Are Big Cities Really Bad Places to Live?

Improving Quality-of-life Estimates across Cities

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Abstract

Hedonic estimates of quality of life across cities depend on how high the cost-of-living in a city is relative to its local wage-level. Adjusting the standard hedonic model to account for federal taxes, non-housing costs, and non-labor income produces quality-of-life estimates quite different from the previous literature. Properly adjusted, the model produces city rankings closer to those in the popular literature, and accurately predicts how housing prices rise with wage levels, controlling for amenities. Mild seasons, sunshine, and coastal location alone account for a majority of quality-of-life differences. Quality of life increases slightly with city size, contrary to the previous literature, as larger cities are located in nicer areas.

Keywords: Quality of life, cost-of-living, federal taxation, compensating differentials.

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1 Introduction

While it has long been established that wage levels increase with city size (e.g. Fuchs 1967), it has also long been argued that these higher wages compensate workers for the disamenities of urban life, such as congestion and pollution (Hoch 1972). Nordhaus and Tobin (1972) argue that the loss in quality of life (QOL) from urbanization is a major cost of economic growth, and that this loss should be subtracted from national income growth when measuring gains in economic welfare over time. Elgin et al. (1974) argue that because QOL is low in larger cities, policy makers should consider "national population redistribution policy aimed at greater population balance," which would depopulate large cities and populate the American hinterland.

Research by Rosen (1979), Roback (1982), and Heohn et. al. (1987) establishes that real – not nominal – wages, netting out local cost-of-living, correctly measure how much workers are compensated for urban disamenities. Stated in reverse, a city's QOL can be measured according to how high its cost-of-living is relative to its wage level. Yet even when accounting for cost-of-living, QOL indices based on this hedonic methodology in Blomquist et. al. (1988), Gyourko and Tracy (1991), and other studies still find that QOL diminishes with city size (Burnell and Galster 1992).[1]

For those familiar with American cities, these hedonic QOL indices often appear counter-intuitive as they do not seem to reflect where individuals would most prefer to live if local wage-levels or cost-of-living could be ignored, leading researchers such as Rappaport (2007a) to deem these indices to be "misplaced.". Ranking 185 metropolitan areas in the United States, Berger et. al. (1987) find Pueblo, CO to be the best city, Binghamton, NY, the 5th best, and Sioux Falls, SD, 34th. On the other hand, San Francisco, CA is 105th; Portland, OR, 138th; Seattle, WA, 144th; and New York, NY 165th. Ranking the states, Gabriel et. al. (2003) give the top three places to Wyoming, South Dakota, and Arkansas, but rank Hawaii 35th, Washington 41st, and California 42nd.[2] These rankings are not positively correlated with measures of QOL found in works such as the *Places Rated Almanac* (Savageau 1999), where many large cities score quite favorably in overall "livability" in spite of their high cost-of-living.[3]

[1] Gyourko, Kahn, and Tracy (1999) provide excellent guidance to this literature; a more recent survey is provided by Lambiri et al. (2007).

[2] These differences persist when measured at the county level in Blomquist et al. (1988) where suburban Marin County is ranked 142nd (out of 253 counties), even lower than the City and County of San Francisco, ranked 105th.

[3] Burnell and Galster (1992) note that, according to *Places Rated*, QOL peaks at a city size of 4 million, while quality-of-life decreases monotonically using hedonic indices found in Berger et al. (1987). Oppositely, Clark et al (1992) find that QOL reaches a minimum at 4 million. Their measures are based on nominal, rather than real, wage measures, arguing that this should hold in a monocentric city model with free mobility, where – paradoxically – cities are of fixed size. Heohn et al. (1987), allow city size to

As argued here, the hedonic model of Rosen (1979), which has long dominated the economic QOL literature, produces much more sensible QOL estimates once three adjustments are made. First, cost-of-living measures should incorporate cost differences beyond housing alone. Second, wage differences across cities should be measured after accounting for federal taxes. Third, income from sources other than labor - including income from investments, real estate, or transfers - should be considered in determining a household's buying power, as all income is worth less in more expensive areas.

These three adjustments imply that cost-of-living differences are greater and disposable income differences smaller across cities than previous measures implied. In determining QOL, previous measures put too much weight on how low wage-levels are, and too little weight on how high housing-costs are. Thus, in large cities, where both wages and cost-of-living are high, they overestimated real incomes and underestimated QOL. The adjustments proposed here put more weight on housing-cost differences and less weight on wage differences, implying that real incomes in large cities are lower, and QOL higher, than previously thought. Interestingly, adjusted QOL estimates no longer fall with city size, in fact, they increase slightly. Furthermore, the adjusted QOL measures produce more believable city rankings: the top two cities in the United States are Honolulu, HI, and Santa Barbara, CA, followed closely by San Francisco. Some large cities such as Boston, Chicago, Los Angeles and New York are above the national average, rather than being near the bottom. These QOL rankings are positively correlated with the rankings found in *Places Rated*.

The three proposed adjustments not only produce more believable city rankings, but they also pass a novel empirical test. Namely, the adjusted model successfully predicts how housing costs rise with wage levels across cities, controlling for various amenities that should influence QOL. The predicted housing costs of the unadjusted model, on the other hand, are soundly rejected by this empirical test.

The adjusted QOL model is used to estimate how much households value individual amenities, which together determine overall QOL. The estimates indicate that households have a substantial willingness-to-pay to live in coastal areas and in areas with sunshine and free of excessive cold or heat. In fact, a parsimonious model using only four variables for weather and coastal-location explains over 60 percent of the variation in QOL across cities. The positive cross-sectional relationship between QOL and city size is due to the fact that cities are larger in areas with nicer weather and along the coasts, reflecting the location choices of households, previously noted by Rappaport and Sachs (2003) and Rappaport (2007b). Once these amenities are controlled for, the relationship between QOL and city size is very flat, suggesting that

be endogenous in a system of monocentric cities, and re-establish the need to use real, rather than nominal, wage differences.

population growth does not lower the QOL in American cities.

By avoiding a bias against larger cities, the adjusted model also finds that households are willing to pay to live near cultural amenities and to avoid air pollution and urban sprawl. Interestingly, regulations which restrict the use of residential land do not have a significant effect on QOL at the metropolitan level.

Besides fixing the standard economic model of QOL to produce more sensible rankings and amenity valuations, this paper makes a number of other methodological contributions. First, it provides an intuitive graphical explanation of how wage and price differentials across cities are converted into QOL estimates. Second, it establishes that the aggregate QOL estimates are an average of household QOL valuations, with each household weighted by their share of income. Third, it provides evidence that a log-linear specification, whereby QOL and amenity values are measured in terms of percent of income, rather than dollar amounts, fits the data better than a linear specification. Fourth, it establishes a single-equation method to infer amenity valuations from the QOL estimates, a method which reports the proportion of QOL variation explained by a given set of amenities. Finally, it proposes a theoretical extension of the standard Rosen model to simultaneously account for taste-heterogeneity and imperfect household mobility using a single parameter. This extension is used to theoretically establish downward-sloping demand curves for city-specific amenities, upward-sloping local labor supply curves, as well as model how restrictions on housing supply can raise the price of housing, but reduce the value of land.

2 Model Set-up

To explain how QOL differences are reflected in local wages and prices, this paper uses the canonical model of Rosen (1979) and Roback (1982), developed further by Albouy (2008). The national economy contains many cities, indexed by j, which trade with each other and share a homogenous population of mobile households. Households are assumed to be fully mobile between cities, but they must live and work in the same city, where they receive wage w^j, and consume a numeraire good, x, which is tradable across cities, and a "home good," y, which cannot be traded across cities, and has a local price p^j.

Cities differ in quality of life, Q^j, which is a function of a vector of amenities, $\mathbf{Z}^j$, such as weather, so that $Q^j = \widetilde{Q}\left(\mathbf{Z}^j\right)$ for some function $\widetilde{Q}$. Firm productivity in either traded or home goods may also vary across cities, but this does not need to be modeled here (see Roback 1982 and Albouy 2008 for further detail).

Households have identical tastes and endowments, and each supplies h^j units of labor. Households also own identical diversified portfolios of land and capital, which pay an income I which does not depend on their location. This assumption is meant to capture the situation of an average potential migrant, who may own property anywhere in the country. Total income, $m^j \equiv I + w^j h^j$, varies across cities only as wages vary.

Out of this income, households pay a federal income tax of $\tau(m)$. As explained in Albouy (2008), federal expenditures are not correlated with federal taxes, while most federal public goods, such as national defense, benefit all individuals equally. Therefore, differences in the disposable income of households across cities should be measured after federal taxes. Tax deductions for expenditures such as housing and local government-provided goods are modeled in the Appendix: their effects are relatively minor.[4]

Household preferences are modeled by a utility function, $U(x, y, h; Q)$, that is quasi-concave, increasing in x, y, and Q and decreasing in h. The after-tax net expenditure necessary to obtain utility u, given local prices p^j,w^j, quality-of-life Q^j and tax schedule τ can be written as the function:

$$e(p^j, w^j, \tau, u; Q^j) \equiv \min_{x,y,h} \left\{x + p^j y - w^j h - I + \tau(w^j + I) : U\left(x, y, h; Q^j\right) \geq u\right\}$$

Since households are fully mobile, their utility must be the same across all inhabited cities. Therefore, in equilibrium across cities which are inhabited, no household requires any additional compensation to want to live in the city it inhabits, given the income it already earns

$$e(p^j, w^j, \tau, \bar{u}; Q^j) = 0 \tag{1}$$

where $\bar{u}$ is the level of utility attained nationally. This mobility condition need not apply to all households, but only a sufficiently large subset of mobile "marginal" households.[5] It is the set of marginal households

[4] The local public sector does not need to be explicitly modeled. If local government goods are provided efficiently, as in the Tiebout (1956) model, these goods can be treated as consumption goods, part traded and part non-traded. Efficiency differences in local public sectors may be captured by differences in Q (Gyourko and Tracy 1989).

[5] It is a strong assumption to assume that markets are all in equilibrium. Greenwood et al. (1991) estimate equilibrium real wages separately from actual real wages, and find that in only 7 out of 51 cases are the two the statistically different at the 90 percent significance level (Hunt 1991). Interestingly, the QOL estimates from Greenwood et al. (1991), which depend on migration patterns, as well as real wages, are not adjusted for federal taxes or non-labor income, and are higher for Arkansas, Mississippi, and South Dakota than they are for Hawaii and California. In an out-of-equilibrium setting, in-migration should occur in cities where QOL is high relative to the cost-of-living net of local income differences. Other things equal, cities experiencing above-average levels of in-migration may have higher levels of QOL than the estimates here suggest. However, population movements are also influenced greatly by productivity changes in traded or home goods, which affect the availability of local jobs and housing. In-migration may then reflect workers moving to take advantage of available jobs or housing, rather than higher QOL.

that determines the values observed, just as it is with goods in other competitive markets.

To see how wage and prices should vary with QOL, fully differentiate equation (1) to get

$$\frac{\partial e}{\partial p}dp^j + \frac{\partial e}{\partial w}dw^j + \frac{\partial e}{\partial Q}dQ^j = 0$$

This approximation is taken around a city with average prices and QOL, so that we ignore superscripts j on the derivatives, which are evaluated at the national average $\bar{p}, \bar{w}$,and $\bar{Q}$. Applying Shepard's Lemma and rearranging this formula

$$y \cdot dp^j - \left(1 - \tau'\right) h \cdot dw^j = p_Q \cdot dQ^j \tag{2}$$

where τ' is the marginal tax rate on income and $p_Q \equiv -\partial e/\partial Q = (\partial U/\partial Q) / (\partial U/\partial x)$ is the willingness-to-pay to increase QOL by one unit. Log-linearizing this formula, so that $\hat{p}^j \equiv dp^j/p$, $\hat{w}^j \equiv dw^j/w$ and, normalizing appropriately, $\hat{Q}^j \equiv p_Q \cdot dQ^j/m$, it follows

$$s_y \hat{p}^j - \left(1 - \tau'\right) s_w \hat{w}^j = \hat{Q}^j \tag{3}$$

where $s_y \equiv py/m$ is the expenditure share for home goods and $s_w \equiv w/m$ is the share of income received from labor. The term $s_y \hat{p}^j$ represents how much higher cost-of-living is in percentage terms relative to the national average, while $(1 - \tau')s_w \hat{w}^j$ measures how much higher nominal incomes are after-taxes in percentage terms. Thus (3) equates local QOL with how much local cost-of-living exceeds after-tax nominal income levels, or how low real incomes are after taxes, relative to the national average.

3 Choosing the Right Parameters

Equation (3) makes it clear that measures of QOL depend heavily on the parameters s_y, τ', and s_w used to weight the wage differential, $\hat{w}^j$, and the home-good price differential, $\hat{p}^j$. Most previous studies take $\hat{p}^j$ to refer to housing costs only and choose an s_y of approximately 25 percent.[6] Furthermore, they do not adjust for federal taxes or non-labor income, so that τ' is effectively set to zero and s_w set to one. Applying these choices to equation (3), the previous parametrization implies that when estimating QOL a one percent fall

[6]This includes Berger et al. (1987), Blomquist et al. (1988), Beeson and Eberts (1989), Gyourko and Tracy (1991), and Davis and Orthalo-Magne (2007).

in the wage level is weighted four times more than a one percent rise in housing costs, or

$$\hat{Q}^j = 0.25\hat{p}^j - \hat{w}^j$$

A more realistic parametrization which accounts for non-housing differences in cost-of-living, federal taxes, and non-labor income is $s_y = 0.36, \tau' = 0.32$ and $s_w = 0.75$. These three adjustments all place more weight on housing costs relative to wages. This parametrization weighs a one-percent wage decrease only one-and-a-half times as much as a one percent housing-cost:

$$\hat{Q}^j = 0.36\hat{p}^j - 0.51\hat{w}^j$$

All three adjustments are discussed in greater detail below.

Households are aggregated by weighing each by their respective income. As discussed in Appendix A.1, this produces the most sensible results when we wish to determine how QOL differences across cities affect wages and prices. Thus, the three parameters and the calculated wage and cost differentials should based on income-weighted averages.

3.1 The Expenditure Share for Home Goods

In the previous literature – with the exception of two studies, Gabriel et al. (2003) and Shapiro (2006) – the cost-of-living differential $s_y\hat{p}^j$ is limited to cost differences in shelter and utilities, with an expenditure share between 18 and 28 percent used to weight housing-cost differentials across cities.[7] Yet, cost differences for non-housing goods also affect household consumption and utility, and therefore need to be included. Following Gabriel et. al. (2003), the cost-of-living differential is recast in terms of housing and non-housing goods, rather than in home and traded goods

$$s_y\hat{p}^j = s_{hous}\hat{p}^j_{hous} + s_{oth}\hat{p}^j_{oth} \tag{4}$$

where s_{hous} and the s_{oth} are the expenditure shares for housing and other goods, and $\hat{p}_{hous}$ and $\hat{p}_{oth}$ are the cost differentials for housing and other goods. Income not spent on goods, is saved or paid in taxes,

[7] The term "housing cost" is used here to refer to the cost of housing services for households. This refers to rent or, for homeowners, an imputed rent based on housing prices, which in standard practice, includes the cost of utilities. This practice is followed here since contract rents often include utilities, which make it difficult to disentangle utilities.

including Social Security. Expenditure shares are taken from the Consumer Expenditure Survey (CEX) which reports the share of income spent on shelter and utilities, s_{hous} is 0.22, and the share of income spent on other goods, s_{oth} is 0.56 (Bureau of Labor Statistics 2002).[8]

While data on regional differences in housing costs, used for $\hat{p}_{hous}$, are of good quality, data on regional differences in the cost of other goods, used for $\hat{p}_{oth}$, are limited. The most commonly used data come from the ACCRA Cost-of-Living Index, which measures price differences across expenditure categories, and is meant to be used to measure cost-of-living differences for working professionals. There are several problems with this data, discussed by Koo et al. (2000), as it has a limited coverage of goods, is collected by volunteers, and may exaggerate housing-cost differences across areas. A more practical problem here is that these data are not available at the metropolitan level and only cover a limited number of areas.

Rather than use the ACCRA data directly – as Gabriel et al. (2003) do – these data are used to infer how housing costs predict other prices, so that housing costs alone may be used to measure cost-of-living differences using an adjusted formula. Writing the regression formula for non-housing costs as a function of housing costs $\hat{p}^j_{oth} = b\hat{p}^j_{hous} + e^j$, the cost-of-living equation (4) becomes

$$s_y \hat{p}^j = (s_{hous} + s_{oth} b)\hat{p}^j_{hous} + s_{oth} e^j \tag{5}$$

Indices for housing costs and other costs are calculated from the ACCRA data in 2004, reweighted using expenditure weights from the CEX.[9] A regression using this data, using natural logarithms in levels, reveals that housing costs predict other prices well:

$$\ln p^j_{oth} = \underset{(0.043)}{3.57} + \underset{(0.012)}{0.263} \ln p_{hous} + e^j \qquad R^2 = 0.66$$

With $s_{hous} = 0.22$, $s_{oth} = 0.56$, and the estimated coefficient of $b = 0.26$ in (5), the cost-of-living differential based on the rental price is $0.36\hat{p}^j_{hous}$. If housing costs are used to measure cost-of-living differences, then this implies an effective share of $s_y = 0.36$. On average, goods other than housing account for $(s_{oth}b)/s_y = 41$ percent of the cost-of-living differences in this formula. Because two-thirds of the variance in non-housing costs is predicted by housing costs, 86 percent of all cost-of-living variation is

[8] Note also that Davis and Ortalo-Magne (2007) provide evidence that s_{hous} is fairly constant across time and metropolitan areas, justifying the use of a single number for s_y.

