are willing to incur to live in those areas.[5] The process of testing this proposition first for aggregate and then for specific types of public spending involves four steps.

In the first step, a system of two regression equations is specified in which 2000 median housing value, **H**, and rent, **R**, are functions of 1997 per household total direct spending on public services, **P**, and a set of additional exogenous variables, **X**:

$$\begin{aligned} \ln \mathbf{H} &= \mathbf{X}\boldsymbol{\alpha} + \alpha_1 \mathbf{P} + \boldsymbol{\varepsilon}, \\ \ln \mathbf{R} &= \mathbf{X}\boldsymbol{\beta} + \beta_1 \mathbf{P} + \boldsymbol{\upsilon}. \end{aligned} \tag{1}$$

In these equations, $\boldsymbol{\alpha}$, α_1, $\boldsymbol{\beta}$, and β_1 are estimable parameters and $\boldsymbol{\upsilon}$ and $\boldsymbol{\varepsilon} \sim N(0, \sigma)$ represent the stochastic error terms. The matrix **X** includes indicator variables for each of the 47 states involved in the analysis, plus Washington, D.C.; Texas is omitted to avoid perfect multicollinearity with the overall constants.[6]

Next, the second step disaggregates total direct spending into 11 individual types of spending. The identity

$$\mathbf{P} = \mathbf{P}_k + (\mathbf{P} - \mathbf{P}_k) \; \forall \, k = 1,...,13 \tag{2}$$

divides total direct spending into public expenditure of type k, $\mathbf{P}_k$, and all other public expenditures, $(\mathbf{P} - \mathbf{P}_k)$. In this way, each of the 11 measures of public spending—per household expenditure on capital facilities, education, fire protection, housing and community development, libraries, natural resources, parks, police protection, roadways, sewerage, and trash collection—can be isolated and tested individually. Exhibit 2 provides a description of the measures, as defined by the Census Bureau survey form used to collect the data.

Exhibit 2

Description of Public Expenditure Variables

Variable	Variable Description
Total direct expenditures	Sum of direct expenditures, including salaries and wages
Capital facilities	Sum of capital outlays, including construction, equipment, land, and structures
Education	Expenditures on local schools
Fire protection	Expenditures incurred for fire fighting and fire prevention, including contributions to volunteer fire units
Housing and community development	Expenditures on urban renewal, slum clearance, and housing projects
Libraries	Expenditures on municipal and nongovernmental libraries
Natural resources	Flood control and soil and water conservation, drainage, irrigation, forestry and forest fire protection, agricultural fairs, and any other activities for the promotion of agriculture and conservation of natural resources
Parks	Expenditures on parks and recreation, including playgrounds, golf courses, swimming pools, museums, marinas, community music, drama, celebrations, zoos, and other cultural activities
Police protection	Expenditures on municipal police agencies, including coroners, medical examiners, vehicular inspection activities, and traffic control and safety activities
Roadways	Expenditures for construction and maintenance of municipal streets sidewalks, bridges and toll facilities, street lighting, snow removal, and highway engineering, control, and safety
Sewerage	Expenditures for construction, maintenance, and operation of sanitary and storm sewer systems and sewage disposal plants
Trash collection	Expenditures on street cleaning and the collection and disposal of garbage

Source: Census of Governments, form F-21 (2000) 2000 Annual Survey of Local Government Finances

In the third step of the analysis, a set of additional equations is specified:

$$\ln \mathbf{H} = \mathbf{X}\hat{\boldsymbol{\alpha}} + \lambda_k \mathbf{P}_k + \pi_k(\mathbf{P} - \mathbf{P}_k) + \boldsymbol{\varepsilon}, \forall k = 1,...,13$$
$$\ln \mathbf{R} = \mathbf{X}\hat{\boldsymbol{\beta}} + \omega_k \mathbf{P}_k + \psi_k(\mathbf{P} - \mathbf{P}_k) + \boldsymbol{\varepsilon}, \forall k = 1,...,13 \quad (3)$$

where $\hat{\boldsymbol{\alpha}}$ and $\hat{\boldsymbol{\beta}}$ denote the estimated parameters of the model shown in (1). Model (3) is estimated via ordinary least squares (OLS), yielding sets of estimates of λ_k and ω_k for the effects of public expenditure of type k on median housing values and rents, respectively. Note here that the estimation does not impose the restrictions $\lambda_k + \pi_k = \alpha_1$ and $\omega_k + \psi_k = \beta_1$. Instead, to check for consistency in the estimations, the sum of the elasticities for $\mathbf{P}_k$ and $(\mathbf{P} - \mathbf{P}_k)$ is later compared to the elasticity of $\mathbf{P}$ derived from model (1).

Finally, in the fourth step, the model is reestimated using public service expenditure data from 1992, again using the already estimated parameters $\hat{\boldsymbol{\alpha}}$ and $\hat{\boldsymbol{\beta}}$.[7] To be clear, the series of steps just

described enables each individual service expenditure to be examined; simply including all of them at once results in severe multicollinearity and yields unintelligible results.

Relevant variables were collected for all 777 metropolitan counties (1999 definition) in the continental United States, plus Washington, D.C.[8] All counties involved in the analysis are shown in exhibits 3a through 3c, which illustrate the spatial distribution of 2000 median housing values, 2000 median rents, and 1997 per household total direct public service expenditures. For ease of

