Valuation of Metropolitan Quality of Life in Wages and Rents

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Abstract

This analysis uses intermetropolitan differences in quality of life to estimate the value that residents place on metropolitan amenities and disamenities in land and labor markets. Using individual-level data from the 1980 and 1990 Census of Population and Housing merged with metropolitan-level economic, social, and environmental factors, it estimates hedonic wage and rent equations to derive the value of amenities and disamenities for 257 metropolitan areas in the United States. Additionally, the extent to which capitalization of urban amenities and disamenities changes over time is examined. Results show that the valuation of the urban environment changes over time. Amenities appear to play a stronger role in the housing market compared to the labor market. Capitalization appears to adjust in a dynamic process resulting from disequilibrium in the marketplace and/or changes in consumer preferences.

Concern about the impact of growth on quality of life sparks debates across cities in the United States, with many local residents and policymakers fearful that growth will degrade overall quality of life. Throughout the nation local efforts are underway to preserve the quality of life. Debates continue about the benefits of high-density growth over low-density suburban development. Planning efforts strive to enhance local *amenities*—to preserve open space, alleviate traffic congestion, improve air quality, reduce crime rates, and create jobs. They also strive to reduce *disamenities* (such as high rates of crime and unemployment), although some factors (such as a harsh climate) are not subject to change. Local and regional actions aimed at preserving and enhancing the quality of life operate under the assumption that residents value such goals.

This article examines the effect of amenities and disamenities on wage rates and housing costs in 257 U.S. metropolitan areas in 1980 and 1990. It addresses questions such as the following: What factors are important to people making location decisions? To what extent do residents accept higher housing prices and/or lower wages to reside in locations with more amenities? Conversely, how much compensation is required to attract and retain workers in metropolitan areas characterized by low-amenity (or high-disamenity)

bundles? Furthermore, is the value of the quality of life static, or does valuation of the urban environment change over time? This article begins to examine these questions.

Metropolitan areas differ in their desirability. A mild climate, low crime rates, and low unemployment rates may make an area more desirable than one with severe summers or winters, high crime rates, and high unemployment. Areas differ in the location-specific quality-of-life factors offered, and thus people are not neutral toward or indifferent to where they choose to live. People prefer residing in regions with high levels of quality of life (that is, more desirable locations) to those with low levels of quality of life (or less desirable locations) because in economic terms, the former offer individuals the highest *utility level;* that is, the most desirable bundle of amenities and disamenties. Compensating differential theory predicts that desirable locations, which experience higher demand, should have comparatively lower wages and/or higher housing prices than less desirable locations. The theory further predicts that in disequilibrium, migration will occur from less desirable locations to ones that are more desirable in terms of quality-of-life factors. As markets move toward equilibrium, differences in locations are priced out through local labor and land markets. Theoretically, the process continues until a state of *equilibrium* is reached; that is, until all residential choices are achieved and individuals no longer feel that a change of residence would improve their situation.

This article adds to this body of research by estimating the value of metropolitan quality-of-life characteristics by the *capitalization* of amenities and disamenities into metropolitan wages and housing expenditures.

Background

Extensive research has explored the capitalization of amenities into local wages and land rents in a system in equilibrium. Empirical work in this field suggests that amenities tend to be *priced out* through local labor and/or land markets. Thus wages and rents capture local demand for amenities (Beeson and Eberts, 1989; Blomquist, Berger, and Hoehn, 1988; Herzog and Schlottmann, 1993; Hoehn, Berger, and Blomquist, 1987; Izraeli, 1987; Potepan, 1994; Roback, 1982; Rosen, 1979). Previous research can be grouped into those studies that consider wage differentials (for example, Cropper, 1981; Gerking and Weirick, 1983; Rosen, 1979), analyses that consider rent differentials (such as Cheshire and Sheppard, 1995; Ozanne and Thibodeau, 1983; Shultz and King, 2001), and studies that consider both wages and land rents (for example, Blomquist, Berger, and Hoehn, 1988; Hoehn, Berger, and Blomquist, 1987; Izraeli, 1987; Kahn, 1995; Roback, 1982). This article considers both the labor and the housing markets. It demonstrates the importance of location-specific characteristics (such as climate, crime, and pollution) on an individual's utility, aside from local labor market opportunities. The analysis illuminates the tradeoffs between wages, land prices, and quality of life.

Wage differentials play an important role in explaining migration patterns. The extent to which wage differentials persist across different localities is an interesting phenomenon. *Disequilibrium* and regional wage differences can be used to explain migration flows (Knapp and Graves, 1989). In theory, high-wage metropolitan areas should be more desirable to workers than low-wage areas. As a result, wages adjust until equilibrium is reached, meaning that point at which individuals cannot be made better off by moving to another region. It would be expected, a priori, that migration would flow away from low-wage areas and toward high-wage areas. However, many studies testing this hypothesis using aggregate migration data at the metropolitan-area or regional level have produced insignificant results or found that the opposite is true.

