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# A REVEALED-PREFERENCE RANKING OF QUALITY OF LIFE FOR METROPOLITAN AREAS[1]

Mark C. BERGER, *University of Kentucky*

Glenn C. BLOMQUIST, *University of Kentucky*

Werner WALDNER, *University of Kentucky*

Interarea quality-of-life comparisons attract attention because of their all-inclusive nature and emphasis on location-specific amenities. Such information is useful for location and public policy decisions. This study presents a revealed-preference, quality-of-life ranking of metropolitan areas. The weights are based on compensating differences in housing prices and wages and are estimated using a large national data set with variables for climate, environmental quality, and urban conditions. Comparisons are made with alternative rankings.

**Interregional and interurban comparisons of almost any sort attract at-**tention. Comparisons of quality of life get special attention because of their all-inclusive nature which centers on location-specific amenities. People recognize well-being depends upon quality-of-life factors such as climate, environmental quality, crime, and public services as well as the more traditional pecuniary factors such as money income and the prices of goods which determine cost of living. People recognize also how few clear indications of quality-of-life differences come from considering only, say, money income and cost of living. The typical result is that a city which has high money income also has high cost of living. Models of city size (Tolley, 1974) explain the positive correlation between money wages and cost of living by the effect of wages on the price of local goods such as housing, but still give no clear indication of quality of life differences.

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The interest in quality of life in part stems from the fact that it is an important location factor. Consumer-workers consider amenity factors along with earning opportunities and cost of living when deciding whether to stay or move and to where they might want to move. Graves (1979), for instance, showed how climate influences migration decisions of people of different ages. Employers consider amenity factors as assets in recruiting and maintaining a viable work force. Myers (1985), for example, illustrated the relevance of quality of life to the labor force employed by the "high tech" industry. Leaders in business and government place enough emphasis on quality of life in trying to attract industry that Boyer and Savageau's *Places Rated Almanac* (1981, 1985) is a commercial success and rating places is a thriving business.

However, the interest in quality of life also stems in part from other public policy uses. Quality-of-life measures can be used to augment traditional measures of economic performance. Monetary measures are imperfect because they ignore nonmarket commodities which belong in a more comprehensive measure of well-being; see Nordhaus and Tobin (1972). Quality-of-life measures can aid public policymakers in formulating policies by identifying neglected but valuable dimensions of overall well-being, by identifying places with unusually low levels of local public goods, and by monitoring progress of current policies; see Berger and Blomquist (1986), Helburn (1982), and Cutter (1985: 63–64).

A quality-of-life index can be helpful to individual consumers and workers, to corporate planners, and to public policymakers. A quality-of-life index can be useful in assessing the world as it is now and in predicting and influencing future developments. The purpose of this paper is to present a revealed-preference quality-of-life index and use it to rank metropolitan areas. In contrast to most previous studies, the index factors are aggregated not by using externally imposed weights but rather by using weights which are derived from observable behavior of workers and consumers. Amenity weights are estimated via a national multimarket analysis of wages and housing prices. The rich data set facilitates inclusion of a variety of location-specific amenities and calculation of index values for most metropolitan areas in the United States.

## A Revealed-Preference Quality-of-Life Index

An ideal quality-of-life index would measure overall well-being. A holistic measure might include objectively measured money income and subjectively assessed community spirit as well as other factors. It might, as Cutter (1985: 1–3) suggested, cover social, environmental, and perceptual dimensions of overall well-being. The index developed in this paper is a partial index which measures a bundle of location-specific amenities and does not include tangibles such as money income. The index is a measure of a group of factors which are usually classified as intangibles.

Construction of a quality-of-life index is complex because weights for the amenity factors are not readily available. Let the quality-of-life index (QOLI) be defined as follows:

$$\text{QOLI}_j = \sum_{i=1}^{n} k_i a_{ij} \qquad j = 1, \ldots, m \qquad (1)$$

where $k_i$ is the weight for amenity $i$, $a_i$ is the $i$th amenity, $n$ is the number of amenities, and $m$ is the number of locations being ranked. An acceptable QOLI should systematically assign conceptually correct weights (values) to each factor included in the index. Cutter's (1985) review revealed that most earlier studies including Liu (1976) and Boyer and Savageau (1981, 1985) imposed weights in some ad hoc fashion. The weights reflected either the analysts' subjective values or the outcome of an atheoretic statistical procedure. Unlike these studies Rosen (1979) presented a spatial equilibrium model with local public goods and estimated implicit values for amenities through an analysis of interarea wage rates ($w$). The implicit values can serve as weights for amenities in calculating the quality of life index values for areas, i.e., $k_i = dw/da_i$. Rosen's contribution was that the weights were derived from workers' own preferences and were equal to their marginal willingness to pay for various dimensions of quality of life. Rosen's approach was extended by Roback (1982), who showed that in general the weights should be derived from values implicit in rents ($r$) as well as wage rates. Both markets must be considered since payments for amenities can be made through both markets—lower wages and/or higher housing prices. Roback's ranking of cities based on a QOLI which used weights $k_i = b(dr/da_i) - c(dw/da_i)$, where $b$ and $c$ are constants, showed marked differences from Liu's ranking with externally imposed weights. Compared to Roback's work the data used in this study are more recent, more comprehensive, and more reliable in measuring rents.

