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THE PRICE OF LOCAL AMENITIES: THEORY AND MEASUREMENT

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ABSTRACT

This study focuses on the role of wages and rents in allocating workers to locations with various quantities of amenities. The theory demonstrates that if the amenity is also productive, then the sign of the wage gradient is unclear while the rent gradient is positive. The theory is extended to include leisure and non-traded goods. These extensions require little modification of the conclusion. The empirical work on wages shows that the regional wage differences can be explained largely by these local attributes. Using site price data, implicit prices are estimated and quality of life rankings for the cities are computed.

INTRODUCTION

The problem of correctly measuring the implicit prices of urban attributes has received much attention in the past decade. The approach pioneered by Nordhaus and Tobin, and later used by Cropper, Kelley, Rosen, Getz and Huang and others, is to impute prices from inter-city wage differences. One usually neglected aspect of this approach is that unpleasant cities which pay high wages must offer some compensating productivity advantage to induce firms to pay the higher equalizing wages. The other commonly used method is to impute the valuations of the site specific attributes such as pollution or crime from rent differences. The works of Polinsky and Rubinfeld and Ridker and Henning are typical of this approach. The fact that businesses which are perhaps uninterested in clear air may compete for the same land and hence have secondary effects on the equilibrium, is frequently overlooked in these studies.

The different approaches used in the studies cited illustrates that a major unresolved problem in this field are the factors that determine the precise decomposition of the implicit prices into wage and rent differentials across the cities. The present work specifically addresses this question by using a general equilibrium model which allows for both mobile and site-specific factors. It also incorporates the possibility that the amenties may influence productivity. The general qualitative result is that if the amenity is unproductive, then wages fall in high amenity areas while the change in rents is unclear. On the other hand, if the amenity is productive, then the wage change is ambiguous while the rents rise in pleasant areas.

Previous work in this field also illustrates the variety of uses to which the implicit prices may be put. Nordhaus and Tobin, for example, were concerned with the appropriate urban disamenity adjustments to the GNP accounts. Other studies, such as that of Polinsky and Rubinfeld, seek prices for use in cost-benefit studies of particular attributes such as pollution. In still other work, such as Rosen's, the valuations are used as price weights in computing quality of life rankings. All of these issues are addressed below. In particular, the model implies a method for imputing implicit prices from wage and rent amenity regression The exact analytic expressions for this decomposition as well as those for adjusting GNP accounts and for evaluating local improvements are dicussed.

To clarify issues, the simplest possible model is presented in Section I. Section II presents two extensions to the basic model. Specific consideration of the labor-leisure choice and of the non-traded goods market is shown to have little affect on the basic qualitative results.

Empirical results are reported in the final section. Wage and rent equations are presented and implicit prices of amenities are calculated. The prices of crime, pollution and cold weather indicate that these attributes are indeed disamenities, while clear days and, surprisingly, population density are found to be amenities. These prices are then used to compute quality of life rankings for the 98 cities used in the study. Although the prices themselves are somewhat sensitive to the specification of the equation due to multicolinearity, the evidence suggests that the city rankings are fairly robust to specification differences. As a byproduct of the wage equation, the well-known regional differences in wages are examined and are found to be almost entirely explained by differences in amenities.

THE BASIC MODEL

Price Determination

Imagine many cities which vary according to the quantity of an endowed amenity, s, where s varies continously over (S_1, S_2). The residents of each city consume and produce a composite consumption commodity, X, whose price is fixed by world markets and will be taken as numeraire.

The basic framework for all the analysis is a simple general equilibrium model in which both capital and labor are assumed completely mobile across cities. In contrast, land is fixed among cities but is assumed mobile between uses within a city. Given an equilibrium distribution of firms and workers across cities, wage and rent differences can be characterized as functions of s. These differences are determined by the condition that workers' utilities and firms' costs be equalized across cities.

a. Workers

Workers are assumed to be identical in tastes and skills. For simplicity, leisure is ignored in this section and each person supplies a single unit of labor independently of the wage rate. The problem for the representive worker is, given the quantity of s in his location, to choose quantities of x, the composite commodity consumed and ℓ^c, the residential land consumed, to satisfy a budget constraint:

$$(1) \quad \max U(x, \ell^c; s) \quad s.t. \; w + I = x + \ell^c r$$

The wage and rental payments are denoted by w and r respectively. Nonlabor income is denoted by I and assumed to be independent of location.[1]

Associated with (1) is the indirect utility function:

$$V(w + I, r;s) = \max_{x, \ell^c} \{U(x, \ell^c; s) + \lambda[w + I - x - r\ell^c]\}$$

The market equilibrium condition for workers is given by:

(d) $V(w + I, r;s) = k$

Wages and rents must adjust to equalize utility in all occupied locations. Otherwise some workers would have an incentive to move.

The indirect utility function, V, has the usual properties of increasing in income, w, and decreasing in prices, r. In addition, $V_s \equiv \frac{\partial V}{\partial s} > 0$, indicating that s is an amenity. Roy's identity holds in the usual way for r, i.e. $V_r/V_w = -\ell^c$. The expression V_s/V_w is the marginal valuation of s in terms of money, or the price of s. Hence, we define $p_s^* \equiv V_s/V_w$.[2]

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[1] The implicit land ownership assumption is that each person owns an equal share of land in all cities, regardless of his own location. Although migration patterns will certainly influence the overall level of I, individuals disregard their own effect on rents and hence rental income is independent of location.