Knapp and Graves (1989) put forth a compelling explanation of this unexpected outcome, suggesting that high wages might compensate for low amenity levels. Hence, high-wage areas might not attract workers if high wages are perceived as a tradeoff for low amenity levels. Studies exploring the extent to which differences in regional amenities explain regional wage differentials found that amenities are capitalized, at least in part, in local wage rates (Gerking and Weirick, 1983; Herzog and Schlottmann, 1993). *Capitalization* refers to the implicit price individuals place on location-specific amenities. When, theoretically, all location decisions based on relative wage levels have been made and equilibrium has been reached, workers will be indifferent to choices between (1) residing in places with comparatively higher amenity levels that pay relatively lower wages and (2) residing in places paying higher wages to compensate for their lower amenity levels.

Location-specific amenities or urban characteristics are also capitalized into land and/or housing prices (Cheshire and Sheppard, 1995; Knapp and Graves, 1989; Schultz and King, 2001). Theory predicts that, similar to the case of wages, low housing prices should be more desirable to households than high prices. Everything else being equal, one would expect migration toward areas with lower housing prices. Land, however, is a limited resource. As migration into desirable, high-amenity areas occurs, the demand for land will increase. Similarly, as migration from undesirable, low-amenity areas occurs, the demand for land in those locations will decline. Land markets will respond accordingly, with land values rising in desirable places, relative to comparable properties in undesirable areas. Where the cost of land is higher, it follows that housing prices will also be higher. When, theoretically, all location decisions based on relative land value are made, and equilibrium is reached, households are indifferent to choices between residing in (1) places with high-amenity levels but higher housing prices and residing in (2) places with low-amenity levels but comparatively lower housing prices.

Because labor and land markets work together in a dynamic process, several researchers suggest analyzing wages and land rents simultaneously (Hoehn, Berger, and Blomquist, 1987; Izraeli, 1987; Knapp and Graves, 1989; Roback, 1982). Roback (1982) conducted some of the earliest work in this area, suggesting that labor and land markets adjust in equilibrium, making the inclusion of both wages and rents necessary in empirical studies addressing compensating differentials. She argues that land and labor markets are both affected by migration, and hence wages and land prices are simultaneously determined in equilibrium (Roback, 1982). Begin with the assumption that all firms, workers, and cities are identical, and the cost to relocate is zero. With perfect information, people will be indifferent to city of residence because they will achieve the same utility level wherever they reside. However, if all firms and workers are identical, but city characteristics vary, then individuals will sort themselves out by preferences for local amenities. In fact, all other things being equal, people will be attracted to high-amenity cities. Equilibrium will be reached through differences in wages and land prices. High-amenity, desirable cities will have a larger supply of labor and a greater demand for land than low-amenity cities. Since land is a fixed commodity, an increase in demand will result in an increase in land prices. Similarly, everything else being equal, if a city experiences an increase in the labor supply, wages will drop. Hence, workers in high-amenity cities would accept lower wages and/or higher land prices. Low-amenity cities, in contrast, would see lower land prices and/or firms would need to pay workers a compensating wage differential.

A primary assumption in the wage/rent characterization of regional differences is that equilibrium in utility is achieved and that migration occurs only at the margins. Later work by Greenwood et al. (1991) challenges this assumption. The authors suggest that markets might not clear quickly, leaving local wages and rents in disequilibrium. Hence, markets are left with biased estimates concerning amenity values. Greenwood et al. (1991) estimate economic migration across states, using annual data from 1971 to 1988.

They argue that where compensating differentials are overvalued, future net out-migration should occur to "raise wages and lower local prices and rents sufficiently to drive" up relative income (Greenwood et al., 1991). Conversely, where wages/rents have not yet equalized, but are undervalued, they predict large net in-migration.

Local wages and rents reflect the value people place on their urban environment. This analysis uses *hedonic pricing,* a technique that makes it possible to derive the implicit value residents place on amenities as a function of location-specific quality-of-life characteristics generated from wage and housing regression equations. This procedure makes it possible to derive the *implicit prices* of urban characteristics. Implicit prices are the value that people place on amenities and disamenities and can subsequently be used by planners and policymakers to ascertain the importance of regional characteristics to residents.

Such information can be helpful in setting policy agendas and determining the focus of regional planning and development efforts. For example, if residents place a high value on low crime rates, local officials might want to ensure that sufficient resources are used for crime fighting or crime prevention programs to make a difference. If residents highly value open space, planners and policymakers might want to coordinate efforts to secure and protect parks, forests, wetlands, and other types of open space.

Data

This research estimates wage and housing expenditure equations that were used to measure the value of urban characteristics and amenities, using the 1980 and 1990 Census of Population and Housing (the 1 percent Public Use Microdata Samples [PUMS]). Urban characteristics were merged with Census data at the metropolitan-area level. The initial sample was constructed by selecting employed householders,[1] ages 18 to 65 years, who were not currently enrolled in school, not serving as active duty military, and not living in group quarters. Consistent measures of quality of life were obtained for 257 metropolitan areas. The original sample consisted of 349,133 observations for 1980 and 341,328 observations for 1990, for which there were complete data available. Further sample restrictions for the wage and housing regressions are described in later sections.