The QOLI developed in this paper also uses amenity weights that are preference-based values estimated from compensating differences. The underlying model used to generate the weights was developed by Hoehn, Berger, and Blomquist (forthcoming [1987]). It is a theory of location, wages, and rents that accounts for interaction of housing and labor markets and allows for interurban variation in housing prices. The model encompasses the impact of city size and urban structure and allows for an additional compensatory mechanism with interaction of wages and rents. The basic consumption decision for the individual is to select a package of local prices and amenities in order to maximize utility. On the production side, firms at each location produce a composite consumption commodity using local labor and local amenities. Equilibrium is sustained when local wages and rents are such that individuals' utility possibilities are equalized across all locations and firms' unit costs equal unit prices at each location. Though the comparative statics are complex, the full implicit price of an amenity is shown to be measured by a weighted sum of the housing price and wage differentials. Housing consumption and labor supplied are the respective weights. The full implicit price must be positive for amenities and negative for disamenities. In this national multimarket context, however, partial implicit prices from, say, the labor market need not be so signed. In other words, a QOLI using weights based on only housing price or wage differentials may be misleading.

The weights in our QOLI correspond to the full implicit amenity prices in the national multimarket location model. They are the full marginal values which individuals place on various amenities and disamenities taking into account implicit transactions in both the labor market and the housing market. The weights used also depend on the specification of the hedonic equations and the units for the variables. These weights ($k_i$) are calculated for households:

$$k_i = -P_{wa_i}(\bar{h})(\bar{n}) + P_{ra_i}(12) \qquad (2)$$

where the first term on the right-hand side of the equation is the partial implicit price from the labor market and the second term is the partial implicit price from the housing market. The partial implicit earnings price is the product of $P_{wa_i}$, the unit price per hour for amenity $i$, which is obtained by transforming the estimated coefficient for amenity $i$ in the earnings equation; $\bar{h}$, the average annual hours worked; and $\bar{n}$, the average number of workers per household.[2] The partial implicit housing price is the product of $P_{ra_i}$, the unit price per month for amenity $i$, obtained from the corresponding estimated coefficient in the housing expenditure equation, and 12, the number of months per year. The partial implicit price from the labor market is multiplied by $-1$ in equation (2) because individuals pay implicitly for amenities in the labor market through lower wages and are compensated for disamenities through higher wages. A positive $k_i$ indicates that $a_i$ is an amenity while a negative $k_i$ means $a_i$ is a disamenity. These preference-based weights derived from the national multimarket framework are then used to calculate the QOLI values for urban areas.

[2]The actual functional forms of the wage and housing expenditure equations are determined by Box-Cox tests. These tests imply values of $\lambda = .1$ for the wage equation (i.e., $(w^{0.1} - 1)/0.1$), $\lambda = 0.2$ for the rent equation (i.e., $(r^{0.2} - 1)/0.2$), and linear explanatory variables ($\gamma = 1$) for both equations. The parameter estimates from these equations are then transformed to obtain the unit prices $P_{wa_i}$ and $P_{ra_i}$ in equation (2). In particular, $P_{wa_i} = b_{wa_i}(\bar{w}^{0.9})$ and $P_{ra_i} = b_{ra_i}(\bar{r}^{0.8})$, where $b_{wa_i}$ and $b_{ra_i}$ are the parameter estimates for amenity $a_i$ in the wage and housing expenditure equations, and $\bar{w}$ and $\bar{r}$ are the sample mean wage and housing expenditure. While similar in spirit, Roback's (1982) partial implicit prices for amenity $i$ are not identical to ours because of her log-linear specification. Her partial implicit prices are: $P_{wa_i} = b_{wa_i}\bar{w}$, $P_{ra_i} = b_{ra_i}\bar{r}$.

## Data on Amenities, Wages and Housing Prices

The comprehensive data set is eclectic in that numerous smaller sets of data are obtained from several sources and merged to form the larger set. The core of the data set are individual records from the 1 in 1000 Public Use "A" Sample of the 1980 Decennial Census. The starting sample size is approximately 225,000 individuals and 88,000 housing units, with 350 counties and 285 metropolitan areas represented. To this core are merged numerous more aggregate variables which pertain to the environment, climate, urban conditions, and labor market. The unit of observation for these merged variables is the county, metropolitan area, or industry depending on what is appropriate and available.

In all, 46,004 individuals and 34,414 housing units from the 185 metropolitan areas for which we have complete sets of amenity data are included in our estimated housing and wage equations. Retained in the housing sample are all housing units on 10 acres or less for which value of the unit or contract rent is reported. In the wage sample are all individuals aged 16 and over who reported their earnings, hours, and weeks, had nonzero wage and salary earnings, and had positive total earnings. The dependent variable in the housing equation is monthly housing expenditures. For renters, monthly housing expenditures is defined as gross rent including utilities, which is a variable included in the 1980 Census Public Use samples. For owners, reported house value is converted to a monthly imputed rent using a 7.85 percent discount rate obtained from the user cost study by Peiser and Smith (1985). Monthly expenditures for utilities are then added to obtain gross imputed rent for owners. The dependent variable in the wage equation is average hourly earnings, obtained by dividing annual earnings by the product of weeks worked during the year and usual hours worked per week.

The housing hedonic regression includes Census measures of structural characteristics and central city status. The wage hedonic regression has Census-based variables controlling for personal characteristics, occupational group, and central city status. Also included in the wage equation is a variable for industry unionization taken from Kokkelenberg and Sockell (1985). The remaining variables, common to both housing and wage hedonic regressions, come from data merged with the 1980 Census. These variables represent 15 of the 16 components of our QOLI. There are six variables measuring climatic conditions taken from *Comparative Climatic Data* prepared by the National Climatic Data Center. A violent crime variable is included based on figures reported in the *U.S. FBI Uniform Crime Reports for the United States.* Coast is a variable which equals one if the county of residence touches an ocean or one of the Great Lakes. The teacher-pupil ratio is based on school district and county data on enrollment and salaries found in volumes 3 and 4 of the 1982 *Census of Governments*.