[2] It can be shown that $V_s/V_w = U_s/U_x$. Also, because the price of x is the numeraire $U_x = V_w = \lambda$.

b. Firms

Assume that X is produced according to a constant returns to scale production function, $X = f(\ell^p, N;s)$ [3] where ℓ^p is land used is used in production and N is the total number of workers in the city. The problem for the representative firm is to minimize costs subject to the production function. Since f is constant returns to scale, the unit cost function can be considered:

$$C(w, r; s) = \min_{N,\ \ell^p} \{w \frac{N}{X} + r \frac{\ell^p}{X} + \lambda\{1 - f(\frac{N}{X}, \frac{\ell^p}{X}; s)\}\}$$

The equilibrium condition for firms is that unit cost must equal product price, assumed to be unity.

(3) $C(w, r; s) = 1$

Otherwise, firms would have an incentive to move their capital to more profitable cities.

The unit cost function is increasing in both factor prices. If the amenity is productive, then C_s is negative. Also, $C_w = N/X$ and $C_r = \ell^p/X$.

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[3]Actually X is a function of capital as well as ℓ^p and N. But since capital is perfectly mobile and is uninfluenced by amenities, its rate of return will be equal in all places. Hence, the capital input can be assumed to be optimized out of the problem. The same assumption about the ownership of land applies to the ownership of capital.

c. Equilibrium

Notice that equations (2) and (3) perfectly determine w and r as functions of s, given a level of k. The equilibrium levels of wages and rents can be solved from the equal utility and equal cost conditions. That is, w and r are determined by the interaction of the equilibrium conditions of the two sides of the market. The land and labor market clearing conditions will be important later in determining the level of utility. The effects of different quantities of s on wages and rents can be understood with the aid of Figure 1.

The downward sloping lines are combinations of w and r which equallize unit costs at a given level of s. Suppose that s is unproductive so that at $s_2 > s_1$, factor prices must be lower to equalize costs in both cities. The duality of C with the production function is that the less substituable are land and labor, the less the curvature of the factor price frontier. Similarly, the upward sloping lines represent w-r combinations satisfying $V(w; r; s) = k$ at given levels of s. At high sunshine locations, people must pay higher rents at every wage to be indifferent between the two cities. Again, the more substitution between x and ℓ^c, the greater the curvature of the indirect utility function.

The figure clearly shows that in sunnier places, the wages should be lower while the change in rents is uncertain. The intuitive reason for this is that with s -unproductive, firms prefer low s locations while workers prefer high s locations. Because high rents discourage both firms and workers from locating in the area, worker equilibrium requires high rents in high s areas to choke off immigration while firm equilibrium requires low rents in high s areas to induce firm location. On the other hand, a low wage discourages workers and attracts businesses. Essentially, the factor prices are striking a balance between the conflicting locational preferences of the firm and the workers. The reader can easily satisfy himself that if s were productive, the rents would rise while the change in wages would be ambiguous. Also, note that if land is not a factor of production, the wage is determined by the cost function and the rent captures the entire amenity valuation. This is the case considered by Rosen (1979).

These basic results can be obtained algebraically by differentiating equations (2) and (3) and solving for dw/ds and dr/ds. The result is equations (4):

$$(4) \quad \frac{dw}{ds} = \frac{1}{\Delta}\left(-V_s C_r + C_s V_r\right) < 0$$

$$\frac{dr}{ds} = \frac{1}{\Delta}\left(-V_w C_s + V_s C_w\right) \gtrless 0$$

$$\Delta = V_w C_r - V_r C_w = \frac{L(s) V_w}{X} > 0$$

Using the properties of V and C, we can easily see that $dw/ds < 0$ while dr/ds depends on the relative strenghts of the productivity and amenity effects.[4]

Potential Applications

Notice that dw/ds and dr/ds are, in principle, observable. The two equations in (4) express dw/ds and dr/ds in terms of the amenity and productivity effects. Hence equations (4) provide a means of imputing V_s/V_w and C_s. Solving simultaneously and using Roy's identity:

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[4]Elasticities of substitution do not enter these expressions because small changes are being considered. The cost savings alluded to above are of second order small and hence, vanish at the margin.

$$(5)\quad p_s^* \equiv \frac{V_s}{V_w} = \ell^c \frac{dr}{ds} - \frac{dw}{ds} = -(\frac{dx}{ds} + \frac{d\ell^c}{ds} r) \quad \text{or} \quad \frac{p_s^*}{w} = k_\ell \frac{d\log r}{ds} - \frac{d\log w}{ds}$$

$$C_s = -(\frac{N}{X}\frac{dw}{ds} + \frac{\ell^p}{X}\frac{dr}{ds}) = -(\theta_w \frac{d\log w}{ds} + \theta_r \frac{d\log r}{ds})$$

where k_ℓ is the share of land in the consumers budget and θ_i is the share of factor i in the cost of X. These conditions have a straightforward interpretation. The value to consumers is measured by the sum of numeraire good and the residential land they must forego. The productivity effect is the savings in costs or, the share weighted sum of the changes in factor prices.