The 1980 PUMS data are self-weighted, whereas the 1990 PUMS samples are not and therefore required the use of the person and household weights provided in the Census files. The 1980 Census reports 1979 price data for wages and housing expenditures, and the 1990 Census provides 1989 price data. However, 1980 Census price data are reported in 1989 dollars for comparison across the two periods.[2]

Wage Data

For wages the analysis included only wage/salary workers with reported income greater than zero, with self-employed workers excluded from the wage estimation. The final numbers of observations for the wage regressions were 312,786 for 1980 and 301,285 for 1990. The dependent variable used was the imputed weekly income from wages and salary.

Housing Expenditure Data

Census PUMS data do not include land prices. These data do, however, provide monthly rent (for renters), monthly owner costs (for homeowners), and housing value (for homeowners). One drawback in using housing prices as opposed to land values is that data reflect both structural features (such as the number of bedrooms) and local characteristics (such as crime rates and climate). Land rents would serve as a better measure to study

regional amenities, but these data are not generally available. Hence, this analysis controls for structural features of the housing unit (such as number of rooms).

Previous studies used expenditure data for renters or homeowners, housing values, or some combination of these. Kahn (1995) used data on renters only. Ozanne and Thibodeau (1983) and Izraeli (1987) presented separate estimates for housing values and rents. Blomquist, Berger, and Hoehn (1988), Shultz and King (2001), and Voith (1991) used rental rates for renters and imputed rents for owner-occupied housing based on housing value. The dependent variables used for estimating the hedonic housing equations in this analysis were based on monthly housing expenditures for renters and imputed monthly housing expenditures for homeowners.

Several types of housing were excluded from the sample: housing units used for commercial purposes, units on more than 10 acres of land, and structures other than houses or apartments (such as a trailer, van, boat, or tent). The housing sample also excluded renters who reported zero monthly gross rent (for example, persons who may have been living rent-free in the home of a friend). The hedonic housing regressions included measures of structural characteristics consistent across the 1980 and 1990 Census. The final numbers of observations used in the rent equations were 301,160 for 1980 and 307,163 for 1990.

For housing costs for renters the analysis used gross monthly rent, which included contract rent, utility costs, and fuel costs. For the housing costs of homeowners the analysis generated a monthly *imputed rent* derived from the housing value reported in the Census, using a technique used by Voith (1991).[3] For condominiums and other owner-occupied units the imputed rent was combined with real estate taxes; fire, flood, and hazard insurance on the property; utility costs; fuel costs; and monthly condominium fees.

Metropolitan Amenities and Urban Characteristics

Both the wage and housing regressions used common variables that represent urban characteristics—indicators of quality of life on the metropolitan area level. Measures of population, density, and land area came from the *State and Metropolitan Area Data Book* (U.S. Bureau of the Census, 1982, 1986, 1991). Poverty rates, housing vacancy rates, and unemployment rates came from the U.S. Department of Housing and Urban Development's *State of the Cities Data System* (U.S. Department of Housing and Urban Development, 2002). Climatic variables that include measures of average annual rainfall, average July high temperature, and heating and cooling degree-days came from the *Places Rated Almanac* (Boyer and Savageau, 1981, 1985, 1989; Savageau and Boyer, 1993), supplemented with data from Sperling's Best Places (2001). Violent and property crime rates also came from the *Places Rated Almanac*. Exhibit 1 shows the variables and data sources used in the analyses; exhibit 2 provides descriptive statistics of the sample.

Clark and Hunter (1992) suggest that the variables *population* and *density* capture unmeasured urban-scale amenities. However, there may be agglomeration effects related to population and density whereby, at some point of increase, the disamenities outweigh the amenities. Hence, quadratic formulations were used as a test of these types of relationships. To capture the total effect on the labor and land markets, population and density were entered as quadratic formulations, meaning that the partial effects of population and density are not constant but vary with metropolitan area size. The solution to the quadratic equations implies that, for example, there is a threshold effect of density. In other words, there are increasing net amenities as density rises up to some point at which there are net disamenities as density levels continue to increase.

Exhibit 1

Descriptions of Regression Variables and Sources of Data, by Individual, Housing Structure, and Metropolitan-Area Characteristics