The estimated wage and housing expenditure equations also include six environmental variables based on data from four different sources. The ambient concentration of total suspended particulate (TSP) for each county is based on the U.S. Environmental Protection Agency SAROAD data. Visibility data is from reports by Trijonis and Shapland (1979) and daily weather observations supplied by the National Climatic Center. The number of Superfund sites in the individual's county is based on information published in the Council on Environmental Quality report *Environmental Quality 1982*. Two of the last three variables are counts of activity in the individual's county of residence and are based on information available on the RCRA Application of Hazardous Waste Permit Tape obtained from the U.S. Environmental Protection Agency. The counts are for the number of treatment, storage, and disposal (TSD) facilities for hazardous wastes, and the number of National Pollution Discharge Elimination Systems (NPDES) water pollution dischargers in the county of residence. The last variable also comes from the RCRA tape and is the total licensed waste for landfills in the county.

Despite the comprehensive nature of the data set it is not ideal. Perhaps the six climatic variables and six environmental variables capture reasonably well these two dimensions of quality of life. However, the teacher-pupil ratio is surely a proxy for other publicly provided local goods as well as a measure of an educational input. Central city location probably represents publicly provided local goods as well as access to work, entertainment, and the arts. Rural areas cannot be analyzed because of the absence of data. These limitations affect the QOLI and simply reflect the impossibly high cost of constructing a perfect measure of well-being.

## Quality-of-Life Rankings

The parameter estimates from the rent and wage equations are converted to full implicit prices ($k_i$) using equation (2).[3] The means used to

[3]The results from the estimations of the wage and housing expenditure hedonic equations are available upon request from the authors. Besides the amenity measures, included as control variables in the wage equation are experience (age − schooling − 6) and experience squared; race, gender, and gender interactions with race, experience, experience squared, marital status, and children under 18; and schooling, disabled, school enrollment status, dummies for 5 of 6 broad occupation groups, and percentage of industry covered by unions. Control variables which are included in the housing hedonic regression are units at address, age of structure, stories, rooms, bedrooms, bathrooms, condominium status, central air, sewer, lot size exceeding 1 acre, renter status, and renter interaction terms for each of the preceding variables.

calculate the $k_i$ come from the national housing and wage samples used in the estimation. The metropolitan average value for the 16 amenities ($a_i$) is assigned for each of the 185 metropolitan areas in our sample.[4] These amenity values, multiplied by the full implicit prices, are expenditure components of the quality-of-life index given by equation (1). Table 1 lists the 16 components of the QOLI, the mean value of each component across the 185 metropolitan areas, and the standard deviation, minimum, and maximum. A positive sign on the mean value indicates an amenity while a negative sign indicates a disamenity. The sign of the mean value is the same as that of the full implicit price (equation (2)). Precipitation, sunshine, coast, teacher-pupil ratio, and central city are amenities in our QOLI. The only surprise is visibility, which we expected to be an amenity. However, the visibility component of the QOLI is quite small and does not markedly affect the rankings.

The components which at the mean make the largest (absolute value) contributions to the QOLI are humidity, sunshine, and the teacher-pupil ratio. The smallest contributions are by those TSD sites, landfill waste, and total suspended particulates. Some idea of the degree of variation around the mean values can be obtained from the standard deviations, minimums, and maximums in Table 1. Large standard deviations are found for sunshine and the teacher-pupil ratio, and also for variables such as precipitation, cooling degree days, and violent crime.

The overall index has a mean of $270 and a standard deviation of $623. The value of the index across metropolitan areas ranges from −$1,539 to $3,289. Values of the QOLI are perhaps best understood by comparing across metropolitan areas. The bundle of amenities available in the highest ranked metropolitan area is worth $4,828 more per year (in 1980 dollars) to the typical household than the bundle of amenities available in the lowest ranked metropolitan area.

Table 2 ranks all 185 metropolitan areas for which we have data by our QOLI, and compares our ranking for common metropolitan areas with the Liu (1976) overall ranking and Boyer and Savageau's (1981) *Places Rated* overall ranking.[5] Also given is the percentage of each SMSA's population from which our sample was drawn. According to our QOLI ranking, the SMSAs with the best measured quality of life appear to be smaller and medium-sized, especially in the sun belt. In general, larger northern cities

[4] The metropolitan average values are population-weighted averages of the county values in each SMSA. In some cases not all counties in an SMSA are included in our sample because they are not identified in the 1980 Census A sample or do not contain a full set of amenity data. The percentage of each SMSA's population covered by our sample is reported in Table 2.

[5] We report the Boyer and Savageau (1981) ranking instead of the more recent 1985 edition since our data set is based on the 1980 Census and we want to minimize the difference in the time periods.

## TABLE 1

**Amenity Components of the Quality of Life Index**

| Variable[a] | Mean[b] | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Precipitation (inches/year) | $ 810.78 | $314.33 | $ 88.35 | $ 1,573.84 |
| Humidity (%) | −2,996.38 | 293.45 | −3,397.33 | −1,367.62 |
| Heating degree days (number/year) | −357.38 | 177.80 | −780.13 | −16.47 |
| Cooling degree days (number/year) | −478.81 | 348.04 | −1,460.92 | −27.11 |
| Wind speed (mph) | −875.40 | 143.54 | −1,209.18 | −594.84 |
| Sunshine (% of possible) | 2,945.67 | 386.38 | 2,183.30 | 4,172.53 |
| Coast (location near coast or Great Lake) | 116.33 | 200.28 | 0.00 | 467.72 |
| Violent crime (number/100,000 persons) | −553.54 | 277.46 | −1,704.99 | −64.88 |
| Teacher-pupil ratio | 1,785.92 | 364.67 | 741.94 | 4,483.36 |
| Visibility (miles) | −61.94 | 52.43 | −273.15 | −27.31 |
| Total suspended particulates (micrograms/cubic meter) | −25.06 | 6.80 | −59.96 | −12.98 |
| NPDES effluent dischargers (number) | −78.13 | 137.76 | −843.52 | 0.00 |
| Landfill waste (100 millions metric tons) | −14.90 | 71.11 | −631.66 | 0.00 |
| Superfund sites (number) | −59.99 | 122.79 | −954.61 | 0.00 |
| TSD sites (number) | −8.84 | 15.07 | −133.43 | 0.00 |
| Central city (location in central city) | 121.42 | 168.40 | 0.00 | 645.02 |
| Quality-of-life index (QOLI, 1980 dollars per year) | $ 269.77 | $622.93 | $−1,539.31 | $3,288.72 |

[a]Each variable is measured as annual flows or average annual stocks. Coast and central city are measured as the proportion of individuals in the SMSA living in a county bordering the coast or a Great Lake or living in the central city, respectively.