Exhibit 3a

Spatial Distribution of 2000 Median Housing Values

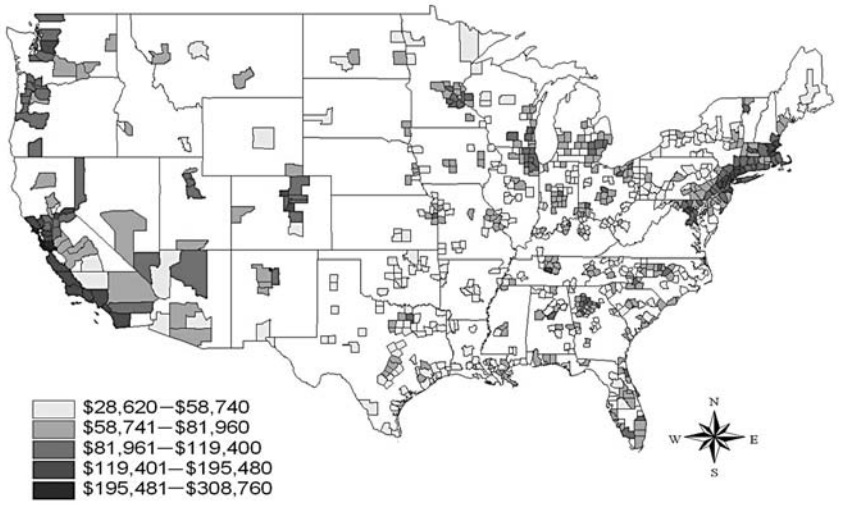


Exhibit 3b

Spatial Distribution of 2000 Median Rents

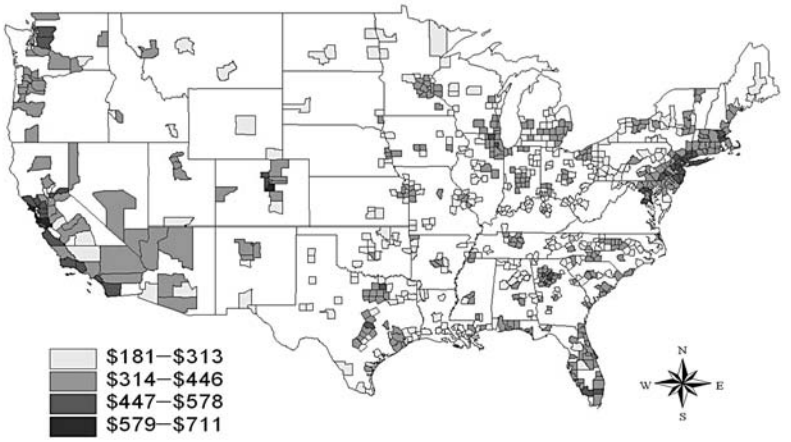
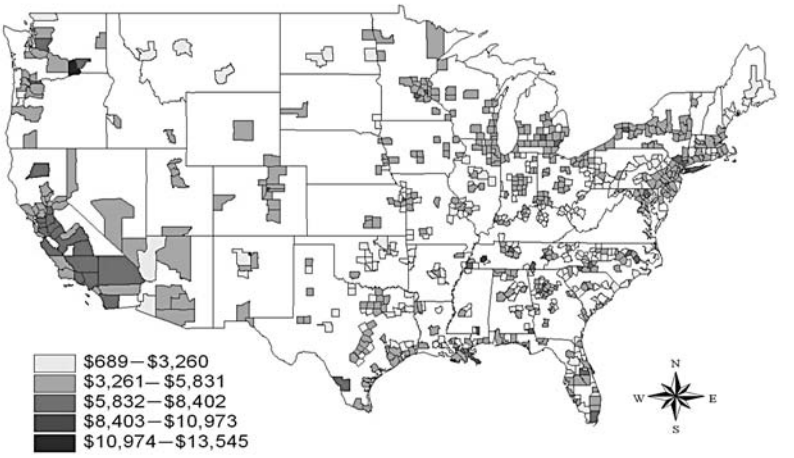


Exhibit 3c

Spatial Distribution of 1997 per Household Total Direct Expenditures



exposition, the individual explanatory variables that comprise **X** are organized into four groupings: *Housing Market Characteristics*, *Demographic Characteristics*, *Economic Characteristics*, and *Political Structure and Fiscal Characteristics*. Exhibit 4 provides the definition and sources of all variables and exhibit 5 provides descriptive statistics for each variable.

It is worth pointing out at this juncture that, between 1990 and 2000, median rent increased nationally by just 0.6 percent per year, but the average annual increase in median housing value was more than twice as high, amounting to 1.3 percent per year.[9] Between 1992 and 1997, total direct expenditures rose by 1.2 percent per year but, as shown in exhibit 6, this increase was not equally distributed across all types of public spending. In particular, with an average annual growth rate of 1.9 percent during the 5-year period from 1992 to 1997, per household spending on education increased significantly, while spending on most other services remained about constant. Further, education spending is by far the most important public expenditure; it accounts for more than 40 percent of total direct expenditures and is more than twice as large as the next largest form of spending, capital facilities.

Exhibit 4

Variable Definitions and Sources

Variable	Definition	Source
Housing Market Characteristics		
Median Rent	Median county rent	United States Census, 2000
Median Housing Value	Median county housing value	United States Census, 2000
Median Number of Rooms	Median number of rooms in houses	United States Census, 2000
% Housing Built Before 1939	Proportion of housing that was built prior to 1939	United States Census, 2000
% Owner Occupied	Proportion of housing that is owner occupied	United States Census, 2000
% Single-Family Housing	Proportion of single-family housing	United States Census, 2000
% Vacant	Proportion of unoccupied housing	United States Census, 2000
Demographic Characteristics		
Population	County population	United States Census, 2000
Population Change	Population change, 1990–2000	United States Census, 1990 and 2000
Per Capita Income	Income divided by population	Regional Economic Information System 1997
% Population >18 Years Old	Proportion of population that is younger than 18 years	United States Census, 2000
% African American	Proportion of population that is African American	United States Census, 2000
Economic Characteristics		
Cost of Living Index	Relative cost of living	*Places Rated Almanac, 1997*
Construction Cost Index	Relative cost of construction	*RS means Building Construction Cost Data: 58th Annual Edition*
Natural Amenity Index	Natural amenity score	Economic Research Service, 1993
Political Structure and Fiscal Characteristics		
Suburban Indicator	1 if yes, 0 if no	n/a
Per Capita Municipalities	Number of municipal governments divided by population (1,000s)	United States Census, 1990 and 2000; Census of Governments, 1992 and1997
Property Tax Burden	Per household property tax divided by median housing value	United States Census, 1990 and 2000; Natural Resources Inventory; Census of Governments, 1997
Per Household Total Direct Expenditures[a]	Expenditure divided by estimated number of households	United States Census, 1990 and 2000; Census of Governments, 1992 and1997

[a] *Includes all 11 other measures of public spending.*
n/a = nonapplicable.