Characteristic	Description
Householder[a]	
Age	Householder's age
Age squared	Householder's age squared
Female	1=female, 0=male
Disabled	1=disabled, 0=otherwise
Education	Years of schooling
Married	1=married, 0=otherwise
Immigrant	1=immigrant, 0=otherwise
White	1=White, 0=otherwise
Hispanic	1=Hispanic, 0=otherwise
African American	1=African American (non-Hispanic), 0=otherwise
Asian	1=Asian (non-Hispanic), 0=otherwise
Other race	1=other race/ethnicity (non-Hispanic), 0=otherwise
Manager	1=managerial and specialty occupation, 0=otherwise
Service	1=service occupations, 0=otherwise
Farming	1=farming, forestry, and fishing, 0=otherwise
Craft	1=precision production, craft, and retail, 0=otherwise
Laborer	1=operators, fabricators, and laborers, 0=otherwise
Sales	1=technical, sales, and administrative support, 0=otherwise
Housing structure	
Number of rooms	Number of rooms in housing unit
Number of bedrooms	Number of bedrooms
Condominium	1=condominium, 0=otherwise
Single-family home	1=one-family house (attached or detached), 0=otherwise
Yrbuilt1	1=unit is <2 years old, 0=otherwise
Yrbuilt2	1=unit is 2–5 years old, 0=otherwise
Yrbuilt3	1=unit is 6–10 years old, 0=otherwise
Yrbuilt4	1=unit is 11–20 years old, 0=otherwise
Yrbuilt5	1=unit is 21–30 years old, 0=otherwise
Yrbuilt6	1=unit is 31–40 years old, 0=otherwise
Yrbuilt7	1=unit is 40 or more years old, 0=otherwise
Sewer	1=public sewer, 0=otherwise
Metropolitan area	
Population	Population of MSA/PMSA
Population squared	Population of MSA/PMSA squared
Density	Population per square mile
Density squared	Density squared
Land area	Land area, square miles
Annual rainfall	Annual rainfall, inches
Average July high	Average daily high in July, °F
Degree-days[b]	Number of heating and cooling degree-days
Violent crime	Violent crime rate, per 100,000 residents
Property crime	Property crime rate, per 100,000 residents
Poverty rate	Poverty rate
Vacancy rate	Housing vacancy rate
Unemployment rate	Unemployment rate
East	1=MSA is located in the northeast Census region, 0=otherwise
South	1=MSA is located in the south Census region, 0=otherwise
West	1=MSA is located in the west Census region, 0=otherwise
Midwest	1=MSA is located in the midwest Census region, 0=otherwise

MSA=metropolitan statistical area, PMSA=primary metropolitan statistical area.
[a]The Census defines one person in household as *householder.* In most cases householder is person who holds the lease or person in whose name the home is owned, being bought, or rented and person listed in column 1 of Census questionnaire.
[b]Measure of severity of climate. Degree-days are number of degrees that average daily temperature deviates from 65 °F multiplied by number of days of deviation.
Note: Data for variables came from Boyer and Savageau (1981, 1985, 1989); U.S. Bureau of the Census (1982, 1983, 1986, 1991, 1992); Savageau and Boyer (1993); Sperling's Best Places (2001); and U.S. Department of Housing and Urban Development (2002).

Exhibit 2

Descriptive Variable Statistics of Householders, Housing Structure, and Metropolitan Area: 1980 and 1990

Characteristic	1980	1990
Householder[a]		
Age	40.08 (12.16)	40.44 (11.01)
Age squared	1,754.39 (1,021.18)	1,756.31 (936.29)
Female	0.217 (0.412)	0.267 (0.443)
Disabled	0.046 (0.208)	0.041 (0.199)
Education	12.8 (3.2)	13.3 (2.9)
Married	0.666 (0.472)	0.611 (0.487)
Immigrant	0.079 (0.270)	0.112 (0.315)
Hispanic	0.064 (0.245)	0.081 (0.273)
African American	0.108 (0.310)	0.115 (0.319)
Asian	0.017 (0.130)	0.027 (0.163)
Other race	0.005 (0.068)	0.005 (0.070)
Manager	0.267 (0.442)	0.310 (0.462)
Service	0.094 (0.292)	0.099 (0.299)
Farming	0.009 (0.095)	0.010 (0.100)
Craft	0.177 (0.382)	0.146 (0.353)
Laborer	0.198 (0.399)	0.156 (0.363)
Housing structure[b]		
Number of rooms	5.53 (1.82)	5.56 (1.94)
Number of bedrooms	3.60 (1.04)	3.63 (1.07)
Condominium	0.03 (0.17)	0.06 (0.23)
Single-family home	0.70 (0.46)	0.68 (0.47)
Yrbuilt1	0.03 (0.18)	0.02 (0.14)
Yrbuilt2	0.11 (0.31)	0.10 (0.31)
Yrbuilt3	0.14 (0.34)	0.10 (0.30)
Yrbuilt4	0.23 (0.42)	0.22 (0.41)
Yrbuilt5	0.20 (0.40)	0.17 (0.38)
Yrbuilt6	0.10 (0.31)	0.15 (0.35)
Yrbuilt7	0.19 (0.39)	0.23 (0.42)
Sewer	0.85 (0.36)	0.86 (0.35)
Metropolitan area[c]		
Population	2,296,039 (2,427,028)	2,450,748 (2,535,345)
Population squared	1.12×10^{13} (1.98×10^{13})	1.24×10^{13} (2.26×10^{13})
Density	1,176.7 (1,748.7)	1,185.6 (1,738.4)
Density squared	4,442,474 (1.41×10^{7})	4,427,550 (1.43×10^{7})
Land area	2,854.5 (2,880.6)	3,061.2 (3,310.1)
Annual rainfall	34.6 (12.9)	34.7 (13.4)
Average July high	85.6 (6.3)	86.0 (6.4)
Degree-days	5,528.8 (1,541.9)	5,474.0 (1,535.8)
Violent crime	662.5 (321.8)	665.7 (360.6)
Property crime	5,783.2 (1,205.6)	5,469.5 (1,340.8)
Poverty rate	0.115 (0.033)	0.121 (0.038)
Vacancy rate	0.064 (0.024)	0.079 (0.034)
Unemployment rate	0.062 (0.019)	0.061 (0.015)
East	0.213 (0.409)	0.201 (0.401)
South	0.298 (0.457)	0.324 (0.468)
West	0.233 (0.423)	0.238 (0.426)

[a]Sample size: 317,286 in 1980; 301,285 in 1990.
[b]Sample size: 301,160 in 1980; 307,163 in 1990.
[c]Means generated from 1990 housing sample size.
Notes: Values are means, with standard deviations in parentheses. For descriptions of variables, see exhibit 1.