The price of s determined in equation (5) can be used to compute index numbers to rank cities according to quality of life. The imputed prices of the various characteristics of cities should be used as weights on the quantities of the attribute in computing a sum. This will be illustrated in Section 3 of this paper. In addition, these results have potential application in cost-benefit analysis of changes in environmental variables such as pollution levels or crime rates. Suppose a community wishes to infer the aggregate willingness to pay for an incremental improvement in air quality. Alternatively, suppose researchers wish to determine how much individuals in a community would have been willing to pay to avoid a deterioration in the environment. To determine aggregate willingness to pay for an increase in amenities in city $\tilde{s}$ take the total value of output foregone by consumers due to increased amenities, or $p_s^* N(\tilde{s})$. Add to this the value of the change in production due to increased s or $-C_s X(\tilde{s})$. Summing, obtain (6):

$$(6)\quad p_s^* N(\tilde{s}) + (-C_s X(\tilde{s})) = \frac{dw}{ds}(N-N) + \frac{dr}{ds}(N(\tilde{s})\ell^c(\tilde{s}) + \ell^p(\tilde{s})) = \frac{dr}{ds} L(\tilde{s}).$$

The incremental value of local willingness to pay for a change in $(\tilde{s})$ can be found by looking at the incremental value of land at location $\tilde{s}$. The effects of the wage changes cancel out because any gain to firms is exactly matched by the loss to consumers.

As a final example of the potential usefulness of the imputed prices of local attributes, consider the adjustments to national income accounts first proposed by Nordhaus and Tobin. The purpose of such adjustments is to determine whether the level of welfare has increased overtime, as suggested by conventionally measured GNP accounts, or whether deterioration in the quality of life has offset the gains in output. To find the appropriate measure of welfare, differentiate the utility function:

$$U_x dx + U_{\ell^c} d\ell^c + U_s ds = dk$$

or

$$dx + r\, d\ell^c + (U_s/U_x) ds = dk/\lambda$$

The change in utility is simply dk/λ, and this is the conceptually appropriate measure of GNP. The sum $dx + r\, d\ell^c$ is the change in conventionally measured GNP. The term U_s/U_x is equal to V_s/V_w, as mentioned in footnote 2. Hence, the adjustment to changes in GNP is simply $p_s^* ds$, where p_s^* can be inferred from the data using equation (5).

The pioneering work of Nordhaus and Tobin made the GNP adjustments using only wage differentials. The conceptually appropriate measure includes the change in rents as well. However, as a practical matter, because the rent change is weighted by the budget share of land which is likely to be small, the omission of rents may not bias the adjustments too seriously.

Residential Density and Population

This simple model also yields implications for residential density and population in more amenable locations. The quantity of land consumed by each person, ℓ^c, can be taken from the demand functions implicit in the solution to the consumer maximization problem. Likewise, C_w and C_r, the input demands per unit of output, are given by the cost minimization problem. Since all consumers are identical and since f is constant returns, the task remaining is to determine N, the number of people in the location and X, the total output of the city.

This easily accomplished with the use of market clearing conditions. Let $L(s)$ be a function describing the quantity of land at each s. Note that this function $L(s)$ is a fundamental parameter of the problem, since the distribution of land at each amenity level is essentially given by nature. Land market clearing requires:

$$L(s) = \ell^c N + \ell^p.$$

Using the relations $C_w = N/X$ and $C_r = \ell^p/X$, we can express $L(s)$ as a function of N, with C_w, C_r and ℓ^c as parameters. And, having found N, X follows immediately from $C_w = N/X$.

$$(7) \quad L(s) = \frac{N}{C_w} \left(\ell^c C_w + C_r\right)$$

Totally differentiating (7), it is simple but tedious to show that:

$$(8) \quad \hat{L}(s) = \hat{N} + \phi_{Lc}\hat{\ell}^c + (\hat{w} - \hat{r})\sigma_{nL}\phi_{Lx}$$

The notation $\hat{x}$ is dx/x, while ϕ_{Lc} is the share of land in consumption, ϕ_{Lx} is the share of land in x production and σ_{nL} is the cross elasticity of substitution in production.[5] This expression indicates that population will increase with the total land available and decrease with the land consumed per capita. Population also decreases with increases in the relative wage rate since labor demand will fall as firms substitute away from high priced labor. This effect is stronger the larger the elasticity of substitution.

Since the relative wage rate probably falls in better locations, ceteris paribus, amenable places should have larger populations. And $\hat{\ell}^c$ is given from the demand function as:

$$(9)\quad \hat{\ell}^c = \eta_{\ell w}\hat{w} + \eta_{\ell r}\hat{r} + \eta_{\ell s}\hat{s}$$

where $\eta_{\ell i} \equiv (\partial\ell/\partial i)i/\ell$. So $\hat{\ell}^c/\hat{s}$ is probably negative unless land and sunshine are very strong complements. This also suggests that amenable locations should have larger populations.[6]

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[5] To derive (8), use the relations $\phi_{Lx} + \phi_{Lc} = 1$, $\sigma_{nL} = C_{wr}/C_w C_r$, $-\sigma_{nL}\theta_w = \sigma_L\theta_r$ and $-\theta_r\sigma_{nL} = \theta_w\sigma_n$, where σ_{ii} is the own compensated elasticity of factor i and θ_i is the share of factor i in total cost.