Exhibit 5

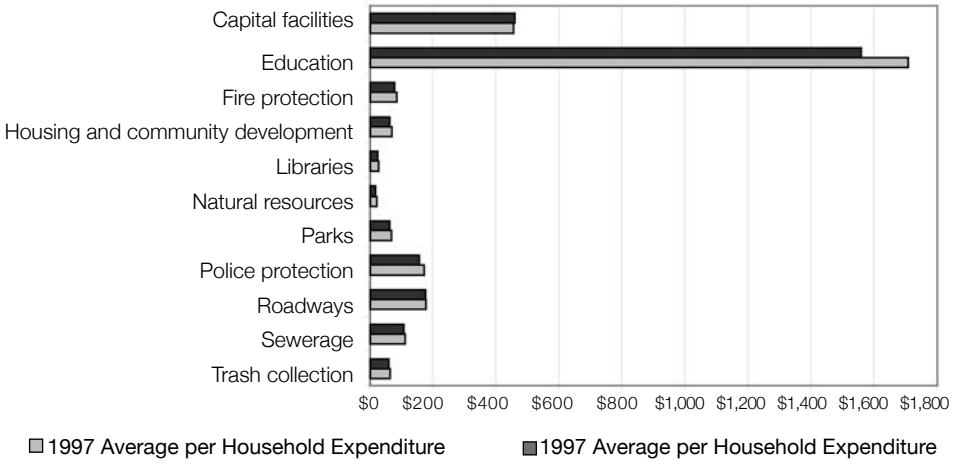
Descriptive Statistics

Variable	Mean	Median	Standard Deviation
Housing Market Characteristics			
Median Rent, 2000	$331.71	$316.20	$114.00
Median Housing Value, 2000	$68,527	$60,180	$60,178
Median Number of Rooms	5.53	5.50	0.38
% Housing Built Before 1939	14.01 %	9.90 %	5.89 %
% Owner Occupied	65.35 %	65.98 %	7.51 %
% Single-Family Housing	66.44 %	67.50 %	9.48 %
% Vacant	8.27 %	7.04 %	5.23 %
Demographic Characteristics			
Population	279,817	126,638	1,220,419
Population Change	1.05	1.04	0.06
Economic Characteristics			
Per Capita Income	14,854.37	14,273.55	3,980.54
% Population >18 Years Old	25.85 %	25.83 %	3.11 %
% African American	9.49 %	5.01 %	12.17 %
Cost of Living Index	50.36	51.35	31.60
Construction Cost Index	92.36	91.50	15.82
Natural Amenity Index	0.33	– 0.01	3.51
Political Structure and Fiscal Characteristics			
Suburb Indicator	0.48	0.00	0.46
Per Capita Municipalities	0.0921	0.0630	0.0624
Property Tax Burden	1.55 %	1.42 %	0.36 %
Per Household Total Direct Expenditures, 1997/1992	$3,930/$3,709	$3,694/$3,471	$1,722/$1,793
Per Household Spending on Capital Facilities, 1997/1992	$455/$459	$415/$362	$246/$309
Per Household Spending on Education, 1997/1992	$1,707/$1,559	$1,630/$1,499	$447/$557
Per Household Spending on Fire Protection, 1997/1992	$84/$78	$77/$73	$59/$58
Per Household Spending on Housing and Community Development, 1997/1992	$70/$63	$51/$44	$98/$97
Per Household Spending on Libraries, 1997/1992	$27/$24	$23/$20	$21/$17
Per Household Spending on Natural Resources, 1997/1992	$21/$18	$6/$5	$73/$51
Per Household Spending on Parks, 1997/1992	$67/$62	$49/$48	$76/$61
Per Household Spending on Police Protection, 1997/1992	$172/$157	$154/$142	$90/$85
Per Household Spending on Roadways, 1997/1992	$177/$176	$155/$157	$69/$65
Per Household Spending on Sewerage, 1997/1992	$111/$107	$95/$89	$88/$108
Per Household Spending on Trash Collection, 1997/1992	$63/$59	$53/$48	$46/$41

Note: All dollar values adjusted to 1982 constant dollars.

Exhibit 6

1997 and 1992 Average per Household Expenditures



Estimation Results

The results of the first step of the empirical analysis are presented in exhibit 7.[10] Nearly all the variables are statistically significant and, where the direction of influence was anticipated in advance (denoted by the one-tailed hypothesis tests), each coefficient carries its expected sign. Moreover, the adjusted R^2 values of 0.88 and 0.84 show that the model does very well at explaining variation in the two dependent variables. Because the models were estimated in semilog form, elasticities were calculated to enable easier interpretation of the coefficients.[11] Working down through the four groupings of explanatory variables, the following paragraphs elaborate on the estimation results.

The *Housing Market Characteristics* reveal that housing with more rooms is associated with higher values and rents; it costs less to live in areas with high proportions of old housing stock; the percentage of owner-occupied housing negatively affects housing values and rents; that the percentage of single-family housing negatively affects housing values but positively affects rents; and higher vacancy rates lead to lower values. All variables are statistically significant and, except where the direction of influence was not anticipated in advance, each carries its expected sign.

The most interesting results here come from the two two-tailed hypothesis tests. First, the percentage of owner-occupied housing is negative and strongly significant in both the ownership and rental markets. At first glance, this sign pattern is counterintuitive because areas dominated by owner-occupied housing are generally more expensive to live in—a condition that is often enforced by exclusionary land use controls (Ulfarsson and Carruthers, 2006). Bearing in mind, however, that the model also controls for tax burden and public spending, both of which are closely linked to local land use regulation, the result is logical: housing values and rents are lower in areas with high proportions of owner-occupied housing after factoring in the costs and benefits of residing in them. Second, the alternating sign pattern on the percentage of single-family housing suggests that

Exhibit 7

SUR Estimates of Median Housing Value and Rent[a]