Model

To construct the models, wage and housing expenditure equations were estimated for two periods: 1980 and 1990. This analysis builds on research conducted by Blomquist, Berger, and Hoehn (1988), Gerking and Weirick (1983), Hoehn, Berger, and Blomquist (1987), and Roback (1982). However, this work differs from previous studies in several ways. First, this study uses metropolitan area as the geographic unit of analysis. Using this approach is better than using the state or the county as the unit of analysis because states are generally too large to represent a labor market, and counties are too small, since many people do not live and work in the same county. Second, this study analyzes the extent of amenity capitalization occurring in both the land and labor markets. Finally, this study examines capitalization of amenities using Census data from two periods, which provides insights on the question of whether the value residents place on urban amenities and disamenities changes over time.

Building on the compensating wage differential work of Gerking and Weirick (1983), this research adds a housing component and considers the general form of the hedonic wage and housing equations as

(1) Wage = f(P, C)

(2) Expense = g(H, C)

where *wage* denotes the real weekly earnings, *expense* denotes monthly housing expenditures for owners or renters, *P* denotes a vector of householder characteristics, *H* denotes a vector of characteristics for the housing structure, and *C* denotes a vector of metropolitan characteristics. Equations (1) and (2) are a reduced form, which indicates how individuals implicitly value the components *P, H,* and *C* (Gerking and Weirick, 1983).

Equations (1) and (2) are specifically estimated in this article as

$$(3)\ \text{Wage} = \alpha_0 + \beta_1 P_1 + \beta_2 P_2 + \beta_3 P_3 + \beta_4 P_4 + \beta_5 P_5 + \beta_6 P_6 + \beta_7 P_7 + \beta_8 P_8 + \beta_9 P_9 + \beta_{10} P_{10} + \beta_{11} P_{11} + \beta_{12} P_{12} + \beta_{13} P_{13} + \beta_{14} P_{14} + \beta_{15} P_{15} + \beta_{16} P_{16} + \gamma_1 C_1 + \gamma_2 C_2 + \gamma_3 C_3 + \gamma_4 C_4 + \gamma_5 C_5 + \gamma_6 C_6 + \gamma_7 C_7 + \gamma_8 C_8 + \gamma_9 C_9 + \gamma_{10} C_{10} + \gamma_{11} C_{11} + \gamma_{12} C_{12} + \gamma_{13} C_{13} + \gamma_{14} C_{14} + \gamma_{15} C_{15} + \gamma_{16} C_{16}$$

$$(4)\ \text{Expense} = \alpha_1 + \delta_1 H_1 + \delta_2 H_2 + \delta_3 H_3 + \delta_4 H_4 + \delta_5 H_5 + \delta_6 H_6 + \delta_7 H_7 + \delta_8 H_8 + \delta_9 H_9 + \delta_{10} H_{10} + \delta_{11} H_{11} + \zeta_1 C_1 + \zeta_2 C_2 + \zeta_3 C_3 + \zeta_4 C_4 + \zeta_5 C_5 + \zeta_6 C_6 + \zeta_7 C_7 + \zeta_8 C_8 + \zeta_9 C_9 + \zeta_{10} C_{10} + \zeta_{11} C_{11} + \zeta_{12} C_{12} + \zeta_{13} C_{13} + \zeta_{14} C_{14} + \zeta_{15} C_{15} + \zeta_{16} C_{16}$$

where Wage = weekly wages

Expense = monthly housing expenditures

P^1 = age

P^2 = age squared

P^3 = female

P^4 = disabled

P^5 = education

P^6 = married

P^7 = immigrant

P^8 = Hispanic[4]

P^{9} = African American

P^{10} = Asian

P^{11} = other race/ethnicity

P^{12} = manager[5]

P^{13} = service

P^{14} = farming

P^{15} = craft

P^{16} = laborer

H^{1} = number of rooms

H^{2} = number of bedrooms

H^{3} = condominium

H^{4} = single-family home

H^{5} = Yrbuilt2[6]

H^{6} = Yrbuilt3

H^{7} = Yrbuilt4

H^{8} = Yrbuilt5

H^{9} = Yrbuilt6

H^{10} = Yrbuilt7

H^{11} = sewer

C^{1} = population

C^{2} = population squared

C^{3} = density

C^{4} = density squared

C^{5} = land area

C^{6} = annual rainfall

C^{7} = average July high

C^{8} = degree days

C^{9} = violent crime

C^{10} = property crime

C^{11} = poverty rate

C^{12} = vacancy rate

C^{13} = unemployment rate

C^{14} = east[7]

C^{15} = south

C^{16} = west

Weekly earnings for employed wage/salary workers is the dependent variable in equation (3). In equation (4) the dependent variable for homeowners represents the monthly housing expenditures, which includes mortgage payment, property taxes, insurance, utilities, and fuel cost. For renters the dependent variable represents monthly gross rent and includes utility and fuel costs.