[9] Results using 1999 ACCRA data are almost identical.

captured using housing costs alone with the proposed approximation. Given that the ACCRA data do not cover many cities and are somewhat noisy, using this approximation is a reasonable method of calculating cost-of-living differences across cities. The approximation also implies that previous studies, which used smaller values of s_y, systematically underestimated the cost-of-living differences across cities.[10]

3.2 The Federal Marginal Tax Rate on Labor Income

Federal taxes reduce the disposable income households gain from moving to a city offering higher wages, thereby narrowing income differences across cities. A wage differential of $\hat{w}^j$ that a worker gains from moving to city j is accompanied by the burden of the tax differential of $\tau' \hat{w}^j$, a burden which comes with no additional benefits.

To calculate the marginal tax rate that workers face on their labor income, a base federal income tax rate is taken from TAXSIM (Feenberg and Coutts 1993), which in 2000 calculates that the average dollar is taxed at a rate of 25.1 percent on the margin. Federal payroll taxes paid on the employee side are added to this rate, including 1.45 percent for Medicare (Congressional Budget Office 2005) and half of the 6.2 percent tax for Social Security (OASDI), based on simulations given in Boskin et al. (1987, Table 4). This increases the effective Federal tax rate to 29.6 percent.[11]

As housing is a major determinant of cost-of-living, it is worth considering the tax advantages to owner-occupied housing that the federal tax code provides (see Rosen 1985). As shown in Albouy (2007), these tax advantages, modeled as a tax deduction for home goods, serve to reduce tax burdens in high-cost areas. Yet, for given costs, these advantages tend to penalize those in high QOL areas, where people consume less of all goods, including housing, and thus take smaller deductions. Adjustments for these tax advantages are made according to a formula given in Appendix A.2: their effects on QOL measurement are minor.

Furthermore, state taxes need to be incorporated since, according to the data mentioned below, 44 percent of inter-metropolitan wage differences occur within state. On average, state income and sales taxes

[10] Gabriel et al. (2003) use the ACCRA data directly. Because the data do not cover enough cities, the authors aggregate and perform their analysis by state. They claim that cost-of-living differences within state should be small relative to differences between states, although this may be problematic in large states such as California, Illinois, Michigan, and New York. According to my calculations, the authors used an effective $s_{hous} = 0.22$ and $s_{oth} = 0.38$, and led to an effective s_y of approximately 0.27, quite similar to the other literature.

Shapiro (2006) does not use the ACCRA data directly, but does use it to compute his effective s_y. He regresses the total ACCRA composite index onto the index for housing alone, finding a slope of 0.34, which is used for s_y in conjunction with housing prices. This is similar to the methodology used here, except that I provide a more explicit formula and use weights taken from the CEX rather than the weights provided by ACCRA.

[11] This accounts for the fact that 15 percent of labor earnings are above the OASDI earnings cap and are not taxed.

combined reduce labor earnings by 8.8 percent on the margin.[12] State tax differentials for each city are computed by calculating the within-state wage differential and multiplying it be the corresponding state tax rate, accounting for deductions. Factoring in state taxes increases the effective marginal tax rate to 35.1 percent on average within state. At the national level, since only 44 percent of wage differences occur within state, state taxes can be approximated by a federal tax rate of 32 percent, 2.4 percent higher than the actual federal tax rate. This approximation is not used in the actual QOL estimates, but is used to simplify the equations shown here.[13]

3.3 The Share of Income from Labor

According to the log-linearization, the term s_w needs to account for how much a household's income changes when it moves across cities where wage levels differ. A value of $s_w = 1$ implies that household income rises one-for-one with the wage level before taxes. This ignores a number of income sources, such as from investments in capital or real estate, or intrafamily transfers. These other sources of income are especially important since s_w is an income-weighted average, and as high-income individuals derive a substantial fraction of their income from non-labor sources.[14]

Allowing for non-labor income allows us to include households whose incomes need not depend on the wage levels available in their city, such as retirees. For instance, if retirees decide to locate close to their children, and families share income, then it makes sense to model retirees and their working children together in the location decision, as in a sort of "dynasty." Even if the location decision of retirees is independent of their children, the approximation used may still be valid if sorting issues are not severe. As shown in the Appendix, QOL estimates may reflect a weighted average of the valuations of working and retired households. In this general equilibrium model, this provides a more realistic representative agent

[12] State income tax rates from 2000 are taken from TAXSIM, which, per dollar, fall at an average rate of 4.5 percent. State sales tax data in 2000 is taken from the Tax Policy Center, originally supplied by the Federation of Tax Administrators. The average state sales tax rate is 5.2 percent. Sales tax rates are reduced by 10 percent to accomodate untaxed goods and services other than food or housing (Feenberg et al. 1997), and by another 8 percent in states that exempt food. State-level deductions for housing expenditures, explicit in income taxes, and implicit in sales taxes, are discussed in the Appendix.

[13] A move from a low-wage city to a high-wage city could potentially increase a household's marginal tax rate. Changes in marginal tax rates are largely ignored for several reasons. First, the calculations are only meant to be a first-order approximation. Second, according to several sources (Blundell and MaCurdy 1999, Congressional Budget Office 2003, Kotlikoff and Rapson 2007) effective marginal tax rates do not vary much for households with incomes above for the median, which account for a large majority of households when weighted by income. Below the median, effective marginal tax rates are highly variable, dependent on several household characteristics, and often very high when foregone benefits, such as Medicaid, are considered. Third, calculating the effective marginal tax rate in one location is quite difficult; calculating the effective marginal tax rate in every location would be extremely onerous, computationally opaque, and likely have little effect on the estimates.

[14] In a sense, this term is a product of the log-linearization. It disappears if s_y expresses share of *labor*, not total, income spent on home goods, which according to this parametrization is 48 percent.

setting than in previous work, e.g. Roback (1982), where cities are inhabited by workers who receive all of their income from labor, and capital and land labor income goes to "absentee landlords" located somewhere off shore.

Based on information from several sources, Krueger (1999) finds that the share of income to labor is close to 0.75; this estimate is used here. Accordingly, an average household moving to a city with 10 percent higher wages sees its before-tax nominal income rise by 7.5 percent.

The figure of 75 percent is corroborated by survey data on individuals' net worth and income in the Survey of Consumer Finances (SCF) in 2001. The average net worth of households is $341,300, 6.9 times the average household income of $49,500. At a modest real interest rate of 3.5 percent, the flow value of this worth is $11,946, or 24.1 percent of income.[15]

4 Data and the Calculation of Wage and Housing-Cost Differences

Wage and housing-cost differentials are estimated using the 5 percent sample of Census data from the 2000 Integrated Public Use Microdata Series (IPUMS). Cities are defined at the Metropolitan Statistical Area (MSA) level using 1999 OMB definitions. Consolidated MSAs are treated as a single city (e.g. San Francisco includes Oakland and San Jose), as well as all non-metropolitan areas within each state. This classification produces a total of 290 areas of which 241 are actual metropolitan areas and 49 are non-metropolitan areas of states. More details are provided in Appendix C.

The 5 percent Census sample is used in its entirety for the first time in this type of study, guaranteeing the precision of the wage and price and differentials: the average city has 14,199 wage and 11,119 housing-price observations; the smallest city has 1093 wage and 817 housing-price observations.

Inter-urban wage differentials are calculated from the logarithm of hourly wages for full-time workers, ages 25 to 55. These differentials need to control for skill differences across workers in cities to provide a meaningful analogue to the representative worker in the model. To take this into account, log wages are regressed on city-indicators (μ^j) and on extensive controls (X_i^{wj}) – interacted with gender – education,

[15] Of course there are a number of complications with all of the parameter choices since we need to know the parameters for the set of potential movers who determine how quality-of-life in different cities is valued. These movers may be younger and more educated than the averages represented by the parameters.

experience, race, occupation, industry, and veteran, marital, and immigrant status, in an equation of the form

$$\log w_i^j = X_i^{wj} \beta^w + \mu^j + e_i^{wj} \tag{6}$$

The coefficients μ^j are used as the wage differentials, and are interpreted as the causal effect of city characteristics on a worker's wage.[16]

To identify these differentials correctly, workers cannot sort across cities according to their unobserved skills, an assumption which is unlikely to hold completely. Glaeser and Maré (2001) argue that up to one third of the urban-rural wage gap could be due to selection. If this is true, then measured wage differentials in larger cities are biased upwards, causing QOL in these cities to be underestimated. It is also possible that the estimated wage differentials are too small as some of the worker characteristics controlled for, such as occupation or industry, could depend on where the worker locates.[17]

Both housing values and gross rents, including utilities, are used to calculate housing-cost differentials. As with previous studies, imputed rents are converted from housing values using a discount rate of 7.85 percent (Peiser and Smith 1985), with utility costs added, to make the imputed rents comparable to gross rents. To avoid measurement error from imperfect recall or rent control, the sample includes only units that were acquired in the last ten years. Housing-cost differentials are calculated in a manner similar to wage differentials, using a regression of gross rents on flexible controls (X_i^{pj}) - interacted with tenure - for size, rooms, acreage, commercial use, kitchen and plumbing facilities, type and age of building, and the number of residents per room.

$$\log p_i^j = X_i^{pj} \beta^p + \nu^j + e_i^{pj} \tag{7}$$

The coefficients ν^j are used as housing-cost differentials. Proper identification of housing-cost differences

[16]The log functional form is supported by work in Blomquist et al. (1988), who use Maximum Likelihood estimation with a Box-Cox transformation of $(w^\gamma - 1)/\gamma$. They find that a value of $\gamma = 0.1$, close to the logarithmic value of $\gamma = 0$, best fits the data. The same holds true using the 2000 Census data for both wages and housing costs, in a specification with MSA dummy variables. Furthermore, the Box-Cox estimation finds the regression of $(\ln w_i^j - X_i^{wj} \hat{\beta}^p)$ on the MSA dummies fits best in a linear fashion.

[17]Adjustment for unionization rates was also considered based on data from Hirsch and Macpherson (2003). MSA unionization rates in 2000 range from 34.4 percent MN in Duluth to 0.6 percent in Hickory, NC. Lewis (1986) concludes that unions raise wages by approximately 15 percent. If somehow these higher wages are not absorbed by a higher cost-of-living – perhaps through restricted entry into union jobs – then this could cause after-tax real incomes to be up to 2.5 percent higher in Duluth relative to Hickory for reasons independent of local amenities. Thus, omitting unionization could cause quality-of-life to be underestimated in highly unionized areas. Adjusted estimates quality-of-life estimates were calculated using an adjustment for unionization: the resulting measures were only slightly different than the ones reported. Since it is unclear whether or not unions actually raise wages (Dinardo and Lee 2004), and whether or not higher wages from unions are absorbed by cost-of-living, adjustments for unionization are not made to the estimates.

requires that average unobserved housing quality does not vary systematically across cities.[18]

Wage and housing-cost differentials are measured logarithmically, so that QOL in (3) is measured as the fraction of income a household is willing to give up (or must be paid if negative) to live in a city, rather than an in an average city. Most studies have measured QOL in dollar terms, as in (2). As explained in Appendix A.3, when aggregating across individuals with different incomes, the choice of logarithms applies best when households value the amenities QOL depends on proportionally to their income.

Empirically, the semi-logarithmic functional form in (6) and (7) is supported by work in Blomquist et al. (1988), who use maximum likelihood estimation with a Box-Cox transformation of the form $\left(w^{\gamma}-1\right)/\gamma$. They find that a value of $\gamma=0.1$ best fits the data for wages, and $\gamma=0.2$ for housing costs, both of which are fairly close to $\gamma=0$, which corresponds to the logarithm. Similar estimates (not shown) using much larger samples from the 2000 Census, and with MSA dummy variables on the right-hand side (rather than measured amenities), result in estimates of γ close to 0.1 for both wages and housing costs. This is not dependent on the control variables X, as the same is true if the predicted effects of the controls are first subtracted from wages and prices, and the residuals are then regressed on the MSA dummies. Thus, wage and price differentials across types are best expressed in percentage terms rather than in dollar amounts.

Data on amenities are taken from various sources, and are described in greater detail in Appendix C. Amenities are divided into two categories. The first are natural site-specific characteristics such as climate and geography, which are exogenous to a city's inhabitants. These include inches of precipitation, heating degree days and cooling degree days per year, sunshine out of the fraction possible, and whether a metropolitan area is adjacent to a coast, either on the sea or the Great Lakes. The second category of amenities are those that depend on a city's inhabitants. These amenities are measured using violent crimes per capita, the median Air Quality Index over the year, restaurants and bars per capita, the Arts & Culture Index from *Places Rated*, an index of residential land use regulation, an index of urban sprawl, local expenditures net of local taxes, and the number of federal dollars spent locally, with the last two expressed as a fraction of income.

[18]This issue may not be grave as Malpezzi et. al. (1998) determine that housing price indices derived from the Census in this way perform as well or better than most other indices.

There is also a question of whether housing prices reflect differences in housing costs as accurately as rents do. Across most cities, rent and housing-price differences are fairly similar. In cities with housing-cost differentials above 0.2, such as Boston, Los Angeles, New York, and San Francisco, housing-price differentials are significantly larger than rent differentials. Since housing prices should reflect the present value of the stream of future rents, this suggests that rents are expected to rise in these cities. Using only rent differentials would result in lower QOL estimates for these cities. This approach is problematic as rent control may artificially depress rents in these cities, and as home-ownership rates decline significantly with price-to-rent ratios. Rental and owner-occupied units were both used here in order to avoid these issues and preserve comparability with previous QOL estimates.

5 Quality-of-life Estimation and Rankings

5.1 Calculating and Visualizing Quality-of-Life Estimates

With the wage and housing-cost differentials and the chosen parameters, QOL can be estimated directly from (3). Figure 1 graphs the wage and price differential for different cities, with $\hat{w}$ on the horizontal axis and $\hat{p}$ on the vertical axis. This figure can be used to see how QOL is estimated by rewriting (3) as

$$\hat{p}^j = \frac{(1-\tau')\, s_w}{s_y}\hat{w}^j + \frac{1}{s_y}\hat{Q}^j \tag{8}$$

This is an equation for an indifference curve for a given QOL differential, $\hat{Q}^j$. The solid line in Figure 1 corresponds to the indifference curve with $\hat{Q}^j = 0$: it passes through the origin and has a slope equal to 1.46. Along this line prices rise with wage levels in the right proportion so that after-tax real incomes remain constant, as does the inferred QOL. Cities above this line have a high cost-of-living relative to local income levels, and thus a higher inferred QOL, equal to s_y times the vertical distance from the solid line. The opposite is true of cities below the line.

Table 1 lists wage, housing-cost, and quality-of-life differentials for several metropolitan areas, the nine Census divisions, and for metropolitan areas of different population sizes. Appendix Table A presents estimates for all 241 metro areas and 49 non-metropolitan areas of states. These estimates are favorable to locations near the Pacific Coast, with Honolulu and Santa Barbara almost tied for first place. Other large cities in the West do quite well: San Francisco, San Diego, Los Angeles, Seattle, and Portland are all in the top 40. On the East Coast, Naples, FL ranks highest, with Boston the best among large cities, although Miami and New York are still in the top 40. Cities in the Midwest and in the South generally fare poorly, although New Orleans and Chicago are above average.[19]

QOL estimates using the unadjusted parametrization, typical of the previous literature, may be visualized using the dashed line in Figure 1. This line has a higher slope of 4, implying that housing costs must rise more quickly with wages to keep households indifferent. Unlike the solid line, the dashed line passes under most of the smaller cities in the sample, so that they have a high inferred QOL, and above most of the larger cities, so that they have a low inferred QOL.[20]

[19]The reader should be reminded that these are consolidated metropolitan areas, with only the first city listed in Table 1 (full names are shown in Table A). For example, Washington, DC also includes Baltimore, MD.

[20]The extreme case where housing costs are ignored and nominal wages are used to measure QOL, corresponds to the case where this line is given by the vertical axis, and QOL is measured as the horizontal distance from this axis.

The QOL estimates using the adjusted parametrization are graphed against the QOL estimates using the unadjusted parametrization in Figure 2. Cities above the diagonal have higher adjusted estimates than unadjusted estimates. The choice of the parametrization is obviously quite important as these estimates are substantially different. When cities are weighted according to their workforce, the correlation between the adjusted and unadjusted QOL estimates is actually negative.[21]

5.2 Quality of Life and City Size

The largest discrepancies between adjusted and unadjusted estimates occur in large cities, where wages and costs are high, and smaller cities, where the opposite is true. The relationship between QOL and city size is shown in Figure 3a for adjusted estimates and 3b for unadjusted estimates. While the adjusted estimates reveal a mild positive relationship between population size and QOL, the relationship with the unadjusted estimates is starkly negative.[22]

Because of agglomeration economies, worker productivity increases with city size, so that larger cities pay higher wages (Rosenthal and Strange 2004), which, holding quality of life constant, are neutralized via higher costs-of-living. As seen clearly in (8), workers bid up the cost-of-living in a city either to enjoy its amenities or to be close to a well-paying job.

The unadjusted parametrization overstates the income gains that households receive from moving to larger cities, and understates the higher cost-of-living they endure. This causes real incomes to be overestimated and QOL to be underestimated in larger cities. Explained in reverse, this logic also explains why real incomes were underestimated and QOL overestimated in smaller cities with lower wages and prices.

5.3 An Empirical Test of the Indifference Slope

A regression line of housing-cost differentials predicted by the wage differentials is shown in Figure 1. Controlling for amenities, the slope of this line can be used to test the parametrization used to measure QOL.