[b]Mean across the 185 SMSAs of the QOLI expenditure components (product of the full implicit price for each amenity and the SMSA value of the corresponding amenity). Values are expressed in 1980 dollars.

## TABLE 2

### Metropolitan Areas Ranked by Quality of Life

| Rank | QOLI (1980 $) | Metropolitan Area | *Places Rated* Rank | Liu Rank |
|---|---|---|---|---|
| 1 | $ 3,288.72 | Pueblo, CO (100%) | 111 | 42 |
| 2 | 1,599.57 | Macon, GA (59%) | 178 | 159 |
| 3 | 1,575.36 | Reno, NV (100%) | 79 | 10 |
| 4 | 1,541.88 | Norfolk–Virginia Beach–Portsmouth, VA–NC (66%) | 90 | 150 |
| (Mean QOLI + 2 *SD* = $1,515.63) | | | | |
| 5 | 1,485.63 | Binghamton, NY–PA (71%) | 54 | 46 |
| 6 | 1,444.63 | Newport News–Hampton, VA (34%) | 64 | 131 |
| 7 | 1,430.84 | Sarasota, FL (100%) | 91 | — |
| 8 | 1,422.54 | West Palm Beach–Boca Raton, FL (100%) | 137 | 93 |
| 9 | 1,341.87 | Tucson, AZ (100%) | 28 | 75 |
| 10 | 1,326.91 | Fort Lauderdale–Hollywood, FL (100%) | 86 | 118 |
| 11 | 1,297.84 | Fort Collins, CO (100%) | 145 | — |
| 12 | 1,280.21 | Charleston–North Charleston, SC (64%) | 93 | 160 |
| 13 | 1,213.97 | Salinas–Seaside–Monterey, CA (100%) | 156 | 68 |
| 14 | 1,197.96 | Denver–Boulder, CO (98%) | 16 | 26 |
| 15 | 1,129.65 | Roanoke, VA (45%) | 66 | 49 |
| 16 | 1,066.51 | Tallahassee, FL (93%) | 133 | 16 |
| 17 | 1,055.49 | Lexington–Fayette, KY (64%) | 62 | 65 |
| 18 | 1,025.75 | Santa Barbara–Santa Maria–Lompoc, CA (100%) | 82 | 14 |
| 19 | 1,022.83 | Oxnard–Simi Valley–Ventura, CA (100%) | 136 | 66 |
| 20 | 1,000.92 | Wilmington, NC (74%) | 85 | 135 |
| 21 | 998.72 | Raleigh–Durham, NC (85%) | 9 | 96 |
| 22 | 980.93 | San Diego, CA (100%) | 20 | 33 |
| 23 | 965.38 | Lancaster, PA (100%) | 128 | 129 |
| 24 | 958.13 | Bradenton, FL (100%) | 172 | — |
| 25 | 957.23 | Greeley, CO (100%) | 182 | — |
| 26 | 923.02 | El Paso, TX (100%) | 102 | 136 |
| 27 | 920.51 | Northeast Pennsylvania, PA (89%) | 120 | 119 |
| 28 | 912.83 | Racine, WI (100%) | 145 | 41 |
| (Mean QOLI + 1 *SD* = $892.70) | | | | |
| 29 | 884.00 | Eugene–Springfield, OR (100%) | 63 | 4 |
| 30 | 870.69 | Phoenix, AZ (100%) | 38 | 91 |
| 31 | 844.96 | Williamsport, PA (100%) | 117 | — |
| 32 | 819.93 | Melbourne–Titusville–Cocoa, FL (100%) | 173 | — |
| 33 | 808.86 | Fresno, CA (100%) | 183 | 63 |
| 34 | 803.73 | Sioux Falls, SD (100%) | 70 | 6 |
| 35 | 803.49 | Anaheim–Santa Ana–Garden Grove, CA (100%) | 13 | 47 |
| 36 | 803.35 | Fort Myers–Cape Coral, FL (100%) | 152 | — |
| 37 | 792.13 | Pittsfield, MA (100%) | 168 | 11 |
| 38 | 791.58 | Madison, WI (100%) | 30 | 5 |
| 39 | 787.31 | Vineland–Millville–Bridgeton, NJ (100%) | 180 | 122 |
| 40 | 763.67 | Harrisburg, PA (52%) | 49 | 101 |
| 41 | 743.99 | Greensboro–Winston-Salem–High Point, NC (81%) | 3 | 153 |
| 42 | 735.50 | Knoxville, TN (67%) | 11 | 102 |
| 43 | 733.40 | Fayetteville–Springdale, AR (56%) | 126 | — |
| 44 | 728.69 | Stockton, CA (100%) | 176 | 73 |
| 45 | 711.21 | Altoona, PA (100%) | 147 | 110 |