[6] To determine the boundary between occupied and unoccupied cities, as well as the common utility level, k, use the three equations:

$$\int_{s_1^*}^{s_2^*} N(s;\, k,\, L(s))ds = \bar{N} \qquad \text{and} \qquad r(s_i^*, k) = 0 \qquad i = 1, 2.$$

where s_i^* are the marginal occupied cities and $\bar{N}$ is the total population in the economy. Two margins must be determined because the highest s cities may be so unproductive that firms would require zero rents to locate there and vice versa for the lowest s cities.

THE MODEL EXTENDED

This section presents two extensions to the basic model developed in the last section. The purpose of this exercise is twofold. First, by relaxing some of the assumptions of the model, it becomes more useful for empirical applications. The extended models illuminate pitfalls which may be encountered in trying to obtain estimates of consumer valuations and production effects of locational attributes. Second, the extensions illustrate the power of the basic model. The model is easily generalized and most of the qualitative results and useful insights are unchanged by the generalization of the model.

The first of the assumptions relaxed in this section is that each worker supplies a fixed amount of labor to the market. Thus, leisure is included in the utility function and labor supply issues can be addressed. The second modification of the model is that a non-traded goods sector is introduced. Thus the housing market, as well as the usual non-traded goods such as haircuts, can be studied. In addition, home production of amenities can be investigated. Suppose people value the good, "comfortable indoor temperature," which can be produced using insulation and fuel, given the outdoor temperature. Or people may decrease the probability of being robbed by purchasing guard dogs, alarm systems and police whistles. In both these examples, the good is produced by the household solely for its own consumption and hence is not traded.

The consumer's problem in this generalized model can be written as:

$$(10)\quad \max\ U(x, \ell^c, t, y; s) \quad \text{s.t.}\ wH = x + \ell^c r + py + wt$$

where y is the quantity of non-traded goods consumers, p is the price of non-traders, t is the amount of leisure consumed and H is the total amount of the time available to the individual. The solution to this problem yields an indirect utility function which must be equal at all locations as indicated in equation (11).

(11) $V(w, r, p; s) = k$

Because the wage is now a relative price, rather than a pure income term as in the case of fixed labor supply, Roy's identity must be modified to $V_r/V_w = -\ell^c/h$ and $V_p/V_w = -y/h$. The usual sign properties hold, however, with $V_r < 0$, $V_p < 0$ and $V_w > 0$.

To modify the firm side of the problem, we must introduce a unit cost function for non-traded goods:

(12) $G(w, r; s) = p(s)$

in addition to the cost function for traded goods:

(3') $C(w, r; s) = 1$

Once again, this is a constant returns to scale production function requiring both land and labor as factors and including s as a neutral shift parameter. Market clearing requires that total output of non-tradeds, Y, is equal to Ny. Because each of the factors is used to produce both traded and non-traded goods, we must define the shares of each factor used in the two sectors. These shares can be defined in terms of the partial derivatives of the cost functions:

$$\phi_{Lx} = C_r\frac{X}{L} \; ; \; \phi_{Ly} = G_r\frac{Y}{L} \; ; \; \phi_{Nx} = \frac{C_w X}{Nh} \; ; \; \phi_{Ny} = \frac{G_w Y}{Nh} \text{ and, of course, } \phi_{Lc} = \frac{\ell^c N}{L}$$

Equations (11), (12) and (3') are sufficient to determine w, r and p. The price-amenity gradients can be found as before by differentiating and solving simultaneously:

$$(13)\quad \frac{dw}{ds} = \frac{1}{\Delta^*}\ \{C_s\,(V_r + V_pG_r) - C_r\,(V_s + V_pG_s)\}$$

$$(14)\quad \frac{dr}{ds} = \frac{1}{\Delta^*}\ \{-C_s\,(V_w + V_pG_w) + C_w\,(V_s + V_pG_s)\}$$

$$(15)\quad \frac{dp}{ds} = \frac{1}{\Delta^*}\ \{C_s\,(G_wV_r - G_rV_w) + V_s\,(-G_wC_r + G_rC_w) + G_s\,(V_wC_r - V_rC_w)\}$$

$$\Delta^* = V_wC_r - V_rC_w - V_p\,(C_wG_r - C_rG_w) = \frac{V_w}{X}\,L(s)\phi_{Nx} > 0.$$

To see how these results relate to those of the simple model, first divide and multiply equation (13) by V_w to get:

$$(16)\quad h\frac{dw}{ds} = \frac{1}{\Delta^*}\ \{-C_sV_w\,(\ell^c + yG_r) - C_r\,(h\frac{V_s}{V_w} - yG_s)\}$$

Notice that equation (16) is expressed in terms of an earnings gradient, rather than a wage gradient. The fixed labor supply assumption in the first section made this distinction unnecessary. Notice secondly, that if $y = 0$ and if the price of s is defined in terms of earnings, then the earnings gradient is directly comparable to that of the simple model. Thus, the impact of incorporating non-traded goods into the model is to include two extra additive terms and to introduce the rescaling factor ϕ_{Nx} which equals unity if $y = 0$, into the denominator.[7]

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[7]The inclusion of both non-traded goods and leisure has secondary effects on both the wages and rent gradients, because all the derivatives of the utility function depend on leisure and non-traded goods.