[21]In essence, most previous studies used the projection of the unadjusted QOL estimates onto the space of individual amenities used in their regression analysis, a procedure which may have mitigated some of the problems with the unadjusted parametrization. Beeson and Eberts (1989) are the first authors that used the aggregate QOL measure seen here, although their study was limited to the 35 largest cities, largely obscuring the implied negative relationship between QOL and city size. Preliminary analysis using 1980 Census data, used by Blomquist et al. (1988), Beeson and Eberts (1989), and Gyourko and Tracy (1991) suggests that unadjusted QOL estimates in 1980, albeit substantially different from adjusted QOL estimates and subject to the same biases, are more positively correlated than they are in 2000.

[22]Adjusted QOL estimates from 1980 still reveal a positive, albeit statistically insignificant, relationship between QOL and city size. Whether this is because urban disamenities, such as pollution, were more severe in 1980 deserves further investigation.

The difference between the regression line and the calibrated indifference curve implies a statistical relationship between QOL and wage levels, which increase with city size. Write the linear projection of $\hat{Q}^j = b_Q \hat{w}^j + \eta^j$, where by construction $E\left[\eta^j | \hat{w}^j\right] = 0$. The expectation of $\hat{p}^j$ conditional on $\hat{w}^j$ in equation (8) is then

$$E\left[\hat{p}^j | \hat{w}^j\right] = \left[\frac{(1-\tau')\, s_w}{s_y} + \frac{b_Q}{s_y}\right] \hat{w}^j \equiv b_w \hat{w}^j$$

The slope of the regression line in Figure 1, and reported in Table 2, is the slope of the indifference curve under the true parametrization, whatever it may be, *plus* a term which depends on how QOL is correlated with wage levels. If wages and QOL are uncorrelated, then $b_Q = 0$, and the indifference curve is given by the regression line.[23] If instead the correct parametrization is known, then b_Q/s_y can be estimated by subtracting $(1-\tau')\, s_w/s_y$ from b_w, which is reported in the bottom row of Table 2. The adjusted parametrization implies a positive relationship between nominal wage levels and QOL; the unadjusted parametrization implies that it is highly negative.

The parametrization test is inspired by equation (8), which implies that if actual QOL, or all of the amenities which cause it, could be perfectly observed and included in the regression equation of $\hat{p}^j$ on $\hat{w}^j$ as a control variable, then b_w would provide an unbiased estimate of the true value of $(1-\tau')\, s_w/s_y$. Since actual QOL cannot be observed directly, a second-best approach is to include amenities which likely to affect QOL as control variables in a regression of of $\hat{p}^j$ on $\hat{w}^j$ and to test whether the estimated b_w is significantly different from the slope implied by the parametrization. This is done in columns 3 and 4 of Table 2. The estimates of b_w are very close to the slope of the indifference curve implied by the adjusted parametrization, lending support to the choice of the parameters and the QOL estimates that result from it. On the other hand, this test soundly rejects the unadjusted parametrization, which can only be correct if the QOL residual not explained by the included amenities is very negatively correlated with wage levels.

5.4 Comparison with *Places Rated Almanac* Rankings

Another check on the validity of the hedonic QOL estimates is to consider how they correlate with other estimates of quality-of-life based on non-hedonic methods, such as those in the *Places Rated Almanac* by Savageau (1999). As explained in Becker et al. (1992), *Places Rated* determines its overall livability index by rating cities according to nine dimensions: climate, crime, health care, transportation, education, arts

[23] This corresponds to the case implicitly assumed in Glaeser, Kolko, and Saiz (2002).

and culture, recreation, housing costs, and job outlook. The rankings of these nine ratings are then added up to determine the overall ranking. The choices made to compute these rankings involve a number of subjective decisions, leading many to question their results. Yet at the same time the final results have a certain plausibility that help account for their popularity. Previous hedonic QOL estimates are generally uncorrelated with these rankings, casting doubt on both methodologies.

As seen in columns 1 and 2 of Table 3, the correlation between the adjusted hedonic ranking and *Places Rated* QOL rankings is in fact positive, with correlation coefficient of 0.29. At the same time, the correlation with the unadjusted hedonic measures is negative at -0.25.

One issue with comparing these rankings is that *Places Rated* incorporates cost-of-living and job-market components in its ranking, elements which do not belong in the hedonic QOL ranking since these components are used to infer the value of the other amenities in the city. The two methodologies are quite different: the hedonic method assumes that in equilibrium, no city is better than any other once cost-of-living and labor-market opportunities are accounted for; the *Places Rated* method attempts to find the cities which offer the most valuable amenities at the lowest cost, producing recommendations similar to the "Best Value" recommendations seen in *Consumer Reports*. The *Places Rated* rankings can be recalculated by removing the housing cost and job outlook components. As seen in columns 3 and 4, these recalculated *Places Rated* rankings are more positively correlated with the adjusted hedonic ranking and more negatively correlated with the unadjusted ranking.

6 Quality of Life and Individual Amenities

6.1 Dependence of Quality of Life on Amenities

The QOL estimates may be used to determine how much value households put on living with particular amenities simply by estimating the city-level regression

$$\hat{Q}^j = \sum_k \pi_k Z_k^j + \varepsilon^j \tag{9}$$

where

$$\pi_k = -\frac{p_Q}{m}\frac{\partial \widetilde{Q}}{\partial Z_k}$$

π_k measures the percentage of income an individual is willing to sacrifice to live in a city with one more unit of this amenity. The error term ε^j contains measurement error, unobserved amenities, differences in housing quality (which make it larger), and differences in worker ability (which make it smaller).

Beginning with Rosen (1979), previous studies have typically estimated amenity values by directly estimating individual-level wage and housing-cost equations of the form (6) and (7), except with a vector of amenity variables in place of MSA dummy variables. An amenity's value is calculated by subtracting its coefficient from the wage equation from its coefficient in the housing-cost equation, using the same weights in (3) implied by the parametrization. This one-step method produces almost the exact same estimates of π_k as the two-step method outlined above so long as the same control variables are used in the individual wage and housing-cost equations, and $\hat{Q}^j$ calculated with the same weights. Standard errors from the one-step method tend to be too small, as amenities only vary across cities, and not across individuals within a city, so that the effective sample size is the number of cities, not the number of individuals in the sample (Gyourko, Kahn, and Tracy 1999). The two-step method, on the other hand, provides conservative standard errors (Wooldridge 2003). Furthermore, the two-step method reports a coefficient of multiple correlation (R-squared) from equation (9), which calculates what percentage of QOL variation is explained by the included amenities.[24]

Because previous work over-weighted wage differences and under-weighted price differences, previous amenity value estimates using this methodology are inaccurate and need to be revised. Regardless of the innovations introduced here, inferring amenity values from inter-city differences in wages and housing costs faces a number of potential pitfalls. Across cities, there is a high degree of collinearity between the different amenity variables, making it difficult to obtain precise estimates, and limiting the number of amenity valuations that can be calculated. There are a number of amenities, such as the presence of a charming downtown quarter, that are difficult to measure, and problems from omitted variable bias are potentially severe. Furthermore, artificial amenities may be highly endogenous, and estimates of their values should be subject to additional skepticism.

Means and standard deviations of the amenity variables are shown in Appendix Table B. Regression results using both the adjusted and unadjusted QOL estimates as dependent variables are reported in Table 4. Columns 1 and 2 give results using only natural amenity variables. In column 1 we see that the estimates

[24]Clustering at the city level in the one-step method produces standard errors for amenity values similar to those in the two-step method.

based on adjusted QOL indicate that households pay substantially to live in areas with sunshine, close to a coast, and free of either extreme cold or heat. The R-squared of 62 percent indicates that these four variables alone are enough to explain a majority of the variation in QOL.[25] The results based on unadjusted QOL estimates, in column 2 are often counter-intuitive. They imply that individuals are indifferent towards sunshine and excessive heat, and pay heavily to avoid coasts. These variables also have much less explanatory power.

Columns 3 and 4 add artificial amenities which depend on a city's human population. In column 3, using adjusted QOL, estimates reveal a high willingness-to-pay to avoid urban disamenities such as air pollution, urban sprawl and violent crime, although the latter's value is not measured precisely. Households also pay to be near cultural amenities, such as restaurants and bars, as well as arts and culture. Interestingly, high levels of residential land-use regulation do not appear to significantly affect QOL, at least at the metropolitan level. Federal spending in one's city is valued by households, although only by roughly half its dollar cost. Local expenditures net of taxes have a positive but insignificant effect on QOL. Most of the estimates based on unadjusted QOL in column 4 are insignificant, while the significant estimates pose problems: households have a strong aversion to art and culture, as this is typical of big cities; on the other hand, urban sprawl appears to be an amenity.

The estimated value of the weather amenities is considerably stable across both specifications. From the estimates on heating and cooling degree days, it appears that households are willing to pay even more to avoid hot summers than to avoid cold winters. If climate change increases the number of cooling degrees by the same number that it reduces the number of heating degree days, the estimates imply that households will be worse off. The estimated value for sunshine says that households are willing to sacrifice 3.4 percent of their income for one additional sunny day a week. The estimated value for living near the coast is halved from 3.6 percent in column 1 to 1.8 percent in column 3 as valuable artificial amenities are disproportionately located along the coast – while it is difficult to be sure of this value, the estimate appears entirely plausible.[26]

[25] Excluding precipitation does not change the R-squared of 62 percent. Other variables related to climate and geography, including latitude, wind speed, and humidity are not significant in these regressions. Separating Great Lake coasts from sea coasts results in slightly higher, but insignificantly different, valuations for sea coasts, although even these differences disappear once artificial amenities are included.

[26] Commuting time is not entered as an independent variable as this is an endogenous variable from the individual's viewpoint. Workers should be willing to commute longer hours in order to live in a more desirable metropolitan area. The possibility of using commuting time to infer QOL may deserve serious consideration in further research.

6.2 Amenities and City Size

It is well established that certain amenities and disamenities vary strongly with population size: crime rates, pollution, and congestion typically increase with population, as do consumption and cultural opportunities (Glaeser, Kolko and Saiz 2001). Adding population as a control variable in (9) serves to control for many of the amenities, observed or not, that are correlated with city size. This way, amenity valuations are based off of variations in amenities among cities of the same size.

The results of these regressions are presented in Table 5. Columns 1 and 2 report results from the regression shown in Figure 3 that population appears to be somewhat positively related to the adjusted QOL estimates, but very negatively with the unadjusted QOL estimates. Adding natural amenities in column 3 we see that the relationship between population and adjusted QOL disappears. These natural amenities explain the small but positive relationship observed between QOL and city size. Column 5, which presents how the log of population depends on these amenities, reveals that the key natural amenity is coastal location, as coastal cities are on average 3 times as large as non-coastal cities.

Results in columns 6, 7, and 8 do not change these conclusions. The amenity valuations from the adjusted parametrization are largely unaffected by including population, although certain valuations are less precisely estimated, such as those for cultural amenities, as these are highly correlated with population size.

7 Taste Heterogeneity and Housing-Supply Restrictions

Recent work by Quigley and Raphael (2005), Glaeser et al. (2005), and Gyourko et al. (2006) argues that supply restrictions on housing in certain areas, such as California, have caused housing costs in these areas to increase disproportionately. Yet, in the traditional hedonic framework with homogenous households, supply restrictions in a single city raise housing costs everywhere uniformly; restrictions do not affect the relative price in that city, holding wages constant, although it should affect population size.

7.1 Modeling Heterogeneity and Imperfect Mobility

Although modeling heterogenous households can produce perplexing results, it is possible to incorporate a continuous form of heterogeneity into the standard hedonic model that is fairly tractable and elegant. Suppose that QOL in city j is dependent on a universal component Q_0^j and an a component that varies by household i, ξ_i^j, so that overall QOL for household i in city j is given by $Q_i^j = Q_0^j \xi_i^j$. Furthermore, assume that ξ_i^j is Pareto distributed with parameter $1/\psi$

$$F(\xi_i^j) = 1 - (\underline{\xi}^j/\xi_i^j)^{1/\psi},\ \xi_i^j \geq \underline{\xi}^j$$

A higher ψ implies greater heterogeneity in preferences, with $\psi = 0$ corresponding to the standard model. For simplicity, assume that the outside utility for households is given by a constant $\bar{u}$. For some given constant, $N_{\max}^j$, and some marginal household k with taste parameter ξ_k^j, the population in city j is $N^j = N_{\max}^j \Pr(\xi_i^j \geq \xi_k^j) = N_{\max}^j[1 - F(\xi_k^j)] = N_{\max}^j(\underline{\xi}/\xi_k^j)^{1/\psi}$. Hence,

$$\log N^j = \ln N_{\max}^j + \frac{1}{\psi}[\log \underline{\xi} - \log \xi_k^j] \tag{10}$$

Fully differentiating the equilibrium condition (1), treating N as an endogenous variable, and noting that (10) implies $\hat{N}^j = -\hat{\xi}_k^j/\psi$, leads to an extended version of equation (3)

$$s_y \hat{p}^j - s_w(1 - \tau')\hat{w}^j = \hat{Q}_0^j - \psi \hat{N}^j \tag{11}$$

This says that the QOL for the marginal household of city j decreases with population size, as more marginal households enter a city. In order to decrease the city population by a full one percent, city residents need to see their real income drop by ψ percent.

Holding $\hat{w}^j$ and $\hat{Q}_0^j$ constant, (11) provides a downward-sloping demand curve for residence in city j given in terms of home-good prices as $\hat{N}^j = -(s_y/\psi)\hat{p}^j$. Holding $\hat{p}^j$ and $\hat{Q}_0^j$ constant, (11) provides an upward-sloping local-labor supply curve $\hat{N}^j = [s_w(1-\tau')/\psi]\,\hat{w}^j$. In general, ψ parametrizes household mobility: $\psi = 0$ implies perfect mobility, as in the standard model, while $\psi = \infty$ implies perfect immobility. Mobility may be thought to increase with time, so that ψ decreases with the time elapsed after the change-inducing event in question.

7.2 Effect of a Quality-of-Life Improvement

This model has several applications. Two simplified cases are examined here: the effect of an exogenous increase in an amenity, and the effect of a supply restriction.[27] For ease, assume that the total amount of traded good produced in city j is $X^j = A_X^j N^j h^j$, so that wages are determined exogenously by productivity

[27] An application of this model to tax incidence in an even richer setting is found in Albouy (2008).

in the export sector, $w^j = A_X^j$. The total amount of the home good $Y^j = N^j y^j$ is produced directly from land $\bar{L}_j$, which is fixed in supply. Each city may differ in its productivity in home goods, A_Y^j, so that supply $Y^j = A_Y^j \bar{L}^j$. Because markets are competitive, all payments to home goods go to land, and so $r^j \bar{L}^j = p^j Y^j = p^j A_Y^j \bar{L}^j$, implying $r^j = p^j A_Y^j$.

Now assume that there is an exogenous increase in quality-of-life given by $d\hat{Q}_0^j > 0$, so that $s_y d\hat{p}^j = d\hat{Q}_0^j - \psi \hat{N}^j$. Since Y^j is fixed, $d\hat{N}^j = -d\hat{y}^j = -\eta^u \hat{p}^j = |\eta^u| \hat{p}^j$ where $\eta^u < 0$ is the uncompensated price elasticity of housing. As a result, both home-good prices and population size increase

$$d\hat{p}^j = \frac{1}{s_y + \psi |\eta^u|} d\hat{Q}_0^j$$
$$d\hat{N}^j = \frac{|\eta^u|}{s_y + \psi |\eta^u|} d\hat{Q}_0^j$$

In this case, the value of the amenity improvement is not fully captured by the price change alone. Migrants compelled to move into the city to take advantage of the improved amenity value the city less in other ways. Thus prices are lower relative to the case where all households are homogenous. Welfare of inframarginal residents of city j increases by

$$d\hat{Q}_0^j - s_y d\hat{p}^j = \psi d\hat{N}^j = \frac{\psi |\eta^u|}{s_y + \psi |\eta^u|} d\hat{Q}_0^j$$

In the case where $\psi \to \infty$, no inflow of population occurs, prices do not rise, and residents receive a welfare gain of $d\hat{Q}_0^j$.

7.3 Effect of Supply Restrictions

Suppose that housing supply restrictions reduce the amount of home goods that can be produced from land, causing $d\hat{A}_Y^j < 0$. It then follows that $d\hat{A}^j = d\hat{Y}^j = d\hat{y}^j + d\hat{N}^j = \eta^u d\hat{p}^j + d\hat{N}^j$. Combining this with $s_y d\hat{p}^j = -\psi dN^j$ produces the results

$$d\hat{p}^j = -\frac{\psi}{s_y + \psi |\eta^u|} d\hat{A}_Y^j$$
$$d\hat{N}^j = \frac{s_y}{s_y + \psi |\eta^u|} d\hat{A}_Y^j$$

Thus, without heterogeneity $\psi = 0$, prices will not increase with supply restrictions and the population will decrease proportionally with the home-good supply.[28] The value of land, r^j, will likely decrease as $d\hat{r}^j = d\hat{p}^j - dA_Y^j$, implying

$$d\hat{r}^j = \frac{s_y + \psi\left(|\eta^u| - 1\right)}{s_y + \psi\,|\eta^u|} d\hat{A}_Y^j$$

8 Conclusion

The population size of a metropolitan area does not appear to have an impact on its QOL: it appears that amenities of urban life, such as those from cultural and consumption opportunities, largely compensate for the disamenities, such as pollution and crime. Thus, in measuring welfare changes over time, there is no need to subtract QOL losses due to urbanization from national-income growth, at least not currently in the United States. Furthermore, the lack of a relationship between QOL and city size suggests that negative externalities from greater urban density are likely few, or that such externalities are mitigated through typical urban management. Empirically, this seems to undermine the rationale that cities are too large, and that federal policies should create greater population balance by inducing households to leave larger cities: such policies may be welfare-reducing as they would discourage individuals from living in areas where they most prefer. Such may be said of federal taxes, which discourage individuals from living in larger cities, where nominal wages are high, but real wages are no higher than in the rest of the county.