TABLE 2—*continued*

| Rank | QOLI (1980 $) | Metropolitan Area | *Places Rated* Rank | Liu Rank |
|---|---|---|---|---|
| 46 | 709.16 | Jersey City, NJ (100%) | 125 | 162 |
| 47 | 699.84 | Pascagoula–Moss Point, MS (100%) | 148 | — |
| 48 | 687.80 | Nassau–Suffolk, NY (100%) | 41 | — |
| 49 | 686.46 | Richmond, VA (57%) | 27 | 115 |
| 50 | 667.64 | Los Angeles–Long Beach, CA (100%) | 40 | 57 |
| 51 | 664.83 | Greenville–Spartanburg, SC (86%) | 83 | 152 |
| 52 | 593.80 | Augusta, GA–SC (88%) | 121 | 147 |
| 53 | 559.55 | Mobile, AL (82%) | 136 | 161 |
| 54 | 558.70 | St. Cloud, MN (66%) | 80 | — |
| 55 | 540.27 | Las Vegas, NV (100%) | 127 | 79 |
| 56 | 536.74 | Paterson–Clifton–Passaic, NJ (100%) | 174 | 109 |
| 57 | 533.39 | Boise City, ID (100%) | 92 | 26 |
| 58 | 530.66 | Evansville, IN–KY (54%) | 145 | 78 |
| 59 | 503.38 | Rochester, NY (72%) | 46 | 24 |
| 60 | 498.30 | Savannah, GA (88%) | 115 | 138 |
| 61 | 474.69 | Charlotte–Gastonia, NC (25%) | 44 | 125 |
| 62 | 470.45 | Des Moines, IA (90%) | 89 | 17 |
| 63 | 469.84 | Columbia, SC (100%) | 74 | 151 |
| 64 | 447.02 | Santa Cruz, CA (100%) | 123 | — |
| 65 | 402.87 | Tuscaloosa, AL (100%) | 146 | 141 |
| 66 | 400.74 | Bakersfield, CA (100%) | 166 | 90 |
| 67 | 398.00 | Orlando, FL (67%) | 68 | 130 |
| 68 | 381.69 | Albany–Schenectady–Troy, NY (74%) | 43 | 53 |
| 69 | 371.79 | Trenton, NJ (100%) | 75 | 100 |
| 70 | 365.52 | Wichita, KS (89%) | 88 | 31 |
| 71 | 355.25 | San Jose, CA (100%) | 29 | 21 |
| 72 | 354.81 | Duluth–Superior, MN–WI (83%) | 51 | 34 |
| 73 | 348.79 | Fort Wayne, IN (77%) | 35 | 23 |
| 74 | 340.84 | Champaign–Urbana–Rantoul, IL (100%) | 103 | 64 |
| 75 | 328.84 | Long Branch–Asbury Park, NJ (100%) | 116 | — |
| 76 | 318.59 | Sacramento, CA (88%) | 72 | 7 |
| 77 | 313.42 | Modesto, CA (100%) | 175 | 59 |
| 78 | 301.84 | Fayetteville, NC (100%) | 160 | 157 |
| 79 | 298.77 | Tacoma, WA (100%) | 56 | 88 |
| 80 | 286.38 | Utica–Rome, NY (79%) | 23 | 82 |
| 81 | 276.09 | Reading, PA (100%) | 142 | 132 |
| 82 | 270.04 | Cedar Rapids, IA (100%) | 131 | 28 |
| (Mean QOLI = $269.77) | | | | |
| 83 | 267.35 | Daytona Beach, FL (100%) | 95 | — |
| 84 | 265.21 | Spokane, WA (100%) | 108 | 52 |
| 85 | 254.55 | Syracuse, NY (72%) | 7 | 54 |
| 86 | 249.32 | Provo–Orem, UT (100%) | 124 | 37 |
| 87 | 248.16 | Monroe, LA (100%) | 150 | 126 |
| 88 | 243.41 | Johnstown, PA (69%) | 81 | 127 |
| 89 | 237.02 | Lincoln, NE (100%) | 65 | 1 |
| 90 | 228.86 | Salt Lake City–Ogden, UT (97%) | 37 | 43 |
| 91 | 196.04 | Janesville–Beloit, WI (100%) | — | — |
| 92 | 191.57 | Tampa–St. Petersburg, FL (88%) | 54 | 140 |
| 93 | 189.48 | Sioux City, IA–NE (86%) | 111 | 44 |
| 94 | 171.35 | Kansas City, MO–KS (33%) | 25 | 105 |
| 95 | 168.37 | Hamilton–Middletown, OH (100%) | 170 | 92 |
| 96 | 161.22 | Lansing–East Lansing, MI (58%) | 50 | 18 |
| 97 | 155.61 | Odessa, TX (100%) | 119 | 51 |
| 98 | 154.34 | Springfield, IL (94%) | 76 | 27 |