These results are quite similar to those of Tolley who found that non-traded goods affect intercity wage differentials by both a multiplier effect and an additive term. The multiplier, ϕ_{Nx}, is the fraction of the labor force used in the traded goods industry so that the denominator is smaller the larger the non-traded goods sector. The multiplier effect arises because factor prices increase the price of non-tradeds which in turn, increases the wage premium required. The extra term multiplying the productivity effect can be shown to be a simple extension of the result alluded to in the last section: the productivity effect on wages is stronger the smaller the share of land used in traded-goods production. Algebraically, it is easy to show from equation (16) that:

$$(17) \quad V_w \{\ell^c + yG_r\} = \frac{V_w L}{N} (1 - \phi_{LX})$$

And, from equation (4), the coefficient on the productivity effect without non-traded goods is:

$$(17') \quad V_r = V_w \frac{L}{N} (1 - \phi_{LX})$$

Thus, this additional term multiplying the productivity effect simply reflects the fact that $1-\phi_{LX}$ now includes a term capturing the land used in the non-traded sector as well as the land used for residential consumption.

The second term arising from the inclusion of non-traded goods describes a geniunely new effect. This is the G_s term, which shows the change in the price of local goods made possible by the local amenity. If s influences the production of the non-traded good to decrease its price, then multiplying this price change by y tells the factor price change required in addition to that caused by V_s. Thus, $-yG_s$ can be interpreted as an additional amenity term which enters both the wage and the rent gradient in the same way as does the implicit price of s, $h\, V_s/V_w$.

Turning to the rent gradient, equation (14), the coefficient on the productivity effect is unchanged from the previous section. To see this, substitute for G_s and simplify:

$$(18) \quad V_w + V_p G_w = V_w(1-\phi_{Ny}) = V_w \phi_{NX}$$

Notice that the multiplier ϕ_{NX} appears in both the numerator and denominator so that the coefficient on the productivity term in the rent gradient is identical in equation (14) and (4). Although the productivity effect on earnings is altered by non-traded goods by the introduction of a multiplier, the productivity effect on rents is unchanged. This is because both of these higher factor prices will tend to increase the price of non-tradeds. The wage multiplier arises so that consumers can pay this higher price and still maintain the same utility level. In contrast, no such multiplier is needed for the land market because income from land ownership is independent of location.

Before turning to the non-traded goods price gradient, note that equations (13) - (15) can be solved simultaneously for the implicit price of s and the productivity effects.

$$(19) \quad p_s^* \equiv h\frac{V_s}{V_w} = \ell^c \frac{dr}{ds} + y\frac{dp}{ds} - h\frac{dw}{ds}$$

$$C_s = -(C_w\frac{dw}{ds} + C_r\frac{dr}{ds})$$

$$G_s = -(G_w\frac{dw}{ds} + G_r\frac{dr}{ds})$$

Equation (19) illustrates how the applications discussed in the previous section extend to the more general model.

The change in the price of non-traded goods with respect to a change in amenities is an expansion of the equation:

$$(20) \quad \frac{dp}{ds} = G_w \frac{dw}{ds} + G_r \frac{dr}{ds} + G_s$$

The C_s and V_s terms in equation (15) are easily interpreted in this context. The first term in each of the first two sets of parentheses, (the G_w term), is the effect on p from changes in the wage, while the second term, (the G_r term) reflects the change in p due to changes in rents. The term multiplying C_s is negative, since productivity effects in X production increase the prices of both inputs into Y production and hence, the price of non-traded goods.

The V_s term in equation (15) is ambiguous since the amenity effect in the wage and rent gradients have opposite signs. The effect of s on the cost of non-traded goods, G_s, has a direct and an indirect effect. The direct effect, of course, is to lower costs of production. The indirect effect is that factor prices must change somewhat, i.e. that wages fall and rents rise. By inspection of equation (15), the direct effect of increased productivity in the y sector outweighs the indirect effects so that the price of non-traded goods falls in high s locations.

The upshot of this analysis for empirical work is clear: predictions about cross-city variation in housing prices are more difficult to make than those about variation in land prices. However, studies such as those by Polinsky and Rubinfeld and Ridker and Henning, which examine intra-city housing prices, have been successful in finding higher housing values associated with amenities such as clean air or downtown accessibility. This is because in these models, housing prices more closely mirror site values. Two sources of ambiguity in the present model are removed when considering intra-city price differences. First, within city differences in productivity in the housing industry are likely to be negligible. Secondly, although the amenities are consumed jointly with the housing, a job can be held anywhere in the city. Thus, wages of identical individuals must be independent of location. Since land rents are higher in good locations and since wages are constant and because the price of housing is simply a sum of these two factors, the price of housing rises unambiguously with s.

EMPIRICAL RESULTS

The Relation of Empirical Work to Theory

The theory developed earlier assumes that all individuals have identical tastes and skills. Because tastes for amenities differ among people in the data, however, we expect those with stronger preferences for amenities to sort themselves into more amenable places and be willing to accept a lower wage. Those with weaker preferences will be willing to accept a lower wage than their co-workers to go without the amenity and hence, will be found in less pleasant cities. Therefore, the estimated wage difference will be an underestimate of the true equalizing wage difference for those with strong tastes for amenities and an underestimate for those with weak preferences. A similar argument can be made for biases in the estimated rent gradient.

Figure 2 illustrates the wage bias graphically. Type A consumers have stronger preferences for amenities than type B consumers. Points A and B will be observed in the data and hence, will define the market equalizing wage difference. However, points A and A' define the true equalizing difference for the type A consumers while the wage difference associated with points B and B' is the equalizing difference for the type B consumers. Clearly, the difference between the wages at A and B lies between the true equalizing differences for each group.