Methodologically, it is encouraging that hedonic estimates, based on economic theory, are not at odds with popular notions of what cities are indeed nice places to live. Estimates of the value of individual amenities suggest that popular ratings such as *Places Rated* should consider placing additional weight on factors such as weather and geographic location when producing their rankings. These estimates also raise additional concern over global warming as they find that households have a higher willingness-to-pay to avoid heat than to avoid cold.

The fact that a majority of QOL differences are explained by natural amenities that cannot easily be changed has interesting policy implications. Perhaps greater attention should be placed on land-use policies which allow households to move to areas where they can enjoy the amenities they value most. Restrictions on housing development, such as in the clement, coastal areas of California, deprive households nation-

[28]This corresponds closely to the result of Aura and Davidoff (forthcoming) who calibrate the elasticity of prices with respect to housing supply. Establishing this equivalence requires noting that $f(\xi_j)\xi_j/[1 - F(\xi_j)] = 1/\psi$ and that $\xi_j = \theta_j/s_y$ in the Aura-Davidoff model. The parameter ψ can be adapted to their calibrations by using $\psi = s_y \ln r/(\ln 2f)$, where r is "Median Valuation θ/price q" and f is "Market Size/National Population."

wide from living in areas that would make them better off. While these restrictions may help to bolster local housing prices by making local amenities more scarce, ultimately they lower the value of local land. Furthermore, although restrictions which limit urban growth may limit congestion, they are unlikely to improve the QOL of their residents in the long run as they prevent the production of consumption and cultural opportunities that arise in larger cities.

References

Albouy, David (2008), "The Unequal Geographic Burden of Federal Taxation" National Bureau of Economic Research Working Paper No. 13995, Cambridge, MA.

Aura, Saku and Thomas Davidoff (forthcoming) "Supply Constraints and Housing Prices." *Economics Letters*.

Becker, Richard A., Lorraine Denby, Robert McGill, and Allan R. Wilks (1987) "Analysis of Data From the *Places Rated Almanac.*" *The American Statistician*, 41, pp. 169-186.

Beeson, Patricia E. (1991) "Amenities and Regional Differences in Returns to Worker Characteristics." *Journal of Urban Economics*, 30, pp. 224-241.

Beeson, Patricia E. and Randall W. Eberts (1989) "Identifying Productivity and Amenity Effects in Interurban Wage Differentials." *The Review of Economics and Statistics,* 71, pp. 443-452.

Berger, Mark C. (1987) "A Revealed-Preference Ranking of Quality of Life for Metropolitan Areas." *Social Science Quarterly,* 68, pp. 761-778.

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

Blundell, Richard and Thomas MaCurdy (1999) "Labor Supply." in O. Ashenfelter and D. Card, eds. *Handbook of Labor Economics,* Vol 3A. Amsterdam: North Holland.

Boskin, Michael J., Laurence J. Kotlikoff, Douglas J. Puffert, and John B. Shoven (1987) "Social Security: A Financial Appraisal Across and Within Generations." *National Tax Journal,* 40, pp. 19-34.

Brady, Peter, Julie-Anne Cronin and Scott Houser (2003) "Regional Differences in the Utilization of the Mortgage Interest Deduction." *Public Finance Review,* 31, pp. 327-366.

Burchfield, Marcy, Henry G. Overman, Diego Puga, Matthew A. Turner (2006) "Causes of Sprawl: A Portrait from Space." *Quarterly Journal of Economics*, 121, pp. 587-633.

Bureau of Labor Statistics (2002) "Consumer Expenditures in 2000." Washington D.C.: Government Printing Office.

Burnell, James D. and George Galster (1992) "Quality-of-life Measurements and Urban Size: An Empirical Note." *Urban Studies*, 29, pp. 727-735.

Clark, David, James R. Kahn and Haim Ofek (1988) "City Size, Quality of Life, and the Urbanization Deflator of the GNP: 1910-1984." *Southern Economic Journal,* 54, pp. 701-714.

Congressional Budget Office (2003) "Effective Federal Tax Rates, 1997 to 2000." Washington D.C.: Government Printing Office.

Congressional Budget Office (2005) "Effective Marginal Tax Rates on Labor Income." Washington D.C.: Government Printing Office.

Davis, Morris and Francois Ortalo-Magne (2007) "Household Expenditures, Wages, and Rents." mimeo, University of Wisconsin.

Dinardo, John and David S. Lee (2004) "Economic Impacts of New Unionization On Private Sector Employers: 1984-2001." *Quarterly Journal of Economics*, 119, pp. 1383-1441.

Elgin, Duane, Tom Thomas, Tom Logothetti and Sue Cox (1974) "City Size and the Quality of Life: An Analysis of the Policy Implications of Continued Population Concentration" U.S. Department of Health, Education & Welfare.

Ermisch, J.F., J. Findlay, and K. Gibb (1996) "The Price Elasticitity of Housing Demand in Britain: Issues of Sample Selection." Journal of Housing Economics, 5, pp. 64-86.

Feenberg, Daniel R. and Elisabeth Coutts (1993), "An Introduction to the TAXSIM Model." *Journal of Policy Analysis and Management*, 12, pp. 189-194.

Feenberg, Daniel R., Andrew W. Mitrusi, and James M. Poterba (1997), "Distributional Effects of Adopting a National Retail Sales Tax." National Bureau of Economic Research Working Paper No. 5885, Cambridge, MA.

Fuchs, Victor M. (1967) *Differentials in Hourly Earnings by Region and City Size, 1959*. National Bureau of Economic Research, Occasional Paper 101.

Gabriel, Stuart A., Joe P. Mattey, William L. Wascher (2003) "Compensating Differentials and Evolution in the Quality-of-life among U.S. States." *Regional Science and Urban Economics*, 33, pp. 619-649.

Gabriel, Stuart A. and Stuart S. Rosenthal (2004) "Quality of the Business Environment versus Quality of Life: Do Firms and Households Like the Same Cities?" *The Review of Economics and Statistics*, 86, pp.548-444.

Glaeser, Edward L., Jed Kolko, and Albert Saiz (2001) "Consumer City." *Journal of Economic Geography*, 1, pp. 27-50.

Glaeser, Edward L. Joseph Gyourko and Raven E. Saks (2005) "Why Have Housing Prices Gone Up?" *American Economic Review Papers and Proceedings*, 95, pp. 329-333.

Glaeser, Edward L. and David Maré (2001) "Cities and Skills." *Journal of Labor Economics,* 19, pp. 316-342.

Goodman, Allen C. (1988) "An Econometric Model of Housing Price, Permanent Income, Tenure Choice, and Housing Demand." *Journal of Urban Economics,* 23, pp. 327-353.

Goodman Allen C. (2002) "Estimating Equilibrium Housing Demand for 'Stayers.'" *Journal of Urban Economics*, 51, pp. 1-24.

Goodman, Allen C. and Masahiro Kawai (1986) "Functional Form, Sample Selection, and Housing Demand." *Journal of Urban Economics*, 20, pp. 155-167.

Greenwood, Michael J., Gary L. Hunt, Dan S. Rickman, and George I. Treyz (1991) "Migration, Regional Equilibrium, and the Estimation of Compensating Differentials." *American Economic Review,* 81, pp. 1382-1390.

Gyourko, Joseph and Joseph Tracy (1989) "The Importance of Local Fiscal Conditions in Analyzing Local Labor Markets." *Journal of Political Economy,* 97, pp. 1208-31.

Gyourko, Josesph and Joseph Tracy (1991) "The Structure of Local Public Finance and the Quality of Life." *Journal of Political Economy*, 99, pp. 774-806.

Gyourko, Joseph, Matthew Kahn and Joseph Tracy (1999) "Quality of Life and Environmental Comparisons." in E. Mills and P. Cheshire, eds. *Handbook of Regional and Urban Economics,* Vol 3. Amsterdam: North Holland.

Gyourko, Joseph, Christopher Mayer, and Todd Sinai (2006) "Superstar Cities." National Bureau of Economic Research Working Paper No. 12355, Cambridge, MA.

Gyourko, Joseph, Albert Saiz, and Anita A. Summers (forthcoming) "A New Measure of the Local Regulatory Environment for Housing Markets: The Wharton Residential Land Use Regulatory Index" *Urban Studies*.

Hirsch, Barry T. and David A. Macpherson (2003) "Union Membership and Coverage Database from the Current Population Survey: Note." *Industrial and Labor Relations Review*, 56, pp. 349-54.

Hoch, Irving (1972) "Income and City Size." *Urban Studies*, 9, pp. 299-328.

Hunt, Gary L. (1993) "Equilibrium and Disequilibrium in Migration Modelling." *Regional Studies*, 27, pp. 341-349.

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.*

Ioannides, Yannis M. and Jeffrey E. Zabel (2003) "Neighborhood Effects and Housing Demand." *Journal of Applied Econometrics*, 18, pp. 563-584.

Koo, Jahyeoung, Keith R. Phillips, and Fiona D. Sigalla (2000) "Measuring Regional Cost of Living." *Journal of Business & Economic Statistics*, 18, pp. 127-136.

Kotlikoff, Laurence J. and David Rapson (2007) "Does It Pay, at the Margin, to Work and Save? Measuring Effective Marginal Taxes on Americans' Labor Supply and Saving." *Tax Policy and the Economy*, 21, pp. 83-143

Krueger, Alan B. (1999), "Measuring Labor's Share." *American Economic Review,* 89, pp. 45-51.

Lambiri, Dionysia, Bianca Biagi, and Vicente Royuela (2007) "Quality of Life in the Economic and Urban Economic Literature." *Social Indicators Research*, 84, pp. 1-25.

Lewis, H. G. (1986) *Union Relative Wage Effects: A Survey* Chicago: University of Chicago Press.

Malpezzi, Stephen, Gregory H. Chun, and Richard K. Green (1998) "New Place-to-Place Housing Price Indexes for U.S. Metropolitan Areas, and Their Determinants." *Real Estate Economics,* 26, pp. 235-274.

Nordhaus, William D. and James Tobin (1972) "Is Growth Obsolete?" in *Economic Research: Retrospect and Prospect*, Vol 5. *Economic Growth*. New York: Columbia Univ. Press (for National Bureau of Economic Research).

Peiser, Richard B. and Lawrence B. Smith (1985) "Homeownership Returns, Tenure Choice and Inflation." *American Real Estate and Urban Economics Journal*, 13, pp. 343-60.

Quigley, John Q. and Stephen Raphael (2005) "Regulation and the High Cost of Housing in California." *American Economic Review Papers and Proceedings*, 95, pp. 324-328.

Rappaport, Jordan (2007a) "Consumption Amenities and City Population Density." *The Federal Reserve Bank of Kansas City Research Working Paper 06-10*.

Rappaport, Jordan (2007b) "Moving to Nicer Weather." *Regional Science and Urban Economics*, 37, pp. 375-398.

Rappaport, Jordan and Jeffrey D. Sachs (2003) "The United States as a Coastal Nation." *Journal of Economic Growth*, 8, pp. 5-46.

Roback, Jennifer (1982) "Wages, Rents, and the Quality of Life." *Journal of Political Economy*, 90, pp. 1257-1278

Roback, Jennifer (1988) "Wages, Rents, and Amenities: Differences among Workers and Regions." *Economic Inquiry,* 26, pp. 23-41.

Rosen, Harvey (1985) "Housing Subsidies: Effects on Housing Decisions, Efficiency, and Equity." in M. Feldstein and A. Auerbach, eds. *Handbook of Public Economics,* Vol. 1, Amsterdam: North Holland, pp. 375-420.

Rosen, Sherwin (1979) "Wages-based Indexes of Urban Quality of Life." in P. Mieszkowski and M. Straszheim, eds. *Current Issues in Urban Economics,* Baltimore: John Hopkins Univ. Press.

Rosenthal, Stuart S. and William C. Strange (2004) "Evidence on the Nature and Sources of Agglomeration Economies." in J.V. Henderson and J-F. Thisse, eds. *Handbook of Regional and Urban Economics*, Vol. 4, Amsterdam: North Holland, pp. 2119-2171.

Ruggles, Steven; Matthew Sobek; Trent Alexander; Catherine A. Fitch; Ronald Goeken; Patricia Kelly Hall; Miriam King; and Chad Ronnander. (2004) *Integrated Public Use Microdata Series: Version 3.0*. Minneapolis: Minnesota Population Center.

Savageau, David (1999) *Places Rated Almanac.* Foster City, CA: IDG Books Worldwide.

Shapiro, Jesse M. (2006) "Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital." *The Review of Economics and Statistics,* 88, pp. 324-335.

Tiebout, Charles M. (1956) "A Pure Theory of Local Expenditures." *Journal of Political Economy.* 64 pp. 416-424.

Wooldridge, Jeffrey M. (2003) "Cluster-Sample Methods in Applied Econometrics." *American Economic Review: Papers and Proceedings*, 93, pp. 133-138.

Appendix

A Additional Theoretical Details

A.1 Aggregation of Types

Assume there are two types of fully mobile households, referred to as "a" and "b," and that each type lives in every city. The two equilibrium conditions for households, both of whom are assumed to be perfectly mobile, are

$$e^a(p^a, w^a, \tau^a, u; Q^a) = 0 \tag{A.1a}$$
$$e^b(p^b, w^b, \tau^b, u; Q^b) = 0 \tag{A.1b}$$

A third equation is used to model production of the tradable good x, which has a unit price. Production is assumed to have constant returns to scale in labor, which can differ by household, together with capital and home-goods, which can be used as inputs. In equilibrium, because firms are mobile, the unit cost function for x must equal the price of x, which is one

$$c_X(w^a/A_X^a, w^b/A_X^b, p) = 1 \tag{A.2}$$

The terms A_X^a and A_X^b give the relative productivity of each worker type in the city. Log-linearizing equations (A.1a), (A.1b), and (A.2)

$$s_y^a \hat{p} - (1 - \tau^{a\prime}) s_w^a \hat{w}^a = \hat{Q}^a \tag{A.3a}$$
$$s_y^b \hat{p} - (1 - \tau^{b\prime}) s_w^b \hat{w}^b = \hat{Q}^b \tag{A.3b}$$
$$\theta_N^a \hat{w}^a + \theta_N^b \hat{w}^b + \theta_Y \hat{p} = \theta^a \hat{A}_X^a + \theta^b \hat{A}_X^b \equiv \hat{A}_X \tag{A.3c}$$

where θ is used to denote the cost-shares of each factor. This is similar to the models seen in Roback (1988) and Beeson (1991), although they assume that $s_w^a = s_w^b = 1$, and do not include taxes. Let the share of total income accruing to type a worker be $\mu^a = N^a m^a / \left(N^a m^a + N^b m^b\right)$, with the other share $\mu^b = 1 - \mu^a$, and define the following income-weighted averages

$$s_y = \mu^a s_y^a + \mu^b s_y^b \tag{A.4a}$$
$$\hat{Q} = \mu^a \hat{Q}^a + \mu^b \hat{Q}^b \tag{A.4b}$$

and let $s_x = 1 - s_y$.

A case worth considering is where type-a households receive all of their income from wages, and type-b households receive all their income from capital and land. This approximates the situations of prime-age workers, whose incomes are fully tied to local-wage levels, and retirees, whose incomes are completely independent of local-wage levels. Thus $\mu^a = s_w = s_x \theta_N^a$ and $\mu^b = 1 - s_w = s_y + s_x\left(1 - \theta_N^a\right)$. In this situation, we expect a-types to sort into high-wage cities, and b-types into low-wage cities. Nevertheless, approximating around the average city where sorting effects are neutralized, (A.3a) and (A.3b) become

$$s_y^a \hat{p} - (1 - \tau^{a\prime}) \hat{w}^a = \hat{Q}^a$$
$$s_y^b \hat{p} = \hat{Q}^b$$

Averaging these two equations according to their shares of total income, s_w and $1 - s_w$, produces equation (3) in the main text. This results is more approximate in cities with prices and wages away from the average, where sorting is more of an issue. In high-wage cities labor income should be weighed more heavily, while in low-wage cities, non-labor income should be weighed more heavily.