TABLE 2—*continued*

| Rank | QOLI (1980 $) | Metropolitan Area | *Places Rated* Rank | Liu Rank |
|---|---|---|---|---|
| 99 | 152.52 | Abilene, TX (80%) | 139 | 85 |
| 100 | 144.24 | Erie, PA (100%) | 47 | 86 |
| 101 | 140.27 | Bloomington–Normal, IL (100%) | 101 | 12 |
| 102 | 139.55 | San Francisco–Oakland, CA (100%) | 15 | 29 |
| 103 | 137.38 | Terre Haute, IN (64%) | 151 | 38 |
| 104 | 135.46 | Riverside–San Bernardino–Ontario, CA (57%) | 88 | 76 |
| 105 | 131.70 | Chattanooga, TN–GA (67%) | 105 | 143 |
| 106 | 128.25 | Atlantic City, NJ (100%) | 140 | 121 |
| 107 | 128.12 | Rockford, IL (90%) | 179 | 74 |
| 108 | 113.51 | Toledo, OH–MI (77%) | 61 | 71 |
| 109 | 113.46 | Richland–Kennewick–Pasco, WA (76%) | 162 | — |
| 110 | 108.11 | South Bend, IN (86%) | 100 | 45 |
| 111 | 105.46 | Memphis, TN–AR–MS (85%) | 55 | 148 |
| 112 | 100.40 | Lafayette, LA (100%) | 109 | 124 |
| 113 | 97.32 | Tyler, TX (100%) | 141 | 32 |
| 114 | 94.48 | Omaha, NE–IA (70%) | 67 | 50 |
| 115 | 89.02 | Dayton, OH (84%) | 95 | 97 |
| 116 | 84.37 | Lawton, OK (100%) | 181 | 145 |
| 117 | 57.58 | Lubbock, TX (100%) | 107 | 60 |
| 118 | 43.74 | Ann Arbor, MI (100%) | 71 | 30 |
| 119 | 41.45 | Cincinnati, OH–KY–IN (72%) | 17 | 95 |
| 120 | 28.99 | Milwaukee, WI (89%) | 34 | 40 |
| 121 | 19.86 | Davenport–Rock Island–Moline, IA–IL (85%) | 106 | 87 |
| 122 | 9.21 | Philadelphia, PA–NJ (96%) | 6 | 142 |
| 123 | 8.32 | Huntington–Ashland, WV–KY–OH (34%) | 69 | 149 |
| 124 | 5.08 | Washington, DC–MD–VA (62%) | 2 | 55 |
| 125 | 1.03 | Gadsden, AL (100%) | 169 | 137 |
| 126 | −10.60 | Anniston, AL (100%) | 165 | — |
| 127 | −11.48 | Newark, NJ (69%) | 49 | 108 |
| 128 | −12.50 | Elkhart, IN (100%) | — | — |
| 129 | −22.07 | San Antonio, TX (92%) | 42 | 155 |
| 130 | −25.74 | Atlanta, GA (7%) | 1 | 117 |
| 131 | −26.34 | Gainesville, FL (100%) | 96 | 67 |
| 132 | −29.71 | Waterloo–Cedar Falls, IA (100%) | 129 | 15 |
| 133 | −39.09 | Baton Rouge, LA (74%) | 130 | 89 |
| 134 | −43.74 | Green Bay, WI (100%) | 60 | 2 |
| 135 | −85.85 | Kenosha, WA (100%) | 138 | 58 |
| 136 | −86.76 | Lorain–Elyria, OH (100%) | 104 | 113 |
| 137 | −94.14 | Youngstown–Warren, OH (100%) | 99 | 111 |
| 138 | −97.07 | Portland, OR–WA (55%) | 8 | 3 |
| 139 | −100.69 | Lakeland–Winter Haven, FL (100%) | 163 | — |
| 140 | −104.10 | Mansfield, OH (100%) | 158 | 77 |
| 141 | −107.14 | Appleton–Oshkosh, WI (44%) | 133 | 9 |
| 142 | −118.47 | New Orleans, LA (47%) | 59 | 156 |
| 143 | −120.61 | Columbus, OH (79%) | 57 | 61 |
| 144 | −124.18 | Seattle–Everett, WA (100%) | 5 | 8 |
| 145 | −129.26 | Austin, TX (78%) | 84 | 72 |
| 146 | −143.84 | Kankakee, IL (100%) | 155 | — |
| 147 | −174.55 | Billings, MT (100%) | 98 | 13 |
| 148 | −186.91 | Waco, TX (100%) | 157 | 80 |
| 149 | −188.39 | Yakima, WA (100%) | 145 | — |
| 150 | −190.62 | Cleveland, OH (85%) | 15 | 70 |
| 151 | −198.20 | Nashville–Davidson, TN (56%) | 12 | 120 |

TABLE 2—*continued*

| Rank | QOLI (1980 $) | Metropolitan Area | *Places Rated* Rank | Liu Rank |
|---|---|---|---|---|
| 152 | −210.12 | Buffalo, NY (100%) | 32 | 48 |
| 153 | −238.25 | Jacksonville, FL (77%) | 52 | 154 |
| 154 | −247.37 | Bay City, MI (100%) | 123 | 35 |
| 155 | −250.71 | Canton, OH (94%) | 98 | 98 |
| 156 | −260.20 | Beaumont–Port Arthur–Orange, TX (67%) | 155 | 116 |
| 157 | −262.24 | Galveston–Texas City, TX (100%) | 73 | 56 |
| 158 | −284.11 | Indianapolis, IN (66%) | 31 | 106 |
| 159 | −306.50 | Louisville, KY–IN (76%) | 18 | 134 |
| 160 | −308.76 | Decatur, IL (100%) | 177 | 36 |
| 161 | −318.20 | New Brunswick–Perth Amboy–Sayreville, NJ (100%) | 77 | — |
| 162 | −320.47 | Gary–Hammond–East Chicago, IN (19%) | 164 | 133 |
| 163 | −329.96 | Akron, OH (79%) | 79 | 94 |
| (Mean QOLI − 1 *SD* = $−353.16) | | | | |
| 164 | −330.90 | Pittsburgh, PA (81%) | 4 | 123 |
| 165 | −369.20 | New York, NY–NJ (37%) | 25 | 103 |
| 166 | −372.20 | Minneapolis–St. Paul, MN–WI (81%) | 21 | 22 |
| 167 | −381.60 | Wichita Falls, TX (93%) | 171 | 69 |
| 168 | −399.75 | Dallas–Fort Worth, TX (86%) | 10 | 104 |
| 169 | −422.70 | Baltimore, MD (65%) | 27 | 139 |
| 170 | −436.10 | Corpus Christi, TX (82%) | 161 | 114 |
| 171 | −537.30 | Saginaw, MI (100%) | 159 | 81 |
| 172 | −585.10 | Lima, OH (51%) | 114 | 99 |
| 173 | −635.30 | Jackson, MI (100%) | 167 | 19 |
| 174 | −701.10 | Battle Creek, MI (76%) | 112 | — |
| 175 | −758.80 | Peoria, IL (55%) | 150 | 84 |
| 176 | −795.70 | Brownsville–Harlingen–San Benito, TX (100%) | 153 | 144 |
| 177 | −822.80 | Chicago, IL (94%) | 19 | 107 |
| 178 | −823.90 | McAllen–Pharr–Edinburg, TX (100%) | 118 | 146 |
| 179 | −948.40 | Houston, TX (89%) | 33 | 83 |
| 180 | −950.90 | Grand Rapids, MI (74%) | 58 | 40 |
| (Mean QOLI − 2 *SD* = $−976.09) | | | | |
| 181 | −968.00 | Detroit, MI (96%) | 36 | 112 |
| 182 | −976.30 | Kalamazoo–Portage, MI (76%) | 113 | 20 |
| 183 | −990.10 | St. Louis, MO–IL (84%) | 22 | 128 |
| 184 | −1,018.50 | Flint, MI (86%) | 134 | 62 |
| 185 | −1,539.30 | Birmingham, AL (79%) | 45 | 158 |