Even if all workers were identical in their tastes for amenities, the workers may differ in their preferences between land and traded goods. In this case, we expect those with stronger tastes for land to locate in low amenity-low rent cities. This sorting results in a bias similar to that in the case above: the estimated market gradients are in between the true gradients of each group. Hence, because taste differences exist in the data, the estimates presented below are a kind of average of the true gradients for the various groups. For a more detailed discussion of this problem, see Roback.

If workers differ in their skills, then they compete in separate markets. Thus, we expect different gradients for each of the distinct skill markets. This consideration suggests that segmenting the data by broad skill groups may prove useful.[8] In the work reported below, however, productivity traits are entered into the individual wage equations. This procedure, in effect, allows the gradients to be shifted by productivity indicators, but forces the slopes of the wage-amenity gradients to be the same for all skill levels.

The Hypothesis to be Tested

The theory suggests that amenities should be associated with lower wages while productivity enhancing traits of a city should be associated with higher wages. If a single attribute happens to be both amenable and productive, then the sign of the wage difference is unclear. The problem with testing a theory in this form is that we don't really know what attributes people value and we must seek the answer in the data itself. In effect, one is also testing one's prior ideas about what people value enough to pay for.

Of all the variables used in this study, only the climatic indicators really correspond to the theoretical concept of endowed, fixed local attributes. The number of heating degree days (HDD), which is the sum of negative depar-

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[8]Interesting results are obtained for data segmented according to occupation group by Roback and Getz and Huang, and for data segmented by schooling groups by Roback. For a treatment of the case in which skills and tastes are correlated, see Berglas.

tures of average daily temperatures from 65^{o}F, will surely be a disamenity, as well as a proxy for heating costs. The total snowfall, and the number of cloudy days are likely to be disamenities as well. The number of clear days is probably an amenity.

Although the crime rate and the pollution level can be altered by public expenditure of resources, these variables can be taken as given from the individual worker's point of view. And although people can insulate themselves against crime and pollution by purchasing burglar alarms and air conditioning systems, the reported measures of crime and pollution are probably good indicators of the disamenities inherent in the location. Thus, we expect a positive effect on wages of both the crime rate and the pollution level.

Population size and population density are usually regarded as disamenities. Indeed, the association of higher wages with larger cities is a well-known fact. However, increased density may be associated with a greater variety of goods and services and thus, may be a net amenity.

The ten year growth rate of population and the local unemployment rate are included as measures of the strength of local labor demand. As such, we expect a positive effect and a negative effect on wages respectively. However, as suggested by Hall, a high unemployment rate may require that a risk premium be paid. Thus, the sign of the unemployment rate will depend upon the relative strengths of the risk and demand effects.

In addition to testing prior beliefs about individual tastes, we also examine the regional differences in earnings. These persistent region effects have always been something of a puzzle because a mobile labor force ought to bid away any geographic differences in earnings. We test whether these regional differences are really proxies for differences in local amenities.

As an additional check on the reasonableness of the model, higher growth rates should be associated with the cities that the model defines as amenable. Evidence on this point is presented below.

The Data

The principle source of wage data for this study is the Census Bureau's Current Population Survey from May 1973. The May data identify individuals in the 98 largest U. S. cities, which allows many more degrees of freedom and much more detailed productivity information than commonly found in studies of this problem. The study was confined to men over 18 who reported earnings and who lived in one of the identified cities.

Perhaps the only source of data on residential site prices across cities is found in FHA Homes, which reports average site prices per square foot for 83 of the 98 largest cities. Because the data are collected only for FHA qualifying families, the sample is not representative of the same population used in the wage study. Also, no information about the location of the site within the city is avialable. Because of these limitations of the data, the results presented below are merely intended to be illustrative of the method outlined in the theory.

A great variety of city characteristics was gathered from a number of sources. Yearly crime statistics were found in the FBI's Uniform Crime Reports. Data on total crime rates/10,000 population were utilized. The unemployment rates for cities in various years came from the Manpower Report of the President. The 1973 population was taken from the World Almanac; the 1970 population density was taken from the 1970 Census of Population and the change in population from 1960 - 1970 was taken from the 1975 Statistical Abstract.

Pollution data came from the EPA's Air Quality Data, the annual statistics series. This data source reports the average pollution level as well as the number of observations over which the average was taken for a number of monitoring stations within each city. Unfortunately, it was not possible to infer the location of each of the city's stations from the data. So, for each city, a weighted average of all the stations was constructed with the number of observations reported by the station used as the weights. Data on micrograms/cubic meter of particulates have been used.

The climate variables were taken from Local Climatological Data, published by the U. S. Dept. of Commerce. All variables are "climatological normals," that is, average over a thirty year period. This contrasts with the data used by Ben-Chen Liu, and Rosen which were climate data from a single year. Since the theory we are testing is a lon-run equilibrium theory, the normal levels are the preferred variables.

Discussion of Results

a. Wage Results

Table 1 shows the regression of personal characteristics on the log of weekly earnings.[9] This regression used 12001 men over the age of 18 from the

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[9]Throughout this paper, nominal earnings is used as the dependent variable because price level information is available for only 32 of the 98 cities. However, including the price level alters the results reported below only in that heating degree days is insignificant and population density is significantly negative.