An advantage of using income-weighted averages is that it produces sensible comparative statics results when considering the effect of differences in QOL and productivity for either household-type on wages and home-good prices. Ignoring taxes for expositional ease, solving the system reveals the wage differential for a type a household is

$$s_w^a \hat{w}^a = \frac{\mu^b}{s_R}\left(s_y^a \hat{Q}^b - s_y^b \hat{Q}^a\right) - \frac{s_x \theta_Y}{s_R}\hat{Q}^a + \frac{s_x}{s_R} s_y \hat{A}_X \tag{A.5}$$

where $s_R = s_y + s_x \theta_Y$. An analogous expression holds for $\hat{w}^b$. The term beginning with μ^b explains how a-type are paid less in cities they value more, $\hat{Q}^a > 0$, but are paid more in cities that b-types value more, $\hat{Q}^b > 0$. Both types are paid more in productive cities, $\hat{A}_X$, regardless of which type of labor is made more productive. The home-good and average wage differential, weighted by wage-income shares, aggregate neatly

$$\hat{p} = \frac{1}{s_R}\hat{Q} + \frac{s_x}{s_R}\hat{A}_X \tag{A.6}$$

$$\hat{w} \equiv \frac{1}{s_w}\left(s_w^a \mu^a \hat{w}^a + s_w^b \mu^b \hat{w}^b\right) = -\frac{\theta_Y}{\theta_N s_R}\hat{Q} + \frac{s_y s_x}{s_R}\hat{A}_X \tag{A.7}$$

A.2 Housing Deduction and State Taxes

Incorporating the home goods deduction requires amending some of the formulas in the main text. Modeling the income tax now as $\tau = \tau(m - \delta p y)$, where δ is a deduction applied to home-good expenditures, the mobility condition and the log-linearized budget constraint are given by

$$\begin{aligned} \hat{Q} &= \left(1 + \delta\tau'\right) s_y \hat{p} - \delta\tau' s_y \hat{y} - \left(1 - \tau'\right) s_w \hat{w} \\ s_x \hat{x} &= -\left(1 - \delta\tau'\right) s_y \hat{p} - \left(1 - \delta\tau'\right) s_y \hat{y} + \left(1 - \tau'\right) s_w \hat{w} \end{aligned} \tag{A.8}$$

where $s_x = x/m$. Adding these expressions

$$\hat{Q} + s_x \hat{x} = -s_y \hat{y}$$

Assuming homothetic preferences, $\hat{x} = \hat{y} + \sigma_D \hat{p}$, where σ_D is the elasticity of substitution between traded goods and home goods. The uncompensated elasticity is then $\eta^c = -s_x^* \sigma_D$, where $s_x^* = s_x/(s_x + s_y)$ Substituting this in

$$\hat{y} = -(\hat{Q} + s_x \sigma_D \hat{p})/(s_x + s_y) = \eta^c \hat{p} - \frac{1}{s_x + s_y}\hat{Q}$$

Substituting back into (A.8) and using $s_y^* \equiv s_y/(s_x + s_y)$ we have the adjusted mobility condition in terms of wages and prices alone, used to estimate the quality-of-life.

$$\left(1 - \delta\tau' s_y^*\right)\hat{Q} = \left[1 - \delta\tau'\left(1 + \eta^c\right)\right] s_y \hat{p} - \left(1 - \tau'\right) s_w \hat{w} \tag{A.9}$$

State taxes are incorporated by including a second tax differential which depends on wage and housing-cost differences within state, so that the additonal tax differential on labor income due to state taxes is given by $d\tau^s/m = \tau^s s_w \hat{w}^{js}$, where τ^s is the effective tax rate on labor income from state taxes and $\hat{w}^{js}$ is the within-state wage differential for city j in state s, equal to the wage differential for city j, $\hat{w}^j$, minus the wage differential for the entire state, $\hat{w}^s$, i.e., $\hat{w}^{js} = \hat{w}^j - \hat{w}^s$. A working assumption is that state income taxes are redistributed lump sum or spent on state-level public goods or publicly-provided private goods that are valued exactly at cost and uniformly by residents everywhere. For computational purposes it is easier to first compute the federal tax differentials by state and then to compute the additional differential within state due to state and federal taxes combined. Although the formulas for the tax differentials are fairly straightforward to derive once this insight is taken into account, taking into account the houisng deduction makes them particularly long and too unwieldy to present here. The formulas are available upon request.

The state tax rate on labor is calculated by combining state income taxes with sales taxes. The effective sales tax rate is equal to the statuatory rate reduced by 10 percent to account for percent of non-housing expenditures that escape the tax (Feenberg et al. 1997). In states where food is exempt from sales taxes, this rate is reduced by another 8 percent, equal to the share of expenditures spent on groceries.

A.3 Functional Form and Aggregation over Incomes

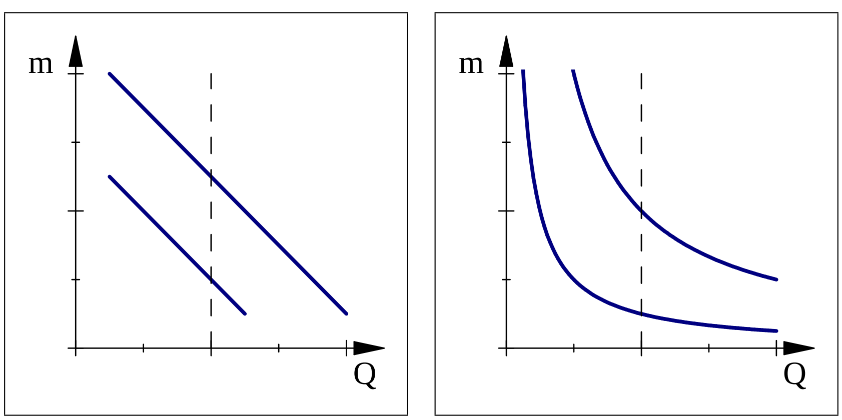
Assume that utility takes the following form with separable labor supply and σ representing the elasticity of substitution between Q and the composite commodity $\phi(x, y)$ where ϕ is homothetic.

$$U(x, y, h; Q) = \left[\omega Q^{\frac{\sigma-1}{\sigma}} + \phi(x, y)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} + f(h)$$

Then it is possible to show that

$$p_Q = \frac{\partial V/\partial Q}{\partial V/\partial m} = \frac{\omega}{\lambda}\left(\frac{m\lambda}{Q}\right)^{\frac{1}{\sigma}}$$

where $\lambda =$ marginal utility of consumption. In the case where quality-of-life and consumption are perfect substitutes, $\sigma \to \infty$, then $p_Q = \omega/\lambda$, which is constant If instead, preferences are Cobb-Douglas, $\sigma = 1$, then, $p_Q = \omega m/Q$, and $\hat{Q} = \omega \cdot dQ$. Indifference curves for the two cases are illustrated below



Perfect Substitutes Cobb-Douglas

In the perfect substitutes case, the willingness to pay for quality-of-life remains constant with income. In the Cobb-Douglas case, the willingness to pay rises proportionally with income. It is this latter case which more consistent with the theoretical presentation and empirical evidence presented in the main text.

B Parameter Calibration

In summary, the following values are taken for the calibration

$$\begin{array}{lll} s_y = 0.36 & \tau' = 0.32 & s_w = 0.75 \\ \delta = 0.31 & s_x = 0.42 & \eta^c = -0.5 \end{array}$$

The parameters s_y , τ', and s_w are explained in Section 3. The remaining parameters are only needed to account for the housing deduction and are explained below.

B.1 Expenditure Share for Traded Goods

As mentioned in Section 3.1 22 percent of income is spent on housing and 56 percent on other goods. Since the share spent on home goods is taken at 36 percent and the two should still sum to 78 percent, s_x, the share of income spent on tradable goods, is calibrated at 42 percent.

B.2 Tax Deduction Level

Determining the deduction level requires taking into account the fact that many households do not itemize deductions. According to the Statistics on Income, although only 33 percent of tax returns itemize, they account for 67 percent of reported Adjusted Gross Income (AGI). Since the income-weighted share is what matters, 67 percent is multiplied by the effective tax reduction given in TAXSIM, in 2000 of 21.6 percent. Thus, on average these deductions reduce the effective price of eligible goods by 14.5 percent. Since eligible goods only include housing, this deduction applies to only 59 percent of home goods. Multiplying 14.5 percent times 59 percent gives an effective price reduction of 8.6 percent for home goods. Divided by a federal tax rate of 29.6 percent, produces a federal deduction level of 29 percent.

At the state level, deductions for income taxes are calculated in an equivalent way using TAXSIM data. Furthermore, all housing expenditures are deducted from the sales tax. Overall this produces an effective deduction level of $\delta = 0.31$.

B.3 Compensated Elasticity of Housing Demand

The compensated elasticity of housing demand with respect to its price, η^c, is needed to determine the extent of indexation conferred through a home goods tax deduction. Using the Slutsky equation $\eta^c = \eta + s_y^* \varepsilon_{y,m}$, where η is the uncompensated price elasticity and $\varepsilon_{y,m}$ is the income elasticity. There is a large literature devoted to trying to estimate these parameters, including Rosen (1985), Goodman Kawai (1986), Goodman (1988) Ermisch et al. (1996), Goodman (2002), and Ionnides and Zabel (2003). The range of plausible estimates in this literature is large, with uncompensated price elasticities ranging from -1 to -0.3, and income elasticities from 1 to 0.4, implying compensated elasticities in the range of -0.25 to -0.75. QOL estimates are not highly affected by which value in this range is chosen; a value of $\eta^c = -0.5$ is adopted here.

C Data and Estimation

C.1 Wage and Housing Cost Data

United States Census data from the 2000 Integrated Public-Use Microdata Series (IPUMS), from Ruggles et al. (2004), are used to calculate wage and housing price differentials. The wage differentials are calculated for workers ages 25 to 55, who report working at least 30 hours a week, 26 weeks a year. The MSA assigned to a worker is determined by their place of residence, rather than their place of work. The wage differential of an MSA is found by regressing log hourly wages on individual covariates and indicators for which MSA a worker lives in, using the coefficients on these MSA indicators. The covariates consist of

- 12 indicators of educational attainment;
- a quartic in potential experience, and potential experience interacted with years of education;
- 9 indicators of industry at the one-digit level (1950 classification);
- 9 indicators of employment at the one-digit level (1950 classification);
- 4 indicators of marital status (married, divorced, widowed, separated);
- an indicator for veteran status, and veteran status interacted with age;
- 5 indicators of minority status (Black, Hispanic, Asian, Native American, and other);
- an indicator of immigrant status, years since immigration, and immigrant status interacted with black, Hispanic, Asian, and other;
- 2 indicators for English proficiency (none or poor).

All covariates are interacted with gender.

This regression is first run using census-person weights. From the regressions a predicted wage is calculated using individual characteristics alone, controlling for MSA, to form a new weight equal to the predicted wage times the census-person weight. These new income-adjusted weights are needed since workers need to be weighted by their income share (see Appendix A.1). The new weights are then used in a second regression, which is used to calculate the city-wage differentials from the MSA indicator variables. In practice, this weighting procedure has only a small effect on the estimated wage differentials.

Housing price differentials are calculated using the logarithm reported gross rents and housing values. Only housing units moved into within the last 10 years are included in the sample to ensure that the price data are fairly accurate. The differential housing price of an MSA is calculated in a manner similar to wages, except using a regression of the actual or imputed rent on a set of covariates at the unit level. The covariates for the adjusted differential are

- 9 indicators of building size;
- 9 indicators for the number of rooms, 5 indicators for the number of bedrooms, number of rooms interacted with number of bedrooms, and the number of household members per room;
- 2 indicators for lot size;
- 7 indicators for when the building was built;
- 2 indicators for complete plumbing and kitchen facilities;
- an indicator for commercial use;
- an indicator for condominium status (owned units only).

A regression of housing values on housing characteristics and MSA indicator variables is first run using only owner-occupied units, weighting by census-housing weights. A new value-adjusted weight is calculated by multiplying the census-housing weights by the predicted value from this first regression using housing characteristics alone, controlling for MSA. A second regression is run using these new weights for all units, rented and owner-occupied, on the housing characteristics fully interacted with tenure, along with the MSA indicators, which are not interacted. The house-price differentials are taken from the MSA indicator variables in this second regression. As with the wage differentials, this adjusted weighting method has only a small impact on the measured price differentials.

C.2 Amenity Data

Heating and cooling degree days (Annual) Degree day data are used to estimate amounts of energy required to maintain comfortable indoor temperature levels. Daily values are computed from each days mean temperature (max + min/2). Each degree that a day's mean temperature is below or above 65 degrees Fahrenheit is counted as one on a given day are equal to 65 minus the average daily temperature in Fahrenheit, if the temperature is below 65, and equal to zero if the temperature is above 65. Averages from 1970 to 2000, are used here. (National Climactic Data Center, 2008)

Sunshine Average percentage of possible. The total time that sunshine reaches the surface of the earth is expressed as the percentage of the maximum amount possible from sunrise to sunset with clear sky conditions. (National Climactic Data Center, 2008)

Precipitation (Inches) The normal precipitation is the arithmetic mean for each month over the 30-year period,adjusted as necessary, and includes the liquid water equivalent of snowfall. (National Climactic Data Center, 2008)

Coastal proximity Equal to one if one or more counties in the MSA is adjacent to an ocean coast or great lake; zero otherwise. Coded by author.

Violent crimes (per capita) These consist of aggravated assaults, robbery, forcible rape, and murder. Taken from the *City and County Data Book 2000.*

Air quality index (Median) An AQI value is calculated for each pollutant in an area (ground-level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide). The highest AQI value for the individual pollutants is the AQI value for that day. An AQI over 300 is considered hazardous; under 50, good; values inbetween correspond to moderate, unhealthy, and very unhealthy. (Environmental Protection Agency, 2008)

Bars and restaurants Number of establishments classified as eating and drinking places (NAICS 722) in *County Business Patterns 2000*.

Arts and Culture Index from *Places Rated Almanac* (Savageau 1999). Based on a ranking of cities, it ranges from 100 (New York, NY) to 0 (Houma, LA).

Sprawl index Percentage of land not developed in the square kilometer around an average residential development in each metropolitan area in 1992. Calculated by Burchfield et al. (2006)

Local government expenditures and taxes Taken from the *City and County Data Book 2000.*

Wharton Residential Land Use Regulatory Index an aggregate measure of regulatory constraint on development .(Gyourko et al., forthcoming)

Federal spending differential Dollars in federal spending to MSA excluding wages, contracts, and transfers to non-workers. Expressed as a percentage of average income. (Albouy, 2008)

TABLE 1: WAGE, HOUSING PRICE AND QUALITY-OF-LIFE DIFFERENTIALS, 2000

	Population Size	Adjusted Diffs Wages	Adjusted Diffs Housing Cost	Quality-of Life	QOL Rank	Unadj. QOL Rank
Main city in MSA/CMSA						
Honolulu, HI	876,156	-0.01	0.49	0.18	1	18
Santa Barbara, CA	399,347	0.11	0.67	0.18	2	90
Salinas, CA	401,762	0.09	0.53	0.14	3	112
San Francisco, CA	7,039,362	0.26	0.75	0.13	4	232
Santa Fe, NM	147,635	-0.05	0.25	0.12	5	23
San Luis Obispo, CA	246,681	0.02	0.40	0.12	6	67
San Diego, CA	2,813,833	0.06	0.44	0.12	7	105
Los Angeles, CA	16,373,645	0.13	0.40	0.07	15	205
Seattle, WA	3,554,760	0.08	0.28	0.06	24	184
Miami, FL	3,876,380	-0.01	0.13	0.05	32	122
Denver, CO	2,581,506	0.05	0.20	0.05	33	169
Portland, OR	2,265,223	0.03	0.17	0.05	34	156
New York, NY	21,199,865	0.21	0.42	0.04	37	238
Boston, MA	5,819,100	0.14	0.35	0.03	51	219
Phoenix, AZ	3,251,876	0.03	0.10	0.02	58	179
Tampa, FL	2,395,997	-0.06	-0.05	0.01	65	113
Chicago, IL	9,157,540	0.13	0.22	0.01	67	234
Sioux Falls, SD	172,412	-0.13	-0.18	0.01	73	58
Washington, DC	7,608,070	0.13	0.17	-0.01	96	235
Cleveland, OH	2,945,831	0.01	-0.04	-0.02	118	194
Minneapolis, MN	2,968,806	0.09	0.06	-0.02	123	231
Dallas, TX	5,221,801	0.07	0.01	-0.03	158	228
Atlanta, GA	4,112,198	0.08	0.02	-0.03	162	233
St. Louis, MO	2,603,607	0.01	-0.09	-0.03	165	206
Detroit, MI	5,456,428	0.13	0.09	-0.03	172	239
Philadelphia, PA	6,188,463	0.12	0.07	-0.04	174	237
Pittsburgh, PA	2,358,695	-0.04	-0.17	-0.04	182	177
Houston, TX	4,669,571	0.07	-0.08	-0.06	215	236
Census Division						
Pacific	45,042,272	0.10	0.36	0.07	1	6
Mountain	18,174,904	-0.05	0.02	0.03	2	1
New England	13,928,540	0.07	0.18	0.03	3	7
Middle Atlantic	39,668,438	0.08	0.11	0.00	4	9
South Atlantic	51,778,682	-0.03	-0.06	0.00	5	5
West North Central	19,224,096	-0.11	-0.25	-0.03	6	2
East North Central	45,145,135	0.00	-0.09	-0.03	7	8
West South Central	31,440,101	-0.07	-0.21	-0.04	8	4
East South Central	17,019,738	-0.12	-0.30	-0.05	9	3
MSA Population						
MSA, 5+ Million	81,606,427	0.16	0.32	0.03	1	5
MSA, 1.5-4.9 Million	55,543,090	0.03	0.05	0.00	2	4
MSA, 0.5-1.4 Million	40,499,870	-0.03	-0.07	-0.01	3	3
MSA, -0.5 Million	36,417,747	-0.09	-0.15	-0.01	4	2
Non-MSA	67,354,772	-0.14	-0.28	-0.03	5	1
United States	281,421,906	0.13	0.29	0.05		
	total		*standard deviations*			

Wage and housing price data are taken from the U.S. Census 2000 IPUMS. Wage differentials are based on the average logarithm of hourly wages for full-time workers ages 25 to 55. Housing price differentials based on the average logarithm of rents and housing prices for units moved in within the last 10 years. Adjusted differentials are city-fixed effects from individual level regressions on extended sets of worker and housing covariates. Quality-of-life is calculated according to equation (A.9) from price and wage differentials, using the share parameters s_y =0.361, s_x =0.56, s_w =0.75 extended to deal with state tax dfferences. Unadjusted share parameters are s_y =0.25, s_x =0.75, τ' = 0, δ = 0, s_w = 1. City rankings out of 241.