Empirical Findings

Regression estimates of equations (3) and (4) were obtained using ordinary least squares. Exhibits 3 and 4 show labor market effects; exhibits 5 and 6 show housing market effects.

Exhibits 3 and 4, respectively, present the coefficient estimates and *t*-statistics for the wage regressions without and with the urban characteristics included in the regressions. Compared with regressions without quality-of-life factors, the addition of the urban characteristics in the wage equation resulted in an increase in R^2 from 0.1307 to 0.1371 in 1980 and from 0.0943 to 0.1017 in 1990. In the wage regressions urban characteristics with negative coefficients can be interpreted as amenity effects. A negative sign on a coefficient indicates that labor markets trade off higher levels of those characteristics for lower weekly wages. Similarly, positive coefficients can be viewed as indicating the effect of disamenities.

Population and density appeared as disamenities in both years (exhibit 4). The value of the density coefficient increased from 1980 to 1990, suggesting that residents have a growing preference for low-density development. The property and violent crime rates both appeared as disamenities, as expected, since theory predicts firms would have to pay

Exhibit 3

Ordinary Least Squares Regression Model of Weekly Wages on Householder Characteristics: 1980 and 1990

	1980 (*n* = 312,786)		1990 (*n* = 301,285)	
Characteristic	β	***t***	β	***t***
Age	36.3	63.4	41.9	44.7
Age squared	–0.4	–54.2	–0.4	–37.8
Female	–200.8	–68.2	–210.5	–54.1
Disabled	–53.9	–12.2	–97.0	–13.9
Education	25.5	71.2	40.5	68.9
Married	66.5	26.3	70.0	20.3
Immigrant	–1.7	–0.4	45.7	8.4
Hispanic	–59.3	–14.4	–50.0	–8.3
African American	–61.9	–20.3	–60.0	–13.3
Asian	–76.4	–10.3	–75.3	–8.0
Other race	–30.7	–2.3	–75.1	–3.8
Manager	112.8	41.9	136.4	35.8
Service	–101.7	–28.5	–110.2	–21.0
Farming	–101.0	–10.2	–148.8	–10.5
Craft	22.1	7.3	–32.8	–6.9
Laborer	–9.4	–3.2	–75.3	–16.2

Notes: Constant = –527.4 for 1980 and –839.7 for 1990. R^2 (adjusted) = 0.1307 for 1980 and 0.0943 for 1990. For descriptions of variables, see exhibit 1.

Exhibit 4

Ordinary Least Squares Regression Model of Weekly Wages on Householder and Metropolitan-Area Characteristics: 1980 and 1990

	1980 (n=312,786)		1990 (n=301,285)	
Characteristic	β **or** γ	t	β **or** γ	t
Householder				
Age	35.9	62.9	41.8	44.8
Age squared	–0.37	–54.0	–0.42	–38.2
Female	–199.0	–67.9	–209.7	–54.1
Disabled	–52.7	–12.0	–92.3	–13.3
Education	24.5	68.3	39.3	66.9
Married	72.3	28.6	77.6	22.5
Immigrant	–16.9	–4.4	–1.28	–0.2
Hispanic	–61.5	–14.5	–69.0	–11.1
African American	–67.5	–21.8	–74.7	–16.3
Asian	–88.7	–11.9	–96.6	–10.2
Other race	–30.3	–2.3	–71.5	–3.6
Manager	114.3	42.6	134.6	35.5
Service	–98.4	–27.6	–102.1	–19.5
Farming	–85.1	–8.6	–117.6	–8.3
Craft	23.9	7.9	–25.2	–5.3
Laborer	–7.9	–2.7	–62.6	–13.4
Metropolitan area				
Population	2.90×0.10^{5}	13.9	1.48×0.10^{5}	5.1
Population squared	-3.41×0.10^{12}	–13.5	-1.67×0.10^{12}	–5.4
Density	0.029	9.1	0.052	10.7
Density squared	-2.11×0.10^{6}	–7.1	-3.70×0.10^{6}	–8.1
Land area	6.20×0.10^{5}	0.1	3.71×0.10^{3}	5.5
Annual rainfall	–0.151	–1.1	–1.07	–5.1
Average July high	–0.332	–1.5	–0.848	–2.6
Degree-days	–0.002	–1.4	–0.019	–11.1
Violent crime	0.025	3.8	0.004	0.4
Property crime	0.002	1.7	0.006	3.2
Poverty rate	–684.1	–14.2	–1,204.1	–15.0
Vacancy rate	–106.7	–1.9	–420.7	–7.0
Unemployment rate	667.7	10.2	2,112.3	11.3
East	–42.3	–13.1	21.6	4.3
South	–4.0	–0.9	14.1	2.2
West	–3.7	–0.7	–35.8	–4.6

β=regression coefficient for respondent characteristic; γ=regression coefficient for metropolitan-area characteristic.
Notes: Constant=–491.9 for 1980 and –655.0 for 1990. R^2 (adjusted)=0.1371 for 1980 and 0.1017 for 1990. For descriptions of variables, see exhibit 1.

higher wages in high-crime areas. The influence of property crime increased from 1980 to 1990, although violent crime was statistically insignificant in 1990. Vacancy in the housing market appeared as an amenity in labor markets. Perhaps this is indicative of a positive relationship between housing availability and price, such that workers are willing to accept a slightly lower wage rate. As expected, unemployment rate appeared as a disamenity with a strong wage effect increase from 1980 to 1990.