May 1973 CPS which includes 98 cities. Examination of the table shows that these variables include all of the usual individual attributes known to influence wages. This detailed information on worker traits is the chief advantage of using this micro data set. In addition to these usual variables, industry dummies were included to hold constant the industrial composition of the city. Also, the poverty incidence variables tells the percentage of the person's neighborhood which is below the poverty line. This variable was included as a crude control on the within-city differences in amenities. It may capture differences in family backgorund and schooling quality as well. All of the variables in Table 1 were included in all subsequent regressions of city traits on wages.

Table 2 presents the results of five regressions of various city traits on log earnings for this full sample of 98 cities. Note that no regional dummies are included in these equations. Looking across a row gives some indication of the robustness of a variable to different specifications. For example, rows 1 and 3 show that the total crime rate (TCRIME 73) and the particulate level (PART 73) always have a positive influence on wages, but this influence is not always statistically significant. The coefficient on the local unemployment rate (UR 73) is always insignificant which suggests either that the required risk premium is small or that a high unemployment rate is indeed a proxy for weak local labor demand. Population size and the population growth rate both have the expected strong positive effects while population density, (DENSSMSA) is consistently insignificant.

It may be conjectured that population size is strongly correlated with the non-climate variables in Table 2. Table 3 shows the correlation of population with these other variables, and with the exception of population density, the correlations are quite small. The commonly held belief that crime and pollution are byproducts of large cities is not supported by these data. The relatively high correlation of density with population may partially account for the weak effects of density in the wage equations of Table 2.

The climate variables in Table 2 perform remarkably well. Heating degree days, (HDD), total snowfall (TOTSNOW) and the number of cloudy days (CLOUDY) all have strong positive coefficients, suggesting that these indicators of climate are net disamenities. The number of clear days (CLEAR) has a strongly negative coefficient which is consistent with the prior notion that clear days are amenable. When several climate variables are entered in the same equation, none is significant.[10]

The next question to be addressed is: What is the influence of the city attributes on the well-known regional differences in earnings? As evidence of the existence of these regional effects in this data, consider the first column of Table 4.[11] The t-statistics on all three of the regional dummies indicate significant differences in wages across regions. Furthermore, an F-test of joint significance of these three variables (comparing equation 1 of Table 4 with the equation in Table 1) gives an F value of 2.10 where the critical F value is 1.88.

We expect that the inclusion of various measures of city attractiveness may considerably diminish the effect of region per se. A comparison of columns 1 and 2 of Table 4 gives some support for this idea. The coefficients on the

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[10] For other results on climate, see Hoch.

[11] For further evidence of and debate about effect of region, see Coelho and Ghali and Ladenson.

Northeastern and Southern dummies fall dramatically and the t-statistics indicate no difference in wages between these two regions and the Midwest. Furthermore, an F test comparing equation 2 of Table 4 with equation 1 of Table 2 shows that regional dummies are jointly insignificant, with an F value of .52. The persistent strength of the Western effect is the only anomaly in this pattern. It is certainly correct to infer from these results that earnings are lower in the West than elsewhare. However, once differences in amenities are taken into account, region plays an insignificant role in explaining earnings on average. The fact that low wages in the West are accompanied by extremely high growth rates of population suggests that living in the West may be a proxy for some unmeasured desirable climatic or cultural attributes (such as the notorious "California mellow"?). Thus, the combined evidence seems persuasive that the regional differences in earnings can be almost completely accounted for by regional differences in local amenities.[12]

The set of regression coefficients defines a market opportunity locus for workers. That is, these coefficients describe the wages a worker can expect to receive in a city with a given set of characteristics. Cities which are above this market opportunity locus offer higher wages for a given set of attributes and thus offer workers a better buy. Therefore, we expect such cities to experience a growth in population.

To test this hypothesis, the average residual from each city was computed from a regression which included all the variables in equation 1 of Table 2 except for GROW 6070. These average residuals were then used as regressors in

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[12] This result is robust to the inclusion of measures of cost of living. See Roback.

explaining the ten year growth rate of population. The result of this regression is shown in Table 5. As can be seen, the residual is a statistically significant predictor of the growth rate, even when regional dummies are included in the regression. This simple test provides strong support for the overall soundness of the method used in this study.

b. Implicit Prices and Quality of Life Indices

Table 6 presents the results of a series of land price equations comparable to those in Table 2. The only significant results are the positive coefficients on the unemployment rate, population density and population growth. The latter two results are most likely demand effects, which proxy for sume unmeasured attributes of the city. The positive effect of the unemployment rate may be due to the selection of the sample: cities with high unemployment rate may be allocated more FHA funding which may in turn encourage the local agencies to finance more expensive housing.

To compute the implicit price of each attribute in percentage terms, we need the coefficients from Tables 2 and 6, as well as the budget share of land. This budget share was computed from the FHA data by multiplying the fraction of income spent on the mortgage by the ratio the site price to the total value of the house. This number was then averaged over all 83 FHA cities to yeild an average budget share. Table 7 reports the implicit prices computed from the columns of Tables 2 and 6. For example, column 2 reports the prices computed from regressions which include total annual snowfall as the climate variable. A negative number indicates a "bad" while a positive number indicates a good. While most of the variables perform as expected, looking across the rows of Table 7 reveals some sensitivity of the prices to specification.