TABLE 2: REGRESSION OF PRICE DIFFERENTIALS ON WAGE DIFFERENTIALS, AND TEST OF THE CALIBRATED SLOPE COEFFECIENT FOR THE INDIFFERENCE CURVE

		Cities Only		
	No Controls (1)	No Controls (2)	Controls for Natural Amenities (3)	Controls for Natural and Artificial Amenities (4)
Wage differential	2.04	2.04	1.57	1.37
(robust s.e.)	(0.06)	(0.17)	(0.12)	(0.15)
R-squared	0.82	0.74	0.89	0.92
Number of Observations	290	241	230	213
p- value of hypothesis test that the regression slope equals the indifference curve slope				
Adjusted slope = 1.45	0.00	0.00	0.37	0.54
Unadjusted slope = 4.00	0.00	0.00	0.00	0.00
Implied relationship between wages and (residual) quality of life, b_Q				
Adjusted	0.59	0.59	0.12	-0.08
Unadjusted	-1.96	-1.96	-2.44	-2.63

Natural amenities, listed in Table 4, include heating degree days, cooling degree days, percent of sunshine possible, inches of precipitation, and proximity to a coast. Artificial amenities include violent crime rate per capita, median air quality index, bars and restaurants per capita, *Places Rated* arts and culture index, residential land-use regulation and sprawl indices, local government expenditures net of local taxes, and federal spending differentials.

TABLE 3: COMPARISON OF HEDONIC QUALITY-OF-LIFE AND *PLACES RATED ALMANAC* RANKINGS, 2000

	Places Rated Score		Revised *Places Rated* Score	
	Adjusted QOL (1)	Unadj. QOL (2)	Adjusted QOL (3)	Unadj. QOL (4)
Rank Correlation	0.29	-0.25	0.35	-0.32

240 cities in sample. Places rated ranking used for first city in CMSA. Revised *Places Rated* Score eliminates cost-of-living and job-market components. All rankings are highly significant, with *p*- values less than 0.001.

TABLE 4: QUALITY-OF-LIFE ESTIMATES AND INDIVIDUAL AMENITIES

Type of Amentiy Variables	Natural Amenities: Climate & Geography Only		Natural and Artificial Amenities + Crime, Cultural, and Fiscal	
Dependent Variables	Adjusted QOL	Unadj. QOL	Adjusted QOL	Unadj. QOL
	(1)	(2)	(3)	(4)
Heating-Degree Days (1000s)	-0.013***	-0.010*	-0.018***	-0.005
	(0.004)	(0.006)	(0.003)	(0.006)
Cooling-Degree Days (1000s)	-0.040***	0.004	-0.036***	0.006
	(0.009)	(0.011)	(0.005)	(0.012)
Sunshine (fraction possible)	0.296***	-0.053	0.241***	0.089
	(0.075)	(0.134)	(0.057)	(0.107)
Precipitation (10s of inches)	0.003	-0.002	0.002	-0.011*
	(0.004)	(0.007)	(0.003)	(0.006)
Proximity to Coast (salt or fresh water)	0.036***	-0.044***	0.018**	0.000
	(0.008)	(0.014)	(0.008)	(0.013)
Violent Crimes per Capita			-2.277	2.470
			(2.208)	(3.121)
Median Air Quality Index (/100)			-0.076***	-0.110*
			(0.026)	(0.056)
Restaurants and Bars per Capita			0.033**	0.024
			(0.013)	(0.031)
Places Rated Arts & Culture Index (/100)			0.034***	-0.092***
			(0.013)	(0.024)
Residential Land Use Regulatory Index			0.008	-0.013
			(0.006)	(0.008)
Sprawl Index (/10)			-0.010***	0.014**
			(0.003)	(0.007)
Local Expenditures net of Local Taxes			0.019	-0.063
			(0.021)	(0.041)
Federal Spending Differential			0.511*	0.342
			(0.275)	(0.552)
Constant	-0.091	0.079	-0.029	0.001
	(0.071)	(0.123)	(0.056)	(0.120)
R-squared	0.62	0.23	0.76	0.54
Number of Observations	230	230	213	213

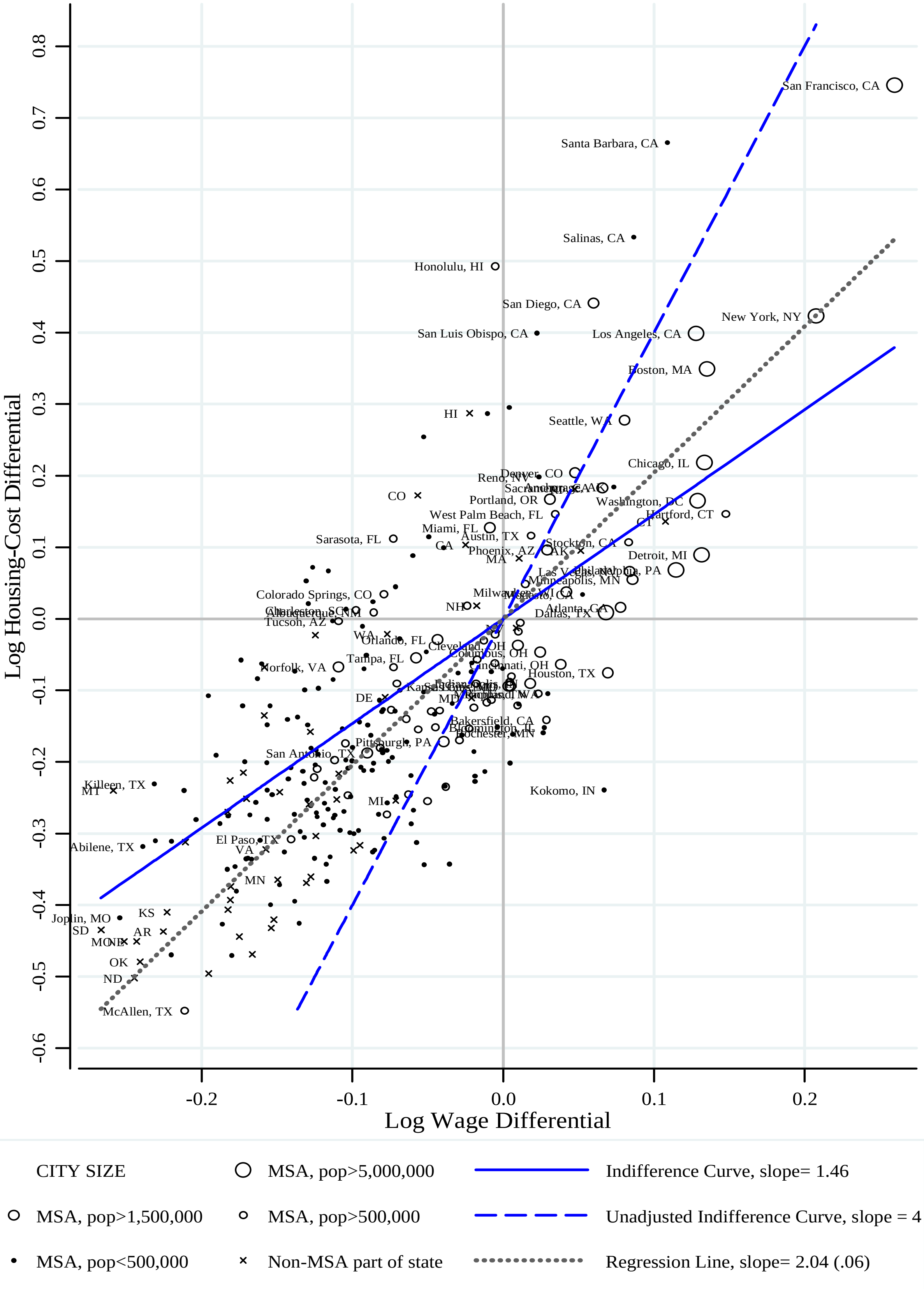
Robust standard errors shown in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Regressions weighted by the sum of individuals in a city, each according to their predicted income in an average city.

TABLE 5: QUALITY-OF-LIFE ESTIMATES, AMENITIES, AND CITY SIZE

Type of Amentiy Variables	Population Only		Natural Amenities: Climate & Geography Only			Natural and Artificial Amenities + Crime, Cultural, and Fiscal		
Dependent Variables	Adjusted QOL	Unadj. QOL	Adjusted QOL	Unadj. QOL	Log(Pop)	Adjusted QOL	Unadj. QOL	Log(Pop)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Logarithm of Population	0.014***	-0.032***	0.003	-0.036***		0.002	-0.041***	
	(0.004)	(0.004)	(0.003)	(0.002)		(0.004)	(0.007)	
Heating-Degree Days (1000s)			-0.013***	-0.009**	0.025	-0.018***	-0.010*	-0.112**
			(0.004)	(0.004)	(0.131)	(0.003)	(0.005)	(0.053)
Cooling-Degree Days (1000s)			-0.040***	-0.003	-0.198	-0.035***	-0.006	-0.288***
			(0.009)	(0.009)	(0.194)	(0.006)	(0.011)	(0.104)
Sunshine (fraction possible)			0.287***	0.058	3.085	0.242***	0.063	-0.634
			(0.068)	(0.074)	(3.306)	(0.057)	(0.086)	(1.447)
Precipitation (10s of inches)			0.003	-0.003	-0.022	0.002	-0.003	0.196
			(0.004)	(0.004)	(0.195)	(0.003)	(0.005)	(0.132)
Proximity to Coast (salt or fresh water)			0.031***	0.017**	1.683***	0.018**	0.020*	0.492***
			(0.007)	(0.008)	(0.321)	(0.008)	(0.010)	(0.151)
Violent Crimes per Capita						-2.219	0.947	-37.379
						(2.215)	(2.594)	(44.474)
Median Air Quality Index (/100)						-0.082***	0.032	3.476***
						(0.028)	(0.051)	(0.648)
Restaurants and Bars per Capita						0.033**	0.013	-0.254
						(0.013)	(0.022)	(0.355)
Places Rated Arts & Culture Index (/100)						0.030*	0.013	2.561***
						(0.016)	(0.024)	(0.293)
Residential Land Use Regulatory Index						0.007	0.004	0.401***
						(0.007)	(0.008)	(0.104)
Sprawl Index (/10)						-0.009**	-0.004	-0.448***
						(0.004)	(0.006)	(0.130)
Local Expenditures net of Local Taxes						0.018	-0.043	0.476
						(0.022)	(0.031)	(0.527)
Federal Spending Differential						0.517*	0.176	-4.079
						(0.278)	(0.414)	(5.246)
Constant	-0.192***	0.456***	-0.129	0.519***	12.159***	-0.050	0.550***	13.458***
	(0.049)	(0.055)	(0.082)	(0.067)	(3.085)	(0.083)	(0.135)	(1.556)
R-squared	0.15	0.54	0.62	0.67	0.37	0.74	0.68	0.86
Number of Observations	241	241	230	230	230	213	213	213

Robust standard errors shown in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Regressions weighted by the sum of individuals in a city, each according to their predicted income in an average city.

Figure 1: Housing Costs versus Wage Levels across Metro Areas, 2000



Log wage (for full-time workers) and housing-price (for home-owners and renters) differentials from dummy variables in regressions controlling for worker and housing charactersitics. Metro areas use 2000 Consolidated Metropolitan Statistcal Area definitions, which combine Primary MSAs; only first city, state named. Non-metro areas in states grouped together as another city.