Variable	2000 Median Housing Value			2000 Median Rent		
	α	η	*t–statistic*	β	η	*t–statistic*
Intercept	9.30E+00 †††	n/a	56.90	4.62E+00 †††	n/a	39.98
Housing Market Characteristics						
Median Number of Rooms	1.38E-01 ***	0.763	6.42	1.45E-01 ***	0.801	9.52
% Housing Built Before 1939	– 4.15E-03 ***	– 0.058	– 5.44	– 4.83E-03 ***	– 0.068	– 8.94
% Owner Occupied	– 2.60E-01 †††	– 0.170	– 2.33	– 7.17E-01 †††	– 0.468	– 9.06
% Single-Family Housing	– 1.29E-03 †	– 0.086	– 1.66	1.01E-03 ††	0.067	1.85
% Vacant	– 4.12E-01 ***	– 0.034	– 3.42	– 4.50E-01 ***	– 0.037	– 5.29
Demographic Characteristics						
Population	1.70E-08 ***	0.005	1.95	5.32E-09 n/s	0.001	0.86
Population Change, 1990–2000	4.63E-01 ***	0.486	5.01	3.13E-01 ***	0.329	4.79
Per Capita Income, 1997	4.30E-05 ***	0.639	20.23	2.06E-05	0.306	13.66
% Population >18 Years Old	– 4.57E-01 ***	– 0.118	– 1.92	8.27E-02 n/s	0.021	0.49
% African American	– 3.01E-01 ***	– 0.029	– 5.20	– 1.14E-01 ***	– 0.011	– 2.78
Economic Characteristics						
Cost of Living Index, 1997	2.94E-03 ***	0.148	9.98	2.10E-03 ***	0.104	10.05
Construction Cost Index	6.53E-03 ***	0.603	6.35	4.62E-03 ***	0.427	6.35
Natural Amenity Index	2.19E-02 ***	0.007	5.31	1.30E-02 ***	0.004	4.44
Political Characteristics and Fiscal Characteristics						
Per Capita Municipalities, 1997	6.83E-02 n/s	0.006	1.12	– 1.74E-01 ***	– 0.016	– 4.02
Suburb Indicator	1.08E-02 n/s	n/a	0.88	3.75E-03 n/s	n/a	0.43
Property Tax Burden, 1997	– 1.07E+01 ***	– 0.166	– 10.58	– 1.47E+00 ***	0.015	– 2.05
Per Household Total Direct Expenditures, 1997	8.70E-06 ***	0.034	1.80	6.28E-07 n/s	0.002	0.18
Adjusted R^2			0. 88			0.84
n			777			777

SUR = seemingly unrelated regression.
[a] All fixed effects have been suppressed in order to conserve space.
**One-tailed test, statistically significant at p < .10.*
***One-tailed test, statistically significant at p < .05.*
****One-tailed test, statistically significant at p < .01.*
† Two-tailed test, statistically significant at p < .10.
†† Two-tailed test, statistically significant at p < .05.
††† Two-tailed test, statistically significant at p < .01.
n/s Denotes not statistically significant.
n/a = Denotes not applicable.

it captures a density/congestion effect in the housing market but picks up a premium in the rental market. This explanation is plausible, given that low residential densities result from low land values, but fewer opportunities are available for renters to find housing in such areas, leading to higher housing values via competition over scarce units.

The results for the *Demographic Characteristics* group show that more populous metropolitan areas have higher housing values (rents are unaffected); rapid growth and high per capita income lead to increased values in both the ownership and rental markets; areas with large proportions of families with children, measured as the percentage of people less than 18 years of age, have more affordable owner-occupied housing (rental housing is unaffected); and areas with high proportions of African-American residents have lower housing values and rents. Each of these findings is consistent with expectations, except for the two insignificant coefficients in the rental market. It may be, however, that larger metropolitan areas have greater amounts of rental housing, so that population does not have a meaningful effect on the rental market and that, because renters generally have fewer options than homeowners, the market is insensitive to family structure.

In the *Economic Characteristics* group, the cost of living index, construction cost index, and natural amenity index are all positive and highly significant in the two equations, illustrating the important role that these factors play in contributing to place-to-place variation in the cost of living.

Finally, in the *Political Structure and Fiscal Characteristics* group, municipal fragmentation, measured as the per capita number of municipalities, has no effect on housing values but negatively affects rents; the suburban county indicator variable is insignificant in both the ownership and rental markets; property tax burden lowers the value of housing; and public spending, measured in this first step as per household total direct expenditures, positively affects the ownership market but does not affect the rental market. It is a bit puzzling that the coefficient on municipal fragmentation is insignificant in the ownership and negative in the rent equation given that other research has shown it to raise property values (Carruthers and Ulfarsson, 2002). It may be, though, that fragmentation offers renters more choice, even as selection and exclusivity offset each other in the ownership market. The finding that public expenditures (on the whole) are capitalized into the ownership market but not the rental market is consistent with expectations: homeowners, by far, bear most of the costs and enjoy the financial benefits of service provision while renters, by and large, do not. The elasticities for the property tax variable, which show that the effect is *10 times* (0.166 *versus* 0.015) as large in the ownership market, bear out this explanation.

The Influence of Individual Public Service Expenditures

As an overarching finding, the positive effect of total direct expenditures in the homeownership market lends good support to the hypothesis that public services account for a significant proportion of interregional variation in housing values. So far, no evidence indicates that the same is true for rents. Even so, certain types of spending are viewed as more beneficial than others, causing their influence to vary by type through the two markets and necessitating the need to isolate their individual effects. This step is achieved via the remaining three steps of the modeling framework, the results of which are summarized in exhibit 8 and shown graphically in exhibits 9a, 9b, 10a, and 10b. Specifically, exhibit 8 shows elasticities calculated from OLS estimates of the parameters λ_k and ω_k in model (3) and their associated *t*-statistics, and exhibits 9a through 10b map out the statistically significant elasticities for easy visual comparison.[12] Together, the table and graphics in the exhibits respond directly to the three remaining research questions: What types of spending make the most difference? How does the effect of expenditures on housing values compare to their effect on rents? Do these effects change over time?

Exhibit 8

Elasticities for Individual Public Expenditures[a]

	2000 Median Housing Value				2000 Median Rent			
	1997 Spending		1992 Spending		1997 Spending		1992 Spending	
	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*
Capital Facilities								
Per Household Expenditure	0.028 ***	3.32	0.006 ***	1.89	0.017 ***	2.95	0.002 n/s	0.66
Per Household Expenditure on Other Services	0.007 n/s	0.80	0.028 ***	5.98	– 0.015 ***	– 2.44	0.000 n/s	– 0.12
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Education								
Per Household Expenditure	0.025 ***	3.13	0.028 ***	3.80	0.002 n/s	0.41	0.001 n/s	0.17
Per Household Expenditure on Other Services	0.010 *	1.38	0.008 n/s	1.17	0.000 n/s	– 0.07	0.000 n/s	0.06
Sum of Elasticities	0.036	n/a	0.036	n/a	0.002	n/a	0.001	n/a
Fire Protection								
Per Household Expenditure	0.007 n/s	1.01	0.001 n/s	0.20	0.011 ***	2.10	0.009 **	1.80
Per Household Expenditure on Other Services	0.027 ***	3.35	0.033 ***	4.10	– 0.009 *	– 1.54	– 0.008 *	– 1.39
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Housing and Community Development								
Per Household Expenditure	0.008 ***	1.95	0.004 n/s	0.92	0.003 n/s	1.01	0.001 n/s	0.44
Per Household Expenditure on Other Services	0.026 ***	4.41	0.030 ***	5.48	– 0.001 n/s	– 0.32	0.000 n/s	– 0.04
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Libraries								
Per Household Expenditure	0.007 *	1.39	0.010 ***	2.15	0.006 *	1.54	0.005 *	1.46
Per Household Expenditure on Other Services	0.027 ***	4.29	0.024 ***	4.06	– 0.004 n/s	– 0.83	– 0.004 n/s	– 0.86
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Natural Resources								
Per Household Expenditure	0.000 n/s	– 0.28	0.000 n/s	0.31	– 0.002 *	– 1.54	0.000 n/s	– 0.02
Per Household Expenditure on Other Services	0.035 ***	8.51	0.034 ***	8.42	0.003 n/s	1.19	0.001 n/s	0.41
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a