such as Chicago and Detroit are located at the bottom of our ranking. There are some exceptions, however: Birmingham, a southern city, is ranked 185th.

There is no obvious correlation between our QOLI ranking and either of the other two rankings. Our top-rated city, Pueblo, CO, is ranked 111th by *Places Rated,* and 42nd by Liu (1976). Pittsburgh, PA, is 4th in the *Places Rated* ranking (for the set of common cities), while it is ranked 164th by our QOLI. Lincoln, NE, is rated best among common cities by Liu (1976) but is 89th in our ranking. In fact, there is no statistically significant correlation between our QOLI ranking and either of the other two rankings. The rank correlation coefficient between our QOLI ranking and the *Places Rated* overall ranking is −.075. Between our QOLI ranking and the Liu (1976) ranking it is .048.[6]

Why is there no correspondence between our ranking and those obtained in the other studies? Liu's ranking is based on 1970 data while ours is for 1980. However, there is only a one-year difference (1980–81) between our ranking and the *Places Rated* ranking. Both Liu (1976) and *Places Rated* include many more factors in their quality-of-life measures than we do, so that may account for some of the differences between the rankings. However, this does not appear to be the major reason for the differences. When our QOLI ranking is recalculated using only the climate variables and the corresponding implicit price weights and compared with the *Places Rated* climate ranking, the rank correlation is .329. This correlation is significant but still rather small.[7] The notable difference between our study and the others is that we use preference-based weights to calculate our QOLI while the others employ externally imposed weights. This difference is probably the most important reason for variation in the rankings between the studies, not differences in time period or sets of variables.

Table 3 shows a partial decomposition of the QOLI in order to illustrate important contributions to a metropolitan area's high or low ranking. The table gives QOLI for the top and bottom ten ranked areas along with the six areas around the median. Next to QOLI premiums are the teacher-pupil, sunshine, humidity, violent crime, and Superfund site components for each metropolitan area. From Table 1, the mean value of the teacher-pupil component across all the areas is $1,786. Seven out of the ten top ranked metropolitan areas are above the mean. In fact, the favorable teacher-pupil ratio is a major contributor to the high overall rankings of Pueblo, Macon, and Binghamton. Similarly, nine out of the top ten areas' sunshine component is above the mean, and eight out of the bottom ten's is below the mean. Low values of sunshine reduce the QOLI for several northern cities in the bottom ten. When all 16 QOLI components are considered (not shown), the top ten metropolitan areas average 11 components above the mean and the bottom ten areas average 10 out of 16 components below the mean. The six areas surrounding the median average 8 components above the sample mean and 8 below the mean.

[6] The rank correlation between the overall rankings of *Places Rated* and Liu (1976) is .070.

[7] Our set of climate variables are precipitation, humidity, heating degree days, cooling degree days, wind speed, sunshine, and location near a coast. *Places Rated* uses mean monthly temperature, seasonal temperature variation, heating degree days, cooling degree days, freezing days, zero days, 90-degree days, and humidity. Thus, the two sets of variables are similar though not exactly the same.