Figure 2: Quality-of-life Estimates: Adjusted vs. Unadjusted

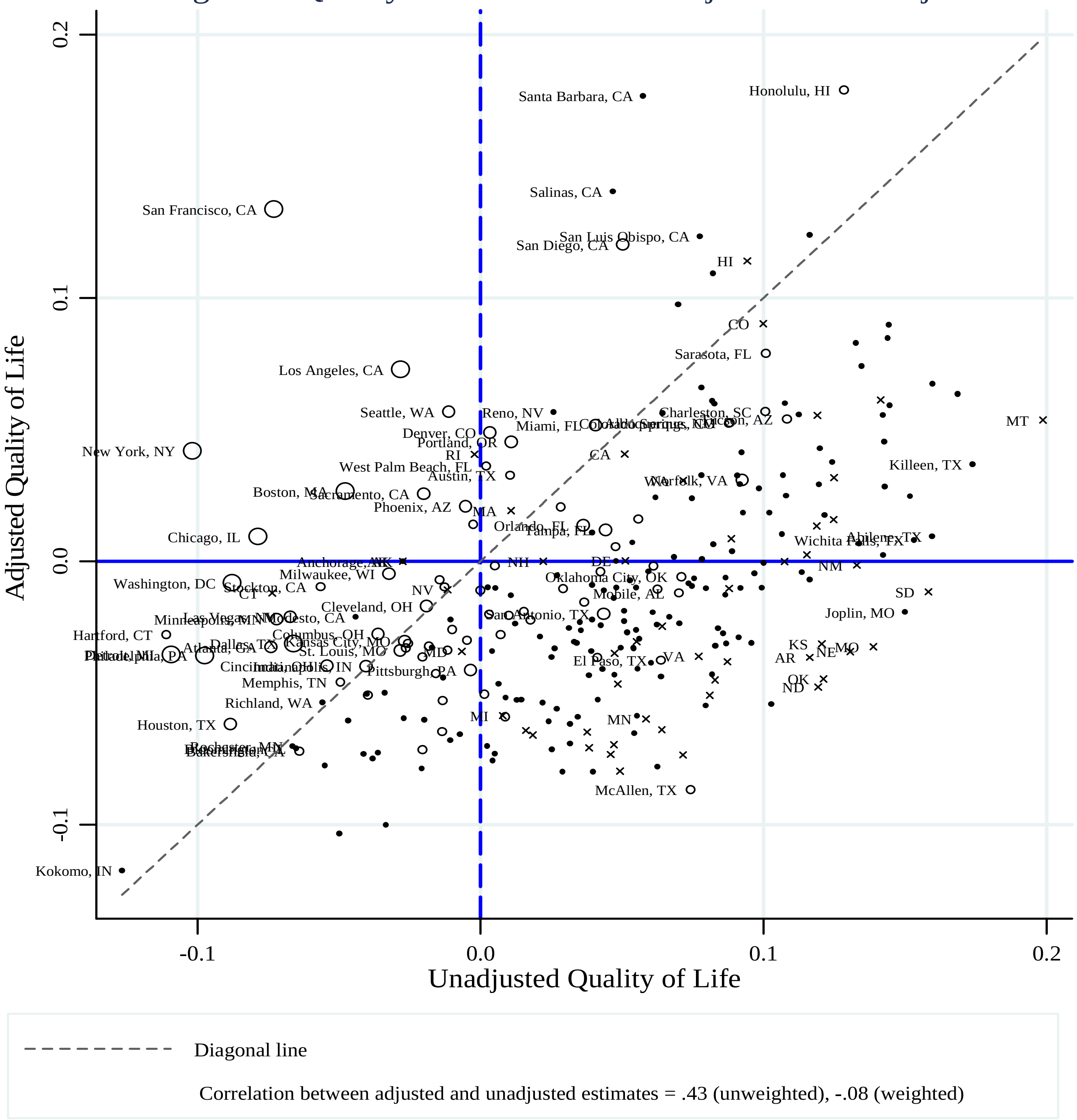


Figure 3: Quality of Life and City Size, 2000

Figure 3a: Adjusted Quality of Life

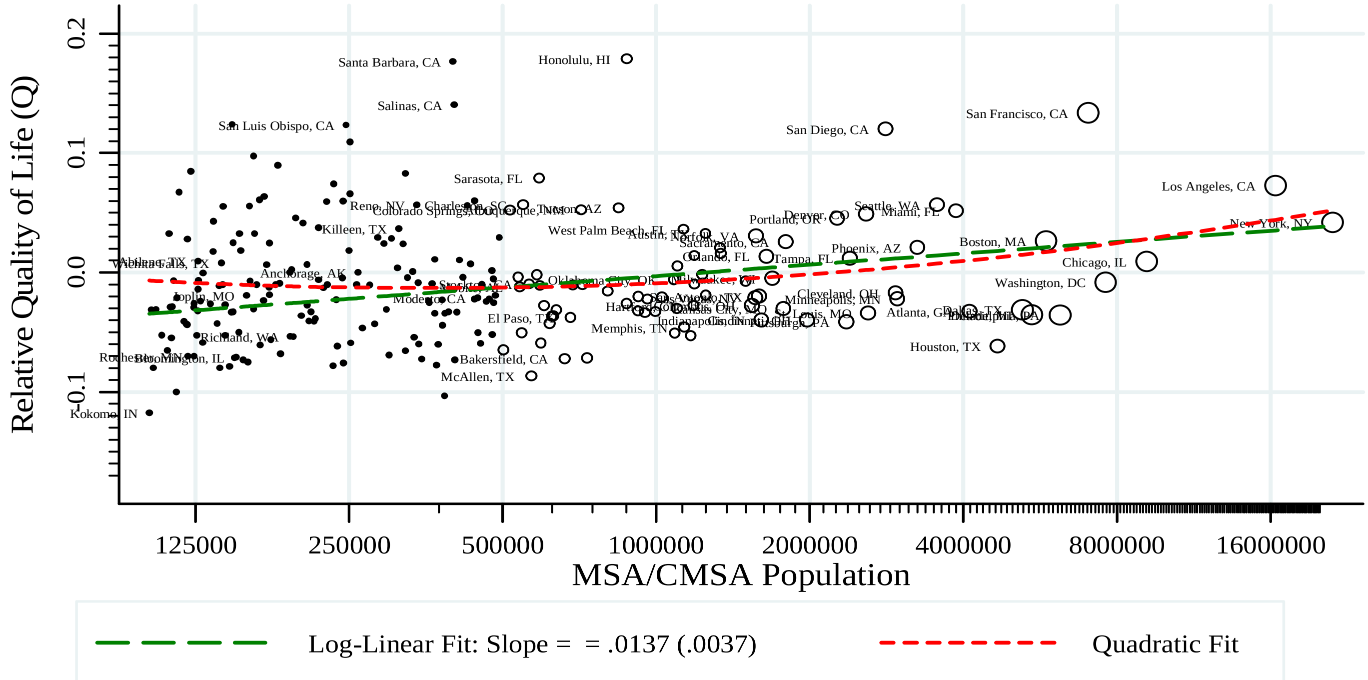


Figure 3b: Unadjusted Quality of Life

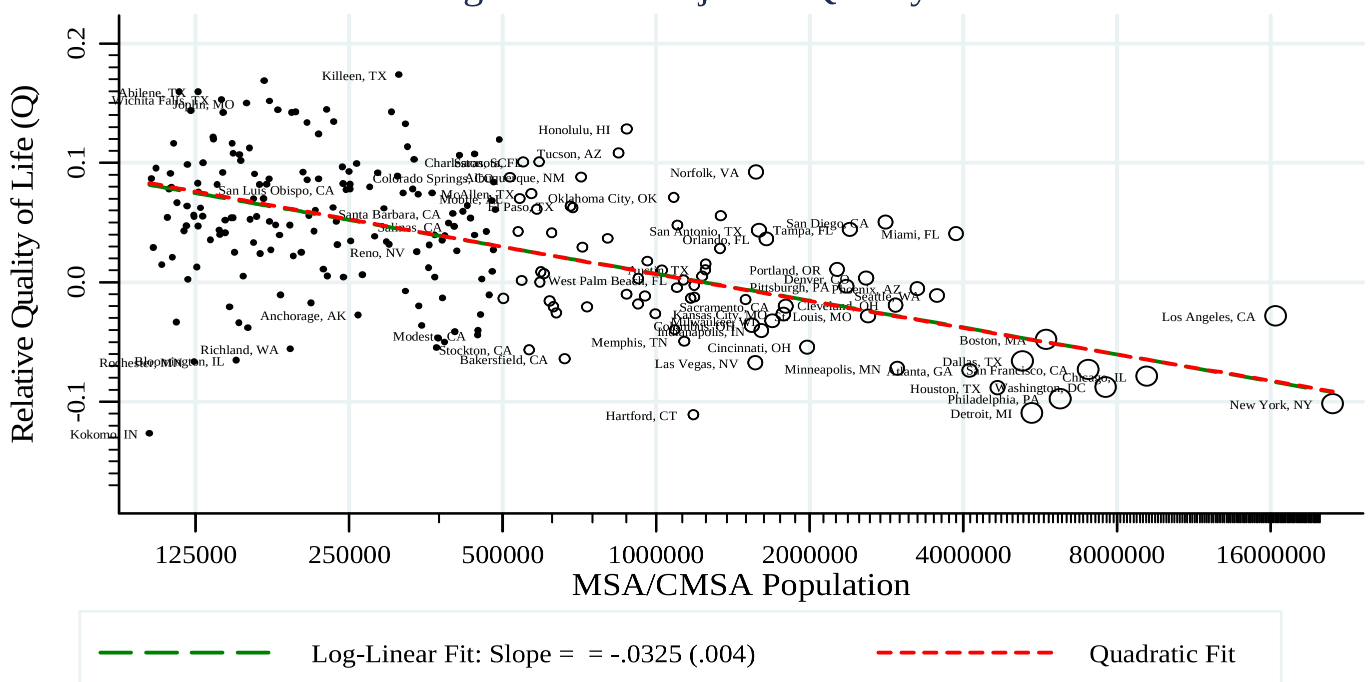


TABLE A: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Adjusted Quality of Life	Adjusted QOL Rank	Unadjusted Quality of Life	Unadjusted QOL Rank
Honolulu, HI MSA	876,156	-0.005	0.493	0.179	1	0.128	18
Santa Barbara--Santa Maria--Lompoc, CA MSA	399,347	0.109	0.665	0.177	2	0.057	90
Salinas, CA MSA	401,762	0.087	0.533	0.141	3	0.047	112
San Francisco--Oakland--San Jose, CA CMSA	7,039,362	0.260	0.746	0.134	4	-0.073	232
Santa Fe, NM MSA	147,635	-0.053	0.254	0.124	5	0.116	23
San Luis Obispo--Atascadero--Paso Robles, CA MSA	246,681	0.022	0.399	0.123	6	0.077	67
San Diego, CA MSA	2,813,833	0.060	0.441	0.120	7	0.050	105
non-metropolitan areas, HI	335,651	-0.022	0.287	0.114	.	0.094	.
Naples, FL MSA	251,377	-0.010	0.287	0.109	8	0.082	59
Barnstable--Yarmouth, MA MSA	162,582	0.004	0.295	0.098	9	0.070	76
non-metropolitan areas, CO	924,086	-0.057	0.172	0.090	.	0.100	.
Medford--Ashland, OR MSA	181,269	-0.126	0.072	0.090	10	0.144	9
Flagstaff, AZ--UT MSA	122,366	-0.131	0.053	0.085	11	0.144	10
Eugene--Springfield, OR MSA	322,959	-0.116	0.067	0.083	12	0.133	17
Sarasota--Bradenton, FL MSA	589,959	-0.073	0.112	0.079	13	0.101	34
Wilmington, NC MSA	233,450	-0.129	0.021	0.074	14	0.135	15
Los Angeles--Riverside--Orange County, CA CMSA	16,400,000	0.128	0.399	0.073	15	-0.028	205
Grand Junction, CO MSA	116,255	-0.174	-0.058	0.067	16	0.160	3
Fort Collins--Loveland, CO MSA	251,494	-0.049	0.115	0.066	17	0.078	66
Fort Walton Beach, FL MSA	170,498	-0.196	-0.108	0.063	18	0.169	2
non-metropolitan areas, VT	608,387	-0.158	-0.068	0.061	.	0.141	.
Bellingham, WA MSA	166,814	-0.060	0.088	0.061	19	0.082	60
Portland, ME MSA	243,537	-0.071	0.045	0.060	20	0.083	57
Fort Myers--Cape Coral, FL MSA	440,888	-0.104	0.014	0.060	21	0.108	29
Asheville, NC MSA	225,965	-0.160	-0.063	0.059	22	0.145	8
Madison, WI MSA	426,526	-0.039	0.099	0.057	23	0.064	79
Seattle--Tacoma--Bremerton, WA CMSA	3,554,760	0.081	0.277	0.057	24	-0.011	184
Reno, NV MSA	339,486	0.024	0.198	0.057	25	0.026	145
Charleston--North Charleston, SC MSA	549,033	-0.098	0.012	0.057	26	0.101	35
non-metropolitan areas, OR	1,194,699	-0.125	-0.023	0.056	.	0.119	.
Charlottesville, VA MSA	159,576	-0.113	-0.003	0.056	27	0.113	26
Punta Gorda, FL MSA	141,627	-0.163	-0.084	0.055	28	0.142	14
Tucson, AZ MSA	843,746	-0.109	-0.003	0.054	29	0.108	27
non-metropolitan areas, MT	774,080	-0.259	-0.240	0.053	.	0.199	.
Albuquerque, NM MSA	712,738	-0.086	0.009	0.053	30	0.088	49
Colorado Springs, CO MSA	516,929	-0.079	0.035	0.052	31	0.088	50
Miami--Fort Lauderdale, FL CMSA	3,876,380	-0.009	0.128	0.052	32	0.041	122
Denver--Boulder--Greeley, CO CMSA	2,581,506	0.048	0.204	0.049	33	0.003	169
Portland--Salem, OR--WA CMSA	2,265,223	0.031	0.167	0.046	34	0.011	156
Myrtle Beach, SC MSA	196,629	-0.173	-0.121	0.045	35	0.143	12
State College, PA MSA	135,758	-0.138	-0.073	0.044	36	0.120	21
New York--Northern New Jersey--Long Island, NY--NJ--CT--PA CMSA	21,200,000	0.208	0.423	0.043	37	-0.102	238
Chico--Paradise, CA MSA	203,171	-0.086	0.024	0.041	38	0.092	43
non-metropolitan areas, CA	1,249,739	-0.025	0.103	0.041	.	0.051	.
non-metropolitan areas, RI	258,023	0.047	0.181	0.041	.	-0.002	.
Gainesville, FL MSA	217,955	-0.155	-0.121	0.038	39	0.124	19
Killeen--Temple, TX MSA	312,952	-0.231	-0.231	0.037	40	0.174	1
West Palm Beach--Boca Raton, FL MSA	1,131,184	0.035	0.146	0.036	41	0.002	173
Iowa City, IA MSA	111,006	-0.091	-0.051	0.033	42	0.078	65
Austin--San Marcos, TX MSA	1,249,763	0.019	0.116	0.033	43	0.010	158
Bryan--College Station, TX MSA	152,415	-0.132	-0.099	0.033	44	0.107	30
Redding, CA MSA	163,256	-0.093	-0.010	0.033	45	0.091	47
non-metropolitan areas, AZ	942,343	-0.159	-0.135	0.032	.	0.125	.
non-metropolitan areas, WA	1,063,531	-0.077	-0.021	0.031	.	0.072	.
Norfolk--Virginia Beach--Newport News, VA--NC MSA	1,569,541	-0.109	-0.067	0.031	46	0.092	42
Tallahassee, FL MSA	284,539	-0.113	-0.085	0.029	47	0.092	45
Daytona Beach, FL MSA	493,175	-0.157	-0.148	0.029	48	0.120	22
Fayetteville, NC MSA	302,963	-0.191	-0.191	0.028	49	0.143	11
Bloomington, IN MSA	120,563	-0.123	-0.097	0.028	50	0.098	38
Boston--Worcester--Lawrence, MA--NH--ME--CT CMSA	5,819,100	0.135	0.349	0.027	51	-0.048	219
Sacramento--Yolo, CA CMSA	1,796,857	0.066	0.183	0.026	52	-0.020	196
Panama City, FL MSA	148,217	-0.143	-0.141	0.025	53	0.108	28
Las Cruces, NM MSA	174,682	-0.212	-0.240	0.025	54	0.152	6
Savannah, GA MSA	293,000	-0.069	-0.028	0.025	55	0.062	85
Fort Pierce--Port St. Lucie, FL MSA	319,426	-0.092	-0.070	0.024	56	0.075	69
Salt Lake City--Ogden, UT MSA	1,333,914	-0.024	0.018	0.021	57	0.028	141
Phoenix--Mesa, AZ MSA	3,251,876	0.029	0.096	0.021	58	-0.005	179
Lincoln, NE MSA	250,291	-0.130	-0.148	0.020	59	0.093	41
non-metropolitan areas, MA	569,691	0.010	0.084	0.019	.	0.011	.
Athens, GA MSA	153,444	-0.136	-0.137	0.019	60	0.102	33
Columbia, MO MSA	135,454	-0.171	-0.200	0.018	61	0.122	20
New Orleans, LA MSA	1,337,726	-0.073	-0.068	0.016	62	0.056	92
non-metropolitan areas, ME	1,033,664	-0.181	-0.226	0.016	.	0.125	.
Raleigh--Durham--Chapel Hill, NC MSA	1,187,941	0.015	0.049	0.014	63	-0.003	176
Orlando, FL MSA	1,644,561	-0.044	-0.029	0.014	64	0.036	130

TABLE A: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

				Adjusted		Unadjusted	
Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Quality of Life	QOL Rank	Quality of Life	QOL Rank
non-metropolitan areas, FL	1,222,532	-0.173	-0.215	0.013	.	0.119	.
Tampa--St. Petersburg--Clearwater, FL MSA	2,395,997	-0.058	-0.054	0.012	65	0.044	113
Provo--Orem, UT MSA	368,536	-0.051	-0.046	0.012	66	0.039	125
Chicago--Gary--Kenosha, IL--IN--WI CMSA	9,157,540	0.133	0.219	0.011	67	-0.079	234
Pensacola, FL MSA	412,153	-0.157	-0.201	0.010	68	0.106	31
Abilene, TX MSA	126,555	-0.239	-0.318	0.009	69	0.160	4
non-metropolitan areas, UT	531,967	-0.128	-0.158	0.009	.	0.089	.
Wichita Falls, TX MSA	140,518	-0.231	-0.310	0.008	70	0.153	5
Boise City, ID MSA	432,345	-0.082	-0.114	0.008	71	0.054	100
Clarksville--Hopkinsville, TN--KY MSA	207,033	-0.204	-0.281	0.007	72	0.134	16
Sioux Falls, SD MSA	172,412	-0.127	-0.181	0.007	73	0.082	58
Jacksonville, FL MSA	1,100,491	-0.070	-0.091	0.005	74	0.048	109
Fayetteville--Springdale--Rogers, AR MSA	311,121	-0.141	-0.208	0.004	75	0.089	48
Laredo, TX MSA	193,117	-0.220	-0.311	0.002	76	0.142	13
non-metropolitan areas, WY	493,849	-0.183	-0.270	0.002	.	0.115	.
Melbourne--Titusville--Palm Bay, FL MSA	476,230	-0.107	-0.153	0.002	77	0.068	77
Montgomery, AL MSA	333,055	-0.124	-0.183	0.001	78	0.078	64
Cedar Rapids, IA MSA	191,701	-0.080	-0.127	0.001	79	0.048	108
non-metropolitan areas, DE	158,149	-0.078	-0.110	0.000	.	0.051	.
non-metropolitan areas, ID	863,855	-0.170	-0.252	0.000	.	0.107	.
non-metropolitan areas, NH	1,011,597	-0.018	0.018	0.000	.	0.022	.
non-metropolitan areas, AK	367,124	0.051	0.095	0.000	.	-0.028	.
Anchorage, AK MSA	260,283	0.073	0.184	0.000	80	-0.027	204
Billings, MT MSA	129,352	-0.164	-0.256	-0.001	81	0.100	36
Nashville, TN MSA	1,231,311	-0.013	-0.030	-0.001	82	0.005	166
non-metropolitan areas, NM	783,050	-0.211	-0.312	-0.001	.	0.133	.
Little Rock--North Little Rock, AR MSA	583,845	-0.105	-0.174	-0.002	83	0.061	86
Springfield, MO MSA	325,721	-0.182	-0.276	-0.003	84	0.114	25
Milwaukee--Racine, WI CMSA	1,689,572	0.042	0.038	-0.004	85	-0.032	207
Spokane, WA MSA	417,939	-0.095	-0.144	-0.004	86	0.059	89
Columbia, SC MSA	536,691	-0.074	-0.127	-0.004	87	0.042	119
Lubbock, TX MSA	242,628	-0.157	-0.239	-0.004	88	0.097	39
Oklahoma City, OK MSA	1,083,346	-0.123	-0.210	-0.005	89	0.071	73
Lexington, KY MSA	479,198	-0.053	-0.103	-0.005	90	0.027	142
La Crosse, WI--MN MSA	126,838	-0.123	-0.190	-0.005	91	0.075	68
Amarillo, TX MSA	217,858	-0.143	-0.224	-0.006	92	0.087	52
Charlotte--Gastonia--Rock Hill, NC--SC MSA	1,499,293	0.010	-0.018	-0.007	93	-0.014	190
Yuma, AZ MSA	160,026	-0.090	-0.149	-0.007	94	0.053	101
Goldsboro, NC MSA	113,329	-0.188	-0.286	-0.007	95	0.116	24
Washington--Baltimore, DC--MD--VA--WV CMSA	7,608,070	0.129	0.165	-0.008	96	-0.088	235
Hickory--Morganton--Lenoir, NC MSA	341,851	-0.125	-0.204	-0.009	97	0.074	72
Lafayette, IN MSA	182,821	-0.072	-0.129	-0.009	98	0.039	124
Champaign--Urbana, IL MSA	179,669	-0.080	-0.130	-0.009	99	0.048	107
Green Bay, WI MSA	226,778	-0.021	-0.062	-0.009	100	0.005	164
Omaha, NE--IA MSA	716,998	-0.064	-0.140	-0.009	101	0.029	139
Biloxi--Gulfport--Pascagoula, MS MSA	363,988	-0.132	-0.230	-0.009	102	0.075	70
Des Moines, IA MSA	456,022	-0.021	-0.074	-0.009	103	0.003	171
Stockton--Lodi, CA MSA	563,598	0.083	0.107	-0.010	104	-0.057	225
Providence--Fall River--Warwick, RI--MA MSA	1,188,613	0.011	-0.006	-0.010	105	-0.013	186
Tuscaloosa, AL MSA	164,875	-0.100	-0.180	-0.010	106	0.055	95
Columbus, GA--AL MSA	274,624	-0.133	-0.213	-0.010	107	0.080	62
Pueblo, CO MSA	141,472	-0.153	-0.246	-0.010	108	0.092	44
Ocala, FL MSA	258,916	-0.168	-0.274	-0.010	109	0.099	37
non-metropolitan areas, NC	2,632,956	-0.148	-0.242	-0.010	.	0.088	.
Knoxville, TN MSA	687,249	-0.112	-0.197	-0.011	110	0.063	82
non-metropolitan areas, NV	285,196	0.008	-0.013	-0.011	.	-0.012	.
Springfield, MA MSA	591,932	-0.005	-0.022	-0.011	111	0.000	175
Yuba City, CA MSA	139,149	-0.069	-0.100	-0.011	112	0.044	114
non-metropolitan areas, SD	629,811	-0.267	-0.435	-0.012	.	0.158	.
non-metropolitan areas, CT	1,350,818	0.108	0.136	-0.012	.	-0.074	.
Mobile, AL MSA	540,258	-0.125	-0.221	-0.012	113	0.070	75
Fargo--Moorhead, ND--MN MSA	174,367	-0.157	-0.280	-0.013	114	0.087	53
Yakima, WA MSA	222,581	-0.030	-0.076	-0.013	115	0.011	157
Dover, DE MSA	126,697	-0.088	-0.163	-0.014	116	0.047	111
Tulsa, OK MSA	803,235	-0.082	-0.180	-0.015	117	0.037	129
Cleveland--Akron, OH CMSA	2,945,831	0.010	-0.037	-0.017	118	-0.019	194
Joplin, MO MSA	157,322	-0.254	-0.418	-0.019	119	0.150	7
Tyler, TX MSA	174,706	-0.100	-0.198	-0.019	120	0.051	104
Greensboro--Winston-Salem--High Point, NC MSA	1,251,509	-0.048	-0.130	-0.019	121	0.015	152
Lakeland--Winter Haven, FL MSA	483,924	-0.118	-0.229	-0.019	122	0.061	87
Minneapolis--St. Paul, MN--WI MSA	2,968,806	0.086	0.055	-0.020	123	-0.072	231
San Antonio, TX MSA	1,592,383	-0.090	-0.187	-0.020	124	0.043	115
Fresno, CA MSA	922,516	-0.017	-0.057	-0.020	125	0.003	170
Louisville, KY--IN MSA	1,025,598	-0.042	-0.128	-0.021	126	0.010	159
Las Vegas, NV--AZ MSA	1,563,282	0.084	0.066	-0.021	127	-0.067	230