Exhibits 5 and 6, respectively, show the estimated coefficients and t-statistics for the housing regressions without and with the urban characteristics. The addition of the urban characteristics to the housing regression results in an increase in R^2 from 0.4174 to 0.5236 in 1980 and from 0.2672 to 0.4932 in 1990. Including the urban characteristics

has a larger effect on the housing regressions than on the wage regressions. Urban characteristics have the greatest effect on the 1990 housing regression, perhaps signaling the growing importance residents place on quality of life in location decisions. In the housing regression urban characteristics with positive coefficients can be interpreted as amenities and negative coefficients can be viewed as disamenities.

Population has a positive effect on housing expenditures in 1980 but a negative effect on housing costs in 1990 (exhibit 6). Expectations are that population is viewed as a disamenity, and thus one would expect a negative effect of population on housing markets. As suggested by Greenwood et al. (1991), housing markets might be slow to adjust toward equilibrium. Perhaps the results found in this analysis indicate the lag at which housing markets adjust to population changes. Density, however, has a positive effect on housing expenditures, and its effect increases over the 10-year period. It is possible that the combined effects of density, population, and land area suggest that urban form might play a key role in metropolitan desirability. The urban-planning community debates whether growth at low density is desirable and whether markets will accept high-density growth patterns. Future research is needed to determine the effect of urban form on labor and housing markets. With respect to climate, rainfall and extreme temperatures appear as disamenities associated with lower housing prices. Rates of property and violent crime have a positive sign but should not be viewed as amenities. It is often the case that higher property crime rates exist in areas with higher priced homes. Furthermore, the dependent variable in the housing regressions comprises housing rents and other housing costs, such as property taxes. It is possible that local governments in high crime areas raise local expenditures (that is, property taxes) for crime fighting and crime prevention activities. Further research should examine the effects of local public finance in conjunction with location-specific amenities on housing markets.

As expected, poverty rates and vacancy rates have a negative effect on housing markets. The sign on the unemployment coefficient shifts from negative in 1980 to positive in 1990. Although high unemployment would not be viewed as an amenity in 1990, this

Exhibit 5

Ordinary Least Squares Regression Model of Monthly Housing Expenditure on Housing Structure Characteristics: 1980 and 1990

	1980 (n = 301,160)		1990 (n = 307,163)	
Characteristic	δ	***t***	δ	***t***
Number of rooms	124.2	181.2	119.3	120.9
Number of bedrooms	28.2	23.3	64.0	35.3
Condominium	99.5	25.1	263.1	66.0
Single-family home	95.1	49.7	20.1	7.8
Yrbuilt2	–26.2	–6.5	–34.5	–5.1
Yrbuilt3	–106.5	–27.0	–149.5	–21.9
Yrbuilt4	–128.8	–34.0	–195.5	–30.1
Yrbuilt5	–186.6	–48.5	–189.7	–28.8
Yrbuilt6	–251.4	–61.5	–195.7	–29.4
Yrbuilt7	–278.1	–72.0	–208.8	–32.1
Sewer	19.7	10.6	23.3	8.6

Notes: Constant = 81.6 for 1980 and 92.6 for 1990. R^2 (adjusted) = 0.4174 for 1980 and 0.2672 for 1990. For descriptions of variables, see exhibit 1.

Exhibit 6

Ordinary Least Squares Regression Model of Monthly Housing Expenditure on Housing Structure and Metropolitan-Area Characteristics: 1980 and 1990

	1980 (n = 301,160)		1990 (n = 307,163)	
Characteristic	δ **or** ζ	t	δ **or** ζ	t
Housing structure				
Number of rooms	125.4	200.5	128.4	154.4
Number of bedrooms	22.6	20.6	49.1	32.5
Condominium	35.4	9.8	142.4	42.6
Single-family home	149.9	83.9	113.5	51.3
Yrbuilt2	–30.3	–8.3	–9.9	–1.7
Yrbuilt3	–110.3	–30.9	–90.5	–15.9
Yrbuilt4	–157.3	–45.8	–161.3	–29.8
Yrbuilt5	–231.1	–66.0	–206.6	–37.7
Yrbuilt6	–293.8	–78.9	–242.4	–43.6
Yrbuilt7	–321.2	–90.4	–265.4	–48.7
Sewer	–40.0	–23.2	–33.2	–14.4
Metropolitan area				
Population	1.81×0.10^{5}	13.5	-7.15×0.10^{6}	–4.5
Population squared	-3.03×0.10^{12}	–18.5	-1.79×0.10^{12}	–10.6
Density	0.133	66.1	0.238	91.1
Density squared	-1.02×0.10^{5}	–52.6	-1.83×0.10^{5}	–74.3
Land area	6.96×0.10^{4}	2.2	2.00×0.10^{3}	5.5
Annual rainfall	–1.612	–18.2	–5.945	–52.0
Average July high	–5.052	–35.2	–9.304	–52.5
Degree-days	–0.025	–33.2	–0.090	–96.2
Violent crime	0.012	2.9	0.074	13.5
Property crime	0.028	30.4	0.017	17.5
Poverty rate	–1,076.9	–34.9	–2,736.5	–61.5
Vacancy rate	–332.4	–9.0	–490.1	–14.8
Unemployment rate	–1,190.8	–28.4	1,585.5	15.3
East	39.5	18.8	210.8	76.0
South	–29.1	–9.5	55.3	15.4
West	36.8	11.0	5.3	1.2