[a] *Derived from seemingly unrelated regression parameter estimates.*

* *One-tailed test, statistically significant at $p < .10$.*

** *One-tailed test, statistically significant at $p < .05$.*

*** *One-tailed test, statistically significant at $p < .01$.*

n/s *Denotes not statistically significant.*

Exhibit 8

Elasticities for Individual Public Expenditures[a] (continued)

	2000 Median Housing Value				2000 Median Rent			
	1997 Spending		1992 Spending		1997 Spending		1992 Spending	
	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*
Parks								
Per Household Expenditure	0.008 **	1.66	0.004 n/s	0.82	0.006 *	1.57	0.005 *	1.55
Per Household Expenditure on Other Services	0.026 ***	4.01	0.030 ***	4.76	– 0.004 n/s	– 0.87	– 0.004 n/s	– 0.99
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Police Protection								
Per Household Expenditure	0.034 ***	3.38	0.027 ***	2.86	0.018 ***	2.52	0.020 ***	2.91
Per Household Expenditure on Other Services	0.000 n/s	0.03	0.007 n/s	0.68	– 0.016 ***	– 2.13	– 0.018 ***	– 2.56
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Roadways								
Per Household Expenditure	0.012 **	1.63	0.009	1.37	0.005 n/s	0.98	0.004 n/s	0.82
Per Household Expenditure on Other Services	0.023 ***	2.93	0.025 ***	3.49	– 0.003 n/s	– 0.53	– 0.003 n/s	– 0.49
Sum of Elasticities	0.035	n/a	0.035	n/a	0.002	n/a	0.001	n/a
Sewerage								
Per Household Expenditure	0.010 **	1.68	0.010 ***	1.94	0.011 ***	2.60	0.004 n/s	1.10
Per Household Expenditure on Other Services	0.024 ***	3.41	0.024 ***	3.77	– 0.009 ***	– 1.84	– 0.003 n/s	– 0.64
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Trash Collection								
Per Household Expenditure	0.006 n/s	1.18	0.005 n/s	0.91	– 0.004 n/s	– 0.95	0.001 n/s	0.17
Per Household Expenditure on Other Services	0.028 ***	4.35	0.029 ***	4.75	0.005 n/s	1.17	0.001 n/s	0.12
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a

[a] *Derived from seemingly unrelated regression parameter estimates.*

** One-tailed test, statistically significant at $p < .10$.*

*** One-tailed test, statistically significant at $p < .05$.*

**** One-tailed test, statistically significant at $p < .01$.*

n/s Denotes not statistically significant.

Exhibit 9a

Influence of 1997 Expenditures on 2000 Median Housing Value

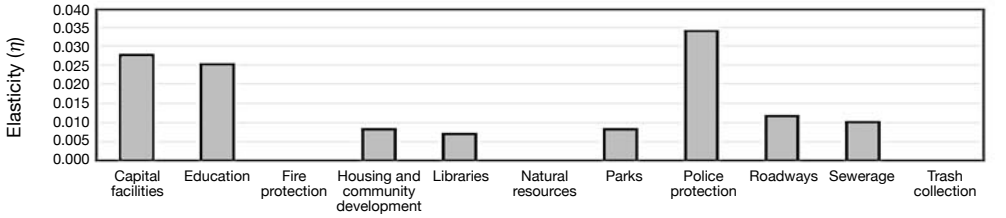


Exhibit 9b

Influence of 1992 Expenditures on 2000 Median Housing Value

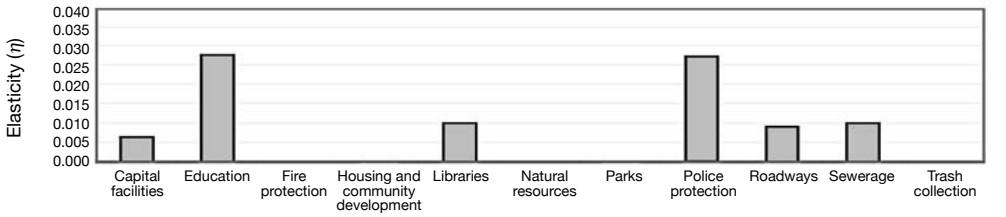


Exhibit 10a

Influence of 1997 Expenditures on 2000 Median Rent

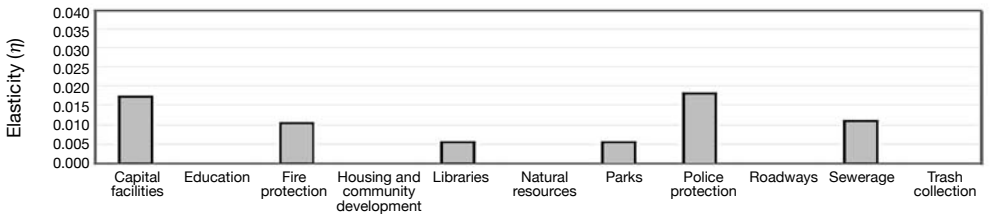
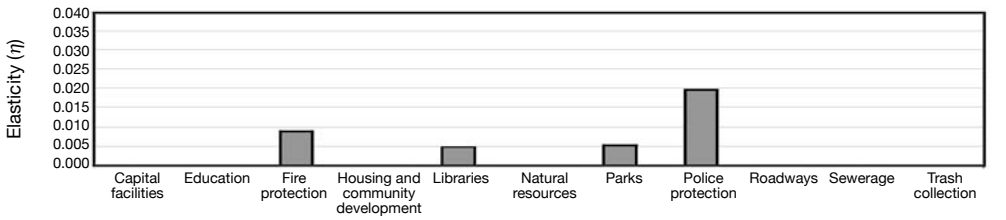


Exhibit 10b

Influence of 1992 Expenditures on 2000 Median Rent



Expenditures that make a difference in the homeownership market—that is, expenditures that are statistically significant—are capital facilities, education, housing and community development, libraries, parks, police protection, roadways, and trash collection. Each of these categories of spending positively contributes to a metropolitan area's median housing value. In the rental market, capital facilities, fire protection, libraries, parks, police protection, and sewerage make positive contributions. In terms of size, as measured by the elasticities for 1997 levels of spending, police protection (0.034), capital facilities (0.028), and education (0.025) by far make the most difference in the ownership market, followed by roadways (0.012) and sewerage (0.010). In the rental market, police protection (0.018) and capital facilities (0.017) also make the most difference, followed closely by fire protection (0.011) and sewerage (0.011).