TABLE A: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

				Adjusted		Unadjusted	
Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Quality of Life	QOL Rank	Quality of Life	QOL Rank
Modesto, CA MSA	446,997	0.053	0.034	-0.021	128	-0.044	217
Auburn--Opelika, AL MSA	115,092	-0.130	-0.253	-0.021	129	0.067	78
Lancaster, PA MSA	470,658	-0.008	-0.074	-0.021	130	-0.011	182
Jackson, MS MSA	440,801	-0.093	-0.212	-0.022	131	0.039	126
Greenville--Spartanburg--Anderson, SC MSA	962,441	-0.056	-0.155	-0.022	132	0.018	151
Appleton--Oshkosh--Neenah, WI MSA	358,365	-0.046	-0.133	-0.023	133	0.012	155
Roanoke, VA MSA	235,932	-0.103	-0.209	-0.023	134	0.051	103
Topeka, KS MSA	169,871	-0.138	-0.273	-0.023	135	0.070	74
Corpus Christi, TX MSA	380,783	-0.081	-0.182	-0.023	136	0.035	132
Waterloo--Cedar Falls, IA MSA	128,012	-0.128	-0.261	-0.024	137	0.062	84
Chattanooga, TN--GA MSA	465,161	-0.094	-0.207	-0.024	138	0.043	118
Albany--Schenectady--Troy, NY MSA	875,583	-0.005	-0.062	-0.024	139	-0.010	181
Davenport--Moline--Rock Island, IA--IL MSA	359,062	-0.077	-0.184	-0.025	140	0.031	138
non-metropolitan areas, SC	1,616,255	-0.129	-0.259	-0.025	.	0.064	.
Glens Falls, NY MSA	124,345	-0.104	-0.197	-0.025	141	0.055	96
Johnson City--Kingsport--Bristol, TN--VA MSA	480,091	-0.161	-0.310	-0.025	142	0.084	55
Greenville, NC MSA	133,798	-0.086	-0.202	-0.026	143	0.036	131
Rocky Mount, NC MSA	143,026	-0.111	-0.238	-0.027	144	0.052	102
Fort Smith, AR--OK MSA	207,290	-0.169	-0.334	-0.027	145	0.086	54
Columbus, OH MSA	1,540,157	0.024	-0.047	-0.027	146	-0.036	210
Sheboygan, WI MSA	112,646	-0.064	-0.172	-0.027	147	0.021	150
Hartford, CT MSA	1,183,110	0.148	0.146	-0.028	148	-0.111	240
Baton Rouge, LA MSA	602,894	-0.045	-0.152	-0.028	149	0.007	162
Rochester, NY MSA	1,098,201	-0.018	-0.091	-0.029	150	-0.005	178
Hattiesburg, MS MSA	111,674	-0.178	-0.346	-0.029	151	0.091	46
Sioux City, IA--NE MSA	124,130	-0.124	-0.271	-0.029	152	0.056	91
non-metropolitan areas, NY	1,744,930	-0.109	-0.217	-0.029	.	0.055	.
Kansas City, MO--KS MSA	1,776,062	0.003	-0.094	-0.029	153	-0.027	202
Benton Harbor, MI MSA	162,453	-0.080	-0.187	-0.030	154	0.033	135
Allentown--Bethlehem--Easton, PA MSA	637,958	0.005	-0.081	-0.030	155	-0.026	200
St. Joseph, MO MSA	102,490	-0.171	-0.335	-0.030	156	0.087	51
Evansville--Henderson, IN--KY MSA	296,195	-0.087	-0.212	-0.031	157	0.034	134
non-metropolitan areas, KS	1,366,517	-0.223	-0.410	-0.031	.	0.121	.
Dallas--Fort Worth, TX CMSA	5,221,801	0.068	0.009	-0.031	158	-0.066	228
Sumter, SC MSA	104,646	-0.183	-0.350	-0.031	159	0.096	40
non-metropolitan areas, MO	1,798,819	-0.251	-0.451	-0.032	.	0.139	.
Eau Claire, WI MSA	148,337	-0.119	-0.258	-0.032	160	0.054	99
Birmingham, AL MSA	921,106	-0.011	-0.117	-0.032	161	-0.018	193
Atlanta, GA MSA	4,112,198	0.078	0.016	-0.032	162	-0.074	233
Alexandria, LA MSA	126,337	-0.167	-0.336	-0.032	163	0.083	56
Merced, CA MSA	210,554	0.000	-0.070	-0.033	164	-0.017	192
St. Louis, MO--IL MSA	2,603,607	0.005	-0.094	-0.033	165	-0.028	206
Shreveport--Bossier City, LA MSA	392,302	-0.116	-0.266	-0.033	166	0.050	106
Richmond--Petersburg, VA MSA	996,512	0.004	-0.088	-0.033	167	-0.026	201
Canton--Massillon, OH MSA	406,934	-0.076	-0.199	-0.033	168	0.026	144
Monroe, LA MSA	147,250	-0.123	-0.277	-0.033	169	0.054	98
non-metropolitan areas, NE	878,760	-0.243	-0.451	-0.033	.	0.131	.
Dayton--Springfield, OH MSA	950,558	-0.019	-0.124	-0.034	170	-0.012	185
non-metropolitan areas, WI	1,866,585	-0.111	-0.253	-0.034	.	0.047	.
non-metropolitan areas, MD	666,998	-0.021	-0.111	-0.034	.	-0.007	.
Lafayette, LA MSA	385,647	-0.101	-0.249	-0.034	171	0.039	127
Detroit--Ann Arbor--Flint, MI CMSA	5,456,428	0.132	0.089	-0.034	172	-0.109	239
Visalia--Tulare--Porterville, CA MSA	368,021	-0.034	-0.118	-0.034	173	0.004	168
Philadelphia--Wilmington--Atlantic City, PA--NJ--DE--MD CMSA	6,188,463	0.115	0.068	-0.035	174	-0.098	237
Springfield, IL MSA	201,437	-0.074	-0.194	-0.035	175	0.025	147
Harrisburg--Lebanon--Carlisle, PA MSA	629,401	-0.008	-0.114	-0.035	176	-0.020	197
Scranton--Wilkes-Barre--Hazleton, PA MSA	624,776	-0.103	-0.247	-0.036	177	0.041	121
non-metropolitan areas, VA	1,640,567	-0.158	-0.322	-0.036	.	0.077	.
non-metropolitan areas, AR	1,607,993	-0.226	-0.437	-0.036	.	0.116	.
El Paso, TX MSA	679,622	-0.141	-0.308	-0.037	178	0.064	81
non-metropolitan areas, IA	1,863,270	-0.181	-0.374	-0.038	.	0.087	.
Lynchburg, VA MSA	214,911	-0.135	-0.297	-0.039	179	0.060	88
Cincinnati--Hamilton, OH--KY--IN CMSA	1,979,202	0.038	-0.064	-0.039	180	-0.054	222
Indianapolis, IN MSA	1,607,486	0.018	-0.090	-0.039	181	-0.040	215
Pittsburgh, PA MSA	2,358,695	-0.039	-0.172	-0.041	182	-0.003	177
Longview--Marshall, TX MSA	208,780	-0.132	-0.306	-0.041	183	0.055	93
Muncie, IN MSA	118,769	-0.112	-0.275	-0.041	184	0.043	116
Waco, TX MSA	213,517	-0.113	-0.278	-0.041	185	0.043	117
Williamsport, PA MSA	120,044	-0.119	-0.288	-0.042	186	0.047	110
Toledo, OH MSA	618,203	-0.023	-0.153	-0.042	187	-0.016	191
Erie, PA MSA	280,843	-0.106	-0.269	-0.043	188	0.038	128
Dothan, AL MSA	137,916	-0.177	-0.381	-0.043	189	0.082	61
Sharon, PA MSA	120,293	-0.145	-0.326	-0.043	190	0.064	80
York, PA MSA	381,751	-0.027	-0.162	-0.043	191	-0.013	187
non-metropolitan areas, OK	1,862,951	-0.241	-0.479	-0.044	.	0.121	.

TABLE A: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Adjusted Quality of Life	Adjusted QOL Rank	Unadjusted Quality of Life	Unadjusted QOL Rank
non-metropolitan areas, TN	2,123,330	-0.181	-0.393	-0.045	.	0.083	.
Memphis, TN--AR--MS MSA	1,135,614	0.023	-0.105	-0.046	192	-0.049	220
South Bend, IN MSA	265,559	-0.061	-0.219	-0.046	193	0.006	163
non-metropolitan areas, GA	2,744,802	-0.124	-0.303	-0.046	.	0.048	.
non-metropolitan areas, ND	521,239	-0.245	-0.502	-0.048	.	0.119	.
Janesville--Beloit, WI MSA	152,307	-0.004	-0.151	-0.049	194	-0.034	209
Lansing--East Lansing, MI MSA	447,728	0.010	-0.119	-0.049	195	-0.040	214
Wichita, KS MSA	545,220	-0.063	-0.245	-0.050	196	0.001	174
Grand Rapids--Muskegon--Holland, MI MSA	1,088,514	0.010	-0.121	-0.050	197	-0.040	213
non-metropolitan areas, TX	4,030,376	-0.183	-0.407	-0.051	.	0.081	.
Buffalo--Niagara Falls, NY MSA	1,170,111	-0.029	-0.170	-0.051	198	-0.013	188
Wausau, WI MSA	125,834	-0.077	-0.257	-0.052	199	0.013	154
Augusta--Aiken, GA--SC MSA	477,441	-0.071	-0.249	-0.052	200	0.009	160
Jackson, TN MSA	107,377	-0.083	-0.273	-0.052	201	0.014	153
Florence, AL MSA	142,950	-0.125	-0.335	-0.053	202	0.041	120
Richland--Kennewick--Pasco, WA MSA	191,822	0.030	-0.105	-0.053	203	-0.056	224
Houma, LA MSA	194,477	-0.096	-0.296	-0.054	204	0.022	149
Brownsville--Harlingen--San Benito, TX MSA	335,227	-0.220	-0.470	-0.054	205	0.103	32
Anniston, AL MSA	112,249	-0.186	-0.427	-0.055	206	0.080	63
Mansfield, OH MSA	175,818	-0.102	-0.299	-0.056	207	0.027	143
non-metropolitan areas, MI	2,178,963	-0.071	-0.254	-0.058	.	0.008	.
non-metropolitan areas, MN	1,565,030	-0.150	-0.365	-0.058	.	0.058	.
Binghamton, NY MSA	252,320	-0.108	-0.295	-0.058	208	0.034	133
Altoona, PA MSA	129,144	-0.148	-0.372	-0.058	209	0.055	94
Kalamazoo--Battle Creek, MI MSA	452,851	-0.019	-0.186	-0.059	210	-0.027	203
St. Cloud, MN MSA	167,392	-0.099	-0.300	-0.059	211	0.024	148
Youngstown--Warren, OH MSA	594,746	-0.077	-0.274	-0.059	212	0.009	161
Reading, PA MSA	373,638	0.006	-0.161	-0.060	213	-0.047	218
Huntsville, AL MSA	342,376	-0.039	-0.234	-0.060	214	-0.020	195
Houston--Galveston--Brazoria, TX CMSA	4,669,571	0.069	-0.075	-0.061	215	-0.088	236
Odessa--Midland, TX MSA	237,132	-0.117	-0.343	-0.062	216	0.032	137
non-metropolitan areas, IN	1,791,003	-0.095	-0.317	-0.064	.	0.016	.
non-metropolitan areas, PA	2,023,193	-0.128	-0.360	-0.064	.	0.038	.
non-metropolitan areas, WV	1,809,034	-0.175	-0.444	-0.064	.	0.064	.
Fort Wayne, IN MSA	502,141	-0.050	-0.255	-0.064	217	-0.014	189
Macon, GA MSA	322,549	-0.060	-0.267	-0.065	218	-0.007	180
Danville, VA MSA	110,156	-0.154	-0.400	-0.066	219	0.054	97
non-metropolitan areas, OH	2,548,986	-0.099	-0.323	-0.066	.	0.018	.
Rochester, MN MSA	124,277	0.027	-0.159	-0.068	220	-0.066	229
Lake Charles, LA MSA	183,577	-0.061	-0.287	-0.068	221	-0.011	183
Utica--Rome, NY MSA	299,896	-0.115	-0.333	-0.068	222	0.032	136
non-metropolitan areas, LA	1,415,540	-0.152	-0.420	-0.070	.	0.047	.
non-metropolitan areas, IL	2,202,549	-0.131	-0.369	-0.070	.	0.038	.
Bloomington--Normal, IL MSA	150,433	0.027	-0.152	-0.070	223	-0.065	227
Albany, GA MSA	120,822	-0.079	-0.307	-0.070	224	0.002	172
Syracuse, NY MSA	732,117	-0.038	-0.235	-0.070	225	-0.021	198
Terre Haute, IN MSA	149,192	-0.117	-0.367	-0.071	226	0.025	146
Peoria--Pekin, IL MSA	347,387	-0.019	-0.220	-0.071	227	-0.036	211
Bakersfield, CA MSA	661,645	0.029	-0.141	-0.072	228	-0.064	226
Saginaw--Bay City--Midland, MI MSA	403,070	-0.012	-0.214	-0.072	229	-0.041	216
Lima, OH MSA	155,084	-0.087	-0.326	-0.073	230	0.005	165
non-metropolitan areas, MS	1,869,256	-0.196	-0.496	-0.073	.	0.072	.
Duluth--Superior, MN--WI MSA	243,815	-0.085	-0.323	-0.073	231	0.004	167
non-metropolitan areas, KY	2,828,647	-0.154	-0.432	-0.074	.	0.046	.
Jackson, MI MSA	158,422	-0.019	-0.227	-0.074	232	-0.038	212
Rockford, IL MSA	371,236	0.005	-0.202	-0.076	233	-0.055	223
Johnstown, PA MSA	232,621	-0.180	-0.470	-0.077	234	0.063	83
Jamestown, NY MSA	139,750	-0.138	-0.395	-0.079	235	0.040	123
Decatur, AL MSA	145,867	-0.057	-0.313	-0.079	236	-0.021	199
non-metropolitan areas, AL	1,504,381	-0.166	-0.469	-0.080	.	0.049	.
Gadsden, AL MSA	103,459	-0.135	-0.426	-0.080	237	0.029	140
McAllen--Edinburg--Mission, TX MSA	569,463	-0.211	-0.548	-0.087	238	0.074	71
Decatur, IL MSA	114,706	-0.052	-0.344	-0.099	239	-0.033	208
Beaumont--Port Arthur, TX MSA	385,090	-0.036	-0.343	-0.103	240	-0.050	221
Kokomo, IN MSA	101,541	0.067	-0.239	-0.117	241	-0.127	241

Populations in non-metropolitan areas are approximate.

TABLE B: DESCRIPTIVE STATISTICS ON INDIVIDUAL AMENITIES FOR CITIES

	Observations	Mean	Std Dev	Min	Max
Heating-Degree Days (1000s)	239	4.221	2.039	0.173	9.687
Cooling-Degree Days (1000s)	239	1.344	0.948	0.059	4.218
Sunshine (fraction possible)	232	0.606	0.086	0.410	0.900
Precipitation (10s of inches)	239	3.920	1.321	0.399	6.637
Proximity to Coast (salt or fresh water)	241	0.592	0.493	0.000	1.000
Violent Crimes per Capita	241	0.005	0.002	0.000	0.011
Median Air Quality Index (/100)	224	0.495	0.127	0.040	0.970
Restaurants and Bars per Capita	239	1.426	0.276	0.655	4.030
Places Rated Arts & Culture Index (/100)	240	0.815	0.241	0.000	1.000
Residential Land Use Regulatory Index	213	0.251	0.682	-1.677	4.103
Sprawl Index (/10)	239	4.00	0.99	2.07	7.33
Local Expenditures net of Local Taxes	241	0.000	0.159	-0.743	0.609
Federal Spending Differential	241	-0.002	0.009	-0.030	0.054