δ = regression coefficient for housing structure characteristic, ζ = regression coefficient for metropolitan-area characteristic.
Notes: Constant = 682.7 for 1980 and 1,492.8 for 1990. R^2 (adjusted) = 0.5236 for 1980 and 0.4932 for 1990. For descriptions of variables, see exhibit 1.

pattern suggests that land or housing markets might be slow to adjust in equilibrium. For example, assume a desirable area has a very strong labor market in 1980. This area would have low unemployment and housing vacancy rates in 1980. Local builders and investors would then be likely to increase the housing stock. However, if workers migrated to the area faster than job growth and/or housing construction occurred, the supply of labor might have overshot equilibrium employment levels and the housing supply, resulting in temporary disequilibrium marked by rising unemployment rates and higher housing prices.

Conclusion

The body of theory on which this research is based is concerned with how people make choices about where to live. Metropolitan areas differ in quality of life and hence in desirability. Amenities such as mild climate, low crime rates, and low unemployment rates may make one area more desirable than another with disamenities, such as extreme

weather and high rates of crime and poverty. Theory holds that in making location decisions, people are not indifferent to quality-of-life factors in different locations. People are thus expected to migrate from low-amenity areas to high-amenity ones, considering all tradeoffs involved, in order to increase their expected utility. In equilibrium these differences are priced out through local labor and land markets.

According to compensating differential theory, desirable locations should have comparatively lower wages and higher land prices than less desirable areas. Hedonic models estimated by scholars, as in this analysis, may be used to examine the extent to which amenities are capitalized in the land and/or labor markets. Previous empirical work suggests that amenities tend to be priced out through local labor and land markets. Metropolitan wages and rents capture the local demand for amenities.

Findings in this analysis are consistent with past studies. They show the capitalization of urban characteristics occurring in metropolitan-level labor and housing markets. The degree of capitalization, however, changes over time. Using individual-level data from the 1980 and 1990 Census of Population and Housing (1 percent Public Use Microdata Samples) merged with urban characteristics, the values of urban amenities and disamenities are generated at the metropolitan level. Although capitalization is seen to occur in both the land and labor markets, the vector of urban characteristics included in this analysis has a greater effect in the housing market.

Residents implicitly pay, through lower wages and higher housing prices, to live in areas with higher amenity levels. This analysis suggests, however, that although hedonic pricing techniques are commonly used in economics and regional science, planners have tended to give them little attention. This approach can be used to ascertain preferences of consumers, residents, and potential residents of localities. This type of analysis can help planners and policymakers establish planning agendas and guide the allocation of public resources to reduce crime, alleviate traffic congestion, improve air quality, curtail poverty, and facilitate economic growth.

This analysis focused on intermetropolitan amenity differences because metropolitan areas represent a labor market. The same approach, however, could be applied to intrametropolitan housing data, with important implications for planners and government officials. Quality of life has local and metropolitanwide fiscal resonance. For example, factors that affect housing prices are translated into property tax revenues for municipal and county governments. Many quality-of-life factors are regional in nature. Housing, poverty, and crime rates are neighborhood specific but affect the well-being of an entire metropolitan area. Goals such as decreasing poverty and unemployment rates, difficult for a single municipality to accomplish, benefit the economic vitality of an area. The values that residents place on such improvements are priced out through labor and housing markets.

Improving quality of life will increase an area's desirability and attract new residents, eventually increasing the demand for land (which might cause housing prices to rise) and increasing the supply of labor (which might hamper future wage growth). These factors will tend to lower disposable income. In equilibrium it can be argued that such a scenario reflects a properly working market. Residents' utility should remain constant, however, and the net desirability of an area may remain the same, since residents are trading off having fewer dollars in their pockets for a higher quality of life.

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Notes

1. The Census defines one person in each household as the householder. In most cases the householder is the person or one of the persons who hold the lease or the person in whose name the home is owned, being bought, or rented and person listed in column 1 of the Census questionnaire. The householder was selected for the analysis discussed in this article.
2. Census data for 1980 wages and rents were adjusted for inflation by the ratio (123.980/72.586). The Consumer Price Index (CPI) in 1979 was 72.586, and the CPI in 1989 was 123.980.
3. Voith (1991) imputed monthly rental value for homeowners by applying a factor of proportionality (0.006) to the house value, which was the technique employed here.
4. Race/ethnicity: *White* is the omitted category.
5. Occupation: *Sale* is the omitted category.
6. Yrbuilt1 (year built: *Unit < 2 years old*) is the omitted category.
7. Census region: *Midwest* is the omitted category.

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