Several important differences are apparent between the two markets. Spending on police protection and on capital facilities makes large contributions to both housing values and rents, but the effect of spending deviates from there. In particular, the salient differences suggest that the ownership market responds to factors affecting the exchange value of housing (such as education and roadways, which can enhance accessibility), while the rental market responds more to factors that affect the use value of housing (such as fire protection and parks). These differences are interesting because they speak to what residents get out of the different kinds of services. Although renters clearly benefit from the factors that affect the ownership market, they do not as often pay a premium for doing so because they are not directly invested. For example, homeowners benefit from high-quality schools whether they have children or not because buyers will pay more for their housing if they choose to sell, but renters gain nothing, unless family members make use of public education. Meanwhile, it is possible that homeowner's insurance insulates homeowners from concern over fire protection even as they rely heavily on police protection to maintain the safety of their neighborhoods and viability of their assets. A final important difference is the negative effect of natural resources in the rental market, but this seems likely to be a spurious correlation.

To illustrate how the effect of spending changes though time, exhibits 9b and 10b show elasticities derived by estimating model (4), with public service spending lagged by 8 years instead of 3. In the median housing value equation, the differences are that housing and community development and parks drop out of statistical significance. In the median rent equation, capital facilities and sewerage become insignificant. In both equations, the overall trend is downward through time, with most types of spending having a lesser effect, as measured by the elasticities. Important exceptions to this are education, libraries, and police protection in the ownership market and fire protection and police protection in the rental market. The key finding here is that the benefits of certain public expenditures are more enduring in the two markets. That spending 8 years past on a broad spectrum of services raises home values is evidence of the large stake homeowners have in locally provided public goods and services via the exchange value of their property. On the other hand, the comparatively smaller range of services that matter from 8 years past in the rental market illustrates the more immediate kind of use value that renters place on public spending.

Summary and Conclusion

This article demonstrates the important role that public service expenditures play in explaining interregional variation in housing values and rents. Generally speaking, police protection makes the most difference for owners and renters alike, with education and fire protection, respectively, being close seconds. Each of these findings is consistent with the theory of compensating differentials, which predicts that people will incur greater costs to live in areas that offer perceived benefits. The differences between the two markets, in which homeowners apparently place greater weight on expenditures that affect exchange value and renters place greater weight on factors that influence use value, are also logical and consistent with theory of human behavior (Logan and Molotch, 1987). Finally, in both markets, certain services (such as police protection) have enduring effects over time while others do not. The temporal decay of benefits captured by the test statistics and elasticities in both markets serves as further and corroborating evidence that homeowners are concerned with expenditures that affect exchange value while renters are concerned mainly with use value. Several conclusions and directions for future research follow from these findings.

Reexamining exhibit 7, it is noteworthy that, although property tax burden and total direct spending are both significant in the median housing value equation, the elasticities suggest that costs (–0.166) are felt at a rate five times as high as benefits (0.034). If services were fully compensating, the two would offset one another, so this discrepancy indicates either that services are inefficiently provided or that owners at least *perceive* a substantially higher share of the costs than the benefits of public spending. For example, a service may be negatively capitalized via its contribution to the property tax burden but not positively capitalized if people take it for granted or do not want it in the first place. Future research should look more deeply into this conclusion because perceived benefits are what ultimately dictate taxpayers' willingness to pay for services and, in turn, the flow of revenues that local governments have to work with.

The results presented here highlight the importance of this point by providing substantive evidence that public policy may be used to directly influence the relative attractiveness of regions. Although much research has focused on the influence of natural features on migration flows, property values, and wages, the present analysis reveals that, contrary to popular opinion, the elasticities of most public service expenditures by far outweigh those of the natural amenity index in both the ownership and rental markets. This finding is particularly compelling, given that good evidence shows that recent economic development has not bypassed older cities located in the Northeast and Midwest; despite having comparatively fewer environmental attractions, these places continue to capture significant proportions of economic growth (Drennan, 2002). Because it is impossible for any region to alter its inherent endowment of natural amenities, fiscal factors will become increasingly important in years to come. This is true, too, of high-amenity areas currently attracting large numbers of people and firms: deteriorating public services as a result of poor growth management may eventually overwhelm an area's ability to remain competitive in the national economy.

Finally, it should be reiterated that, of all expenditures, those related to public safety (police and fire protection) and education emerged as being the most important. Nevertheless, inequities in the quality of these services in particular are on the rise in metropolitan areas nationwide, creating, in some cases, an intractable cycle of socioeconomic decline as the poor become increasingly cut off

from benefits enjoyed by the public at large (Orfield, 2002). If metropolitan areas become winners or losers based on their relative desirability as places to live—as this and much previous research suggests—their ability to avoid the problem of social polarization will become key to their long-term prosperity. Although the present analysis has focused on intermediate outputs (measured by spending), not the final outputs (measured by quality) that residents ultimately enjoy, it is fair to say that forward-looking urban policy should strive to maintain as high a level of public safety and human capital as possible (Glaeser, Scheinkman, and Shleifer, 1995).

The conclusions discussed in the preceding paragraphs illustrate the importance of public service expenditures to the well-being of contemporary metropolitan areas. In an era when compensating differentials have such a large impact on the outcome of regional development, fiscal planning should be viewed as fundamental to the growth process. Unfortunately, however, fiscal planning is all too commonly overlooked. Adding to the problem, most research conducted from an interregional perspective incorporates public services only tangentially; representative measures are usually included in migration models and other forms of analysis but rarely are they the center of attention. As a result, policymakers have little to go on in their fiscal planning processes and even less to act upon when calling on people to make financial sacrifices for the good of the whole. Although a great deal of additional research is needed to identify just how public services may be leveraged, this article has taken a step in that direction by linking a broad spectrum of public goods and services to the place-to-place cost of housing. Important next steps will be to examine the connections between intermediate and final outputs in this context and, as an extension, how they relate to the pace of economic growth and regional well-being.