## TABLE 3

**Partial Decomposition of the Quality of Life Index for the Top, Middle, and Bottom Ranked Metropolitan Areas**

| | | | Components | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Metropolitan Area | (QOLI) | Teacher/ Pupil Ratio | Sunshine | Humidity | Violent Crime | Superfund Sites |
| 1 | Pueblo, CO | $ 3,289 | $4,483 | $3,687 | $−2,290 | $ −868 | $ 0 |
| 2 | Macon, GA | 1,600 | 2,857 | 3,057 | −3,137 | −455 | 0 |
| 3 | Reno, NV | 1,575 | 1,946 | 3,930 | −2,301 | −683 | 0 |
| 4 | Norfolk--Virginia Beach–Portsmouth, VA–NC | 1,542 | 1,640 | 3,057 | −2,974 | −498 | 0 |
| 5 | Binghamton, NY–PA | 1,486 | 3,334 | 2,426 | −3,159 | −108 | −106 |
| 6 | Newport News--Hampton, VA | 1,445 | 1,521 | 3,057 | −2,974 | −478 | 0 |
| 7 | Sarasota, FL | 1,431 | 2,212 | 3,202 | −3,180 | −386 | 0 |
| 8 | West Palm Beach–Boca Raton, FL | 1,423 | 2,313 | 3,542 | −3,126 | −945 | 0 |
| 9 | Tucson, AZ | 1,342 | 1,298 | 4,173 | −1,954 | −586 | −106 |
| 10 | Ft. Lauderdale–Hollywood, FL | 1,327 | 2,331 | 3,542 | −3,180 | −756 | −212 |
| . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 90 | Salt Lake City–Ogden, UT | 229 | 1,333 | 2,377 | −2,355 | −412 | −72 |
| 91 | Janesville–Beloit, WI | 196 | 1,827 | 2,717 | −3,126 | −157 | 0 |
| 92 | Tampa–St. Petersburg, FL | 192 | 1,743 | 3,202 | −3,202 | −901 | −249 |
| 93 | Sioux City, IA–NE | 189 | 1,958 | 3,057 | −3,115 | −236 | 0 |
| 94 | Kansas City, MO–KS | 171 | 2,051 | 3,105 | −2,963 | −777 | −65 |
| 95 | Hamilton–Middletown, OH | 168 | 1,738 | 2,717 | −3,083 | −328 | −212 |
| . . . | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| 176 | Brownsville–Harlingen–San Benito, TX | −796 | 1,539 | 2,960 | −3,245 | −457 | 0 |
| 177 | Chicago, IL | −823 | 1,490 | 2,668 | −3,050 | −638 | −21 |
| 178 | McAllen–Farr–Edinburg, TX | −824 | 1,699 | 2,960 | −3,245 | −188 | 0 |
| 179 | Houston, TX | −948 | 1,638 | 2,785 | −3,296 | −696 | −495 |
| 180 | Grand Rapids, MI | −951 | 1,689 | 2,377 | −3,148 | −445 | −636 |
| 181 | Detroit, MI | −968 | 1,600 | 2,620 | −3,015 | −946 | −112 |
| 182 | Kalamazoo–Portage, MI | −976 | 1,822 | 2,377 | −3,148 | −732 | −212 |
| 183 | St. Louis, MO–IL | −990 | 1,484 | 2,863 | −3,169 | −1,078 | −112 |
| 184 | Flint, MI | −1,018 | 1,621 | 2,620 | −3,115 | −1,011 | −212 |
| 185 | Birmingham, AL | −1,539 | 1,420 | 2,863 | −3,158 | −701 | 0 |

Table 3 shows that specific QOLI components can be important contributors to an area's spot in the rankings. In order to see how sensitive our QOLI ranking is to the set of amenities included, we have recalculated the QOLI for various subsets of amenities and computed a rank correlation between them and our base QOLI ranking. First, if the teacher-pupil ratio, which is the first component shown in Table 3, is omitted, the rank correlation between the resulting index and the base QOLI is .857. If the central city and crime variable are also omitted the rank correlation drops to .726. If, on the other hand, the climate variables are excluded from the index, the rank correlation with the base is .436. When climate variables alone are used to produce an index, the rank correlation with the base QOLI is .648.[8] Thus, the QOLI is somewhat sensitive to the set of variables included in it. But this is not unique to our ranking: the rank correlation between the *Places Rated* climate and overall ranking is .260. The specific set of amenities considered will always have some effect on the resulting rankings.

The rankings can also be affected by the characteristics of the household. In our QOLI, wages, housing expenditures, number of persons per household and hours worked all go into the calculation of the weights ($k_i$). If any of these change, so do the $k_i$'s, and so potentially do the rankings. One obvious way in which the factors that go into calculating the weights may vary is by education. For example, more highly educated individuals earn higher wages and work more hours on average. In order to examine the effect of these differences on the QOLI rankings, we recalculated the rankings for three education groups (0–11 years, 12–15 years, 16+ years) using the average wages, housing expenditures, and annual hours worked in each group. The rankings do change some, but the rank correlations between these alternative QOLI's and the base QOLI are quite high: .893 for the 0–11-years-of-schooling group, .984 for the 12–15-years-of-schooling group, and .960 for the 16+-years-of-schooling group. Thus, in general the QOLI is more sensitive to differences in the specific set of amenities included than to differences in characteristics of households, as measured by differences in wages, housing expenditures, and hours worked across education groups.

## Conclusions

The purpose of this paper is to present a quality-of-life index which uses weights which are based on individuals' revealed preferences and

[8] If instead the entire housing and wage hedonics are reestimated with a subset of the 16 amenities, the rank correlation with the base QOLI are higher than those reported in the text since the parameter estimates change and partly capture the effects of the missing amenities on housing expenditures and wages. This higher correlation holds as long as the amenities included in the equations and those excluded are correlated, which is always the case in our data set.

use the index to rank metropolitan areas. We consider a wide range of metropolitan areas which are geographically dispersed and vary from small to medium to large. A variety of location-specific factors are considered including urban amenities, climate, and environmental quality. The weights for the QOLI are based on full implicit prices which are a weighted average of compensating differences reflected in the housing and labor markets. The full implicit prices are calculated from housing expenditure and wage hedonic equations estimated using individual data from the 1980 Census for over 34,000 households and over 46,000 workers.

The top-ranked areas according to our QOLI are found in small and medium size SMSAs, especially in the sun belt. Larger northern cities tend to fare worse in our ranking, but this pattern is not without exceptions. There is no correlation between our QOLI ranking and earlier rankings of Liu (1976) (rank correlation = .048) and Boyer and Savageau (1981) (rank correlation = −.075). While there are some differences in the set of amenities included in each study, the most notable difference is that we use a preference-based quality-of-life measure and the others do not.

Our QOLI and the rankings based on it can be useful measures of the value of the bundle of nontraded amenity factors at various locations. The index, rankings, and values are all based on averages of national preferences given amenity endowments and tastes. Personal differences in tastes and endowments matter, of course. Some folks love the heat and others want to ski. Some folks are terrified by crime and others feel that they can protect themselves. Some abhor dirty air and others ignore it. With a wide variety of amenity bundles we expect some sorting such that people will tend to like the areas in which they live and work. **SSQ**

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