Authors

Robyn K. Welch is an associate planner at Burgis Associates, Inc.

John I. Carruthers is an economist in the Economic Development and Public Finance Division, Office of Policy Development and Research, U.S. Department of Housing and Urban Development. He also holds an affiliate faculty appointment in the Department of Urban Design and Planning at the University of Washington.

Brigitte S. Waldorf is a professor in the Department of Agriculture Economics at Purdue University.

Notes

1. A previous version of this article, which is derived from Robyn Welch's master's thesis, was presented at the 2003 North American Meetings of the *Regional Science Association International* in Philadelphia, Pennsylvania.
2. Corresponding author.
3. Throughout this article, a distinction is made between *exchange value* and *use value*, where the former is a market construct that is generally expressed in sales prices and the latter is a social construct that is expressed in day-to-day utility (Logan and Molotch, 1987). Although

most economists would say that, in the end, these two terms amount to the same thing, some sociologists disagree: as Logan and Molotch (1987: 2) note, the distinction hinges on "financial return" versus "essential needs of life" and the maximization of one does not necessarily result in the maximization of the other. The two concepts are useful for present purposes because they shed light on differences in the ways that homeowners and renters value public services.

4. Median housing value is not an ideal substitute for the kind of prices that result from individual transactions but is often used as a proxy to meet specific research purposes; see, for example, Chay and Greenstone (2005). In the present case, broad geographic patterns, rather than the behavior of individuals, are of interest, so inferences are made in that spirit.

5. Mathematically, the expectation is that $\partial housing\ value/\partial public\ spending > 0$ and $\partial rent/\partial public\ spending > 0$.

6. The choice of states is arbitrary, but at least one fixed effect or the constant itself must be excluded in order to estimate the equations. Note that the two alternatives amount to the same thing: in these equations, the fixed effect for Texas is expressed by the constant.

7. The time lags are dictated by data availability; the public expenditure data come from the Census of Governments, which is conducted every 5 years (the 2nd and 7th year of each decade).

8. Virginia is not represented in the data because its unique political structure, which includes numerous independent cities, makes consistent data collection impractical.

9. All comparisons use 1982 constant dollars.

10. All fixed effects are suppressed to conserve space; because they reflect ignorance about unobserved characteristics associated with each state, they have no straightforward interpretation.

11. An elasticity is calculated as

$$\eta_i = \frac{\partial y}{\partial x_i}\frac{\bar{x}_i}{y} = \beta_i \frac{\bar{x}_i}{y}.$$

Here, the elasticity of y with respect to x_i (η_i) is estimated by multiplying the ratio of the sample means and the expected value of y at the mean values of *all* explanatory variables ($\bar{x}_i$ divided by $E[y|\mathbf{x}]$) by its coefficient, β_i. Because the regression coefficients in this case are based on the natural logs of the dependent variables, they drop out of the actual calculation, so $\eta_i = \beta_i \cdot \bar{x}_i$. The resulting elasticity is unit free, enabling easy comparison of the relative influence that each explanatory variable has on the dependent variables themselves, not their natural logs (Greene, 2000).

12. The sum of elasticities shown in the grey lines represents *a posteriori* tests of the restriction that the sum of each individual expenditure is equal to β_1 and α_1 from model (1), as specified in equation (2); in all cases, the numbers sum to essentially the same numbers shown in exhibit 7; where they do not, they deviate only by one-hundredth of a point.

References

Blomquist, Glenn C., Mark C. Berger, and John P. Hoehn. 1988. "New Estimates of Quality of Life in Urban Areas," *American Economic Review* 78: 89–107.

Bogart, William T., and Brian A. Cromwell. 2000. "How Much Is a Neighborhood School Worth?" *Journal of Urban Economics* 47: 280–305.

———. 1997. "How Much More Is a Good School District Worth?" *National Tax Journal* 2: 215–232.

Brasington, David M. 2002. "Edge Versus Center: Finding Common Ground in the Capitalization Debate," *Journal of Urban Economics* 52: 524–541.

———. 2001. "Capitalization and Community Size," *Journal of Urban Economics* 50: 385–395.

Brueckner, Jan K., and Man-Soon Joo. 1991. "Voting With Capitalization," *Regional Science and Urban Economics* 21: 453–467.

Carruthers, John I., and Gudmunder F. Ulfarsson. 2002. "Fragmentation and Sprawl: Evidence From Interregional Analysis," *Growth and Change* 33: 312–340.

Chay, Kenneth Y., and Michael Greenstone. 2005. "Does Air Quality Matter? Evidence from the Housing Market," *Journal of Political Economy* 113: 376–424.

Clark, David E., and James C. Cosgrove. 1991. "Amenities Versus Labor Market Opportunities: Choosing the Optimal Distance To Move," *Journal of Regional Science* 31: 311–328.

Clark, David E., William E. Herrin, Thomas A. Knaap, and Nancy E. White. 2003. "Migration and Implicit Amenity Markets: Does Incomplete Compensation Matter?" *Journal of Economic Geography* 3: 289–307.

Clark, David E., and William J. Hunter. 1992. "The Impact of Economic Opportunity, Amenities, and Fiscal Factors on Age-Specific Migration Rates," *Journal of Regional Science* 32: 349–365.

Clark, David E., and James R. Kahn. 1989. "The Two-Stage Hedonic Wage Approach: A Methodology for the Valuation of Environmental Amenities," *Journal of Environmental Economics and Management* 16: 106–120.

Colwell, Peter F., Carolyn A. Dehring, and Geoffrey K. Turnbull. 2002. "Recreation Demand and Residential Location," *Journal of Urban Economics* 51: 418–428.

Cragg, Michael I., and Matthew E. Kahn. 1999. "Climate Consumption and Climate Pricing From 1940 to 1990," *Regional Science and Urban Economics* 29: 519–539.

———. 1997. "New Estimates of Climate Demand: Evidence From Location Choice," *Journal of Urban Economics* 46: 261–284.

Deller, Steven C., Tsung-Hsiu Tsai, David W. Marcouiller, Donald B.K. English. 2001. "The Role of Amenities and Quality of Life in Rural Economic Growth," *American Journal of Agricultural Economics* 83: 352–365.

DiPasquale, Denise, and Edward L. Glaeser. 1999. "Incentives and Social Capital: Are Homeowners Better Citizens?" *Journal of Urban Economics* 45: 354–384.

Downes, Thomas A., and Jeffrey E. Zabel. 2002. "The Impact of School Characteristics on House Prices: Chicago 1987–1991," *Journal of Urban Economics* 52: 1–25.

Drennan, Matthew P. 2002. *The Information Economy and American Cities.* Baltimore, MD: Johns Hopkins University Press.

Fischel, William A. 2001. *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance, and Land Use Policies*. Cambridge, MA: Harvard University Press.

Florida, Richard. 2002. "The Economic Geography of Talent," *Annals of the American Association of Geographers* 92: 743–755.

Gabriel, Stuart A., Joe P. Mattey, and William L. Wascher. In Press. "Compensating Differentials and Evolution in the Quality of Life Among U.S. States," *Regional Science and Urban Economics*.

Glaeser, Edward L., Jose A. Scheinkman, and Andrei Shleifer. 1995. "Economic Growth in a Cross Section of Cities," *Journal of Monetary Economics* 36: 117–143.

Glaeser, Edward L., and Jesse M. Shapiro. 2003. "Urban Growth in the 1990s: Is City Living Back?" *Journal of Regional Science* 42: 139–165.

Graves, Philip E. 1983. "Migration With a Composite Amenity: The Role of Rents," *Journal of Regional Science* 23: 71–87.

Greene, William H. 2000. *Econometric Analysis*. Englewood Cliffs, NJ: Prentice Hall.

Gyourko, Joseph, and Joseph Tracy. 1991. "The Structure of Local Public Finance and the Quality of Life," *Journal of Political Economy* 99: 774–806.

———. 1989. "The Importance of Local Fiscal Conditions in Analyzing Local Labor Markets," *Journal of Political Economy* 97: 1208–1231.

Haurin, Donald, and David M. Brasington. 1996. "School Quality and Real House Prices: Inter- and Intrametropolitan Effects," *Journal of Housing Economics* 5: 351–368.

Henderson, J. Vernon. 1982. "Evaluating Consumer Amenities and Interregional Welfare Differences," *Journal of Urban Economics* 11: 32–59.

Hoehn, John P., Mark C. Berger, and Glenn C. Blomquist. 1987. "A Hedonic Model of Interregional Wages, Rents, and Amenity Values," *Journal of Regional Science* 27: 605–620.

Hoyt, William H. 1999. "Leviathan, Local Government Expenditures, and Capitalization," *Regional Science and Urban Economics* 29: 155–171.

Izraeli, Oded. 1987. "The Effect of Environmental Attributes on Earnings and Housing Values Across SMSAs," *Journal of Urban Economics* 22: 361–376.

Kahn, Matthew E. 2000. "Smog Reduction's Impact on California County Growth," *Journal of Regional Science* 40: 565–582.

Knapp, Thomas A., and Philip E. Graves. 1989. "On the Role of Amenities in Models of Migration and Regional Development," *Journal of Regional Science* 29: 71–87.

Logan, J., and H. Molotch. 1987. *Urban Fortunes: The Political Economy of Place.* Berkeley, CA: The University of California Press.

Means, Robert S. 2000. *RS Means Building Construction Cost Data: 58th Annual Edition*. Kingston, MA: RS Means Company.

Mulligan, Gordon F., John I. Carruthers, and Miles Cahill. 2004. "Urban Quality of Life and Public Policy." In *Advances in Urban Economics*, edited by R. Campello and P. Nijkamp. Amsterdam: Elsevier.

Oates, Wallace E. 1969. "The Effects of Property Taxes and Local Public Spending on Property Value: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis," *Journal of Political Economy* 77: 957–971.

Orfield, Myron. 2002. *American Metropolitics: The New Suburban Reality.* Washington, DC: The Brookings Institution Press.

Ozanne, Larry, and Thomas Thibodeau. 1983. "Explaining Metropolitan Housing Price Differences," *Journal of Urban Economics* 13: 51–66.

Porell, Frank W. 1982. "Intermetropolitan Migration and Quality of Life," *Journal of Regional Science* 22: 137–158.

Potepan, Michael J. 1996. "Explaining Intermetropolitan Variation in Housing Prices, Rents, and Land Prices," *Real Estate Economics* 24: 219–245.

Roback, Jennifer. 1982. "Wages, Rents, and Quality of Life," *Journal of Political Economy* 90: 1257–1278.

Rothenberg, Jerome, George C. Galster, Richard V. Butler, and John R. Pitkin. 1989. *The Maze of Urban Housing Markets: Theory, Evidence, and Policy.* Chicago, IL: University of Chicago Press.

Savageau, David, and Geoffrey Loftus. 2000. *Places Rated Almanac*. Foster City, CA: IDG Books Worldwide.

Tiebout, Charles M. 1956. "A Pure Theory of Local Expenditures," *Journal of Political Economy* 64: 416–424.

U.S. Bureau of Economic Analysis. Selected years. Regional Economic Information System, 1997. www.bea.gov.

U.S. Census Bureau. 2002. *County and City Data Book.* Washington, DC: U.S. Government Printing Office.

———. 1997. *Census of Governments: Volume 4, Compendium of Government Finances*. Washington, DC: U.S. Government Printing Office.

———. 1992a. *Census of Governments: Volume 1, Number 1, Government Organization.* Washington, DC: U.S. Government Printing Office.

———. 1992b. *Census of Governments: Volume 2, Number 1, Assessed Valuations for Local General Property Taxation.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Agriculture, Economic Research Service. 1993. "Natural Amenity Scale." http://www.ers.usda.gov/Briefing/Rural/Data.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. *National Resources Inventory.* Fort Worth, TX: National Cartography and Geospatial Center.

Ulfarsson, Gudmunder F., and John I. Carruthers. 2006. "The Cycle of Fragmentation and Sprawl: A Conceptual Framework and Empirical Model," *Environment and Planning B* 33: 767–788.

Voith, Richard. 1991. "Capitalization of Local and Regional Attributes Into Wages and Rents: Differences Across Residential, Commercial, and Mixed-Use Communities," *Journal of Regional Science* 31: 127–145.

Yinger, John. 1982. "Capitalization and the Theory of Local Public Finance," *Journal of Political Economy* 90: 917–943.

Zellner, Arnold. 1962. "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests of Aggregation Bias," *Journal of the American Statistical Association* 57: 348–368.