One method of testing the severity of this sensitivity is to compute quality of life indices based on the four sets of prices and to see whether the rankings of the cities are sensitive to the choice of specification. Four sets of indices were computed and labeled QOL 1- QOL 4, to represent the columns of Table 7. Table 8 reports the rank correlation coefficients for these 4 rankings. The correlations are all reasonably large, although, as may have been expected, QOL 1 and QOL 2 are highly correlated with each other, as are QOL 3 and QOL 4. The first and second indices are computed from heating degree days and snowfall equations respectively, while QOL 3 and QOL 4 are computed from clear days and cloudy days equations respectively. Because QOL 3 seems to be most highly correlated with other rankings, Table 9 lists the 98 cities ranked according to QOL3.

CONCLUSION

This study has focused on the role of wages and rents in allocating workers to locations with various quantities of amenities. The theory demonstrated that if the amenity is also productive, then the sign of the wage gradient is unclear while the rent gradient is positive. The theory was extended to include leisure and non-traded goods. These extensions required little modification of the conclusion. The empirical work on wages found that the well-known regional wage differences can be explained largely by these local attributes. Finally, using site price data, implicit prices were estimated and quality of life rankings for the cities were computed. Much interesting work remains to be done to refine the site price data and to obtain more reliable estimates of this gradient.

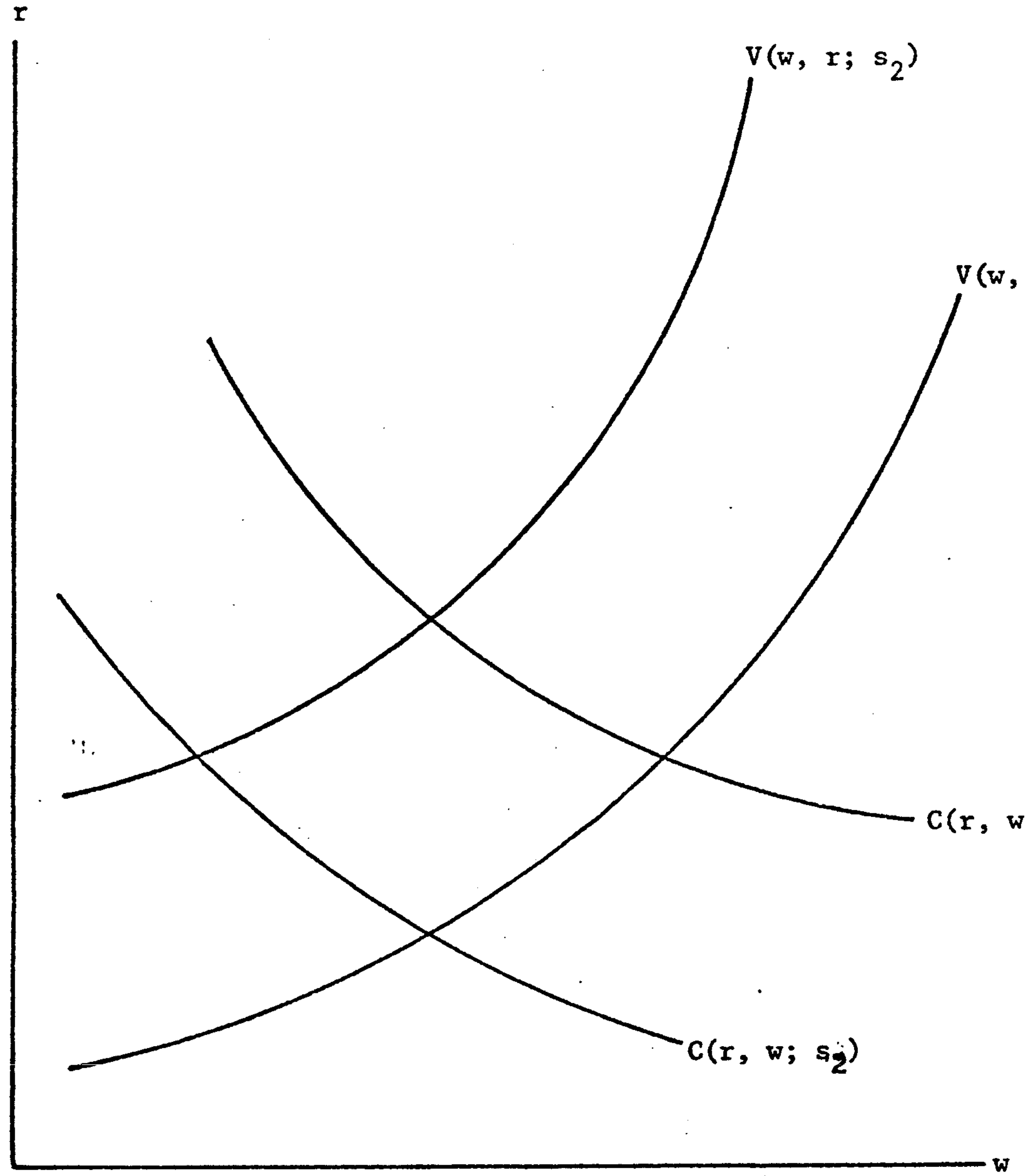

Figure 1. Equilibrium Wage and Rent Determination in the Simple Model.

$s_1 < s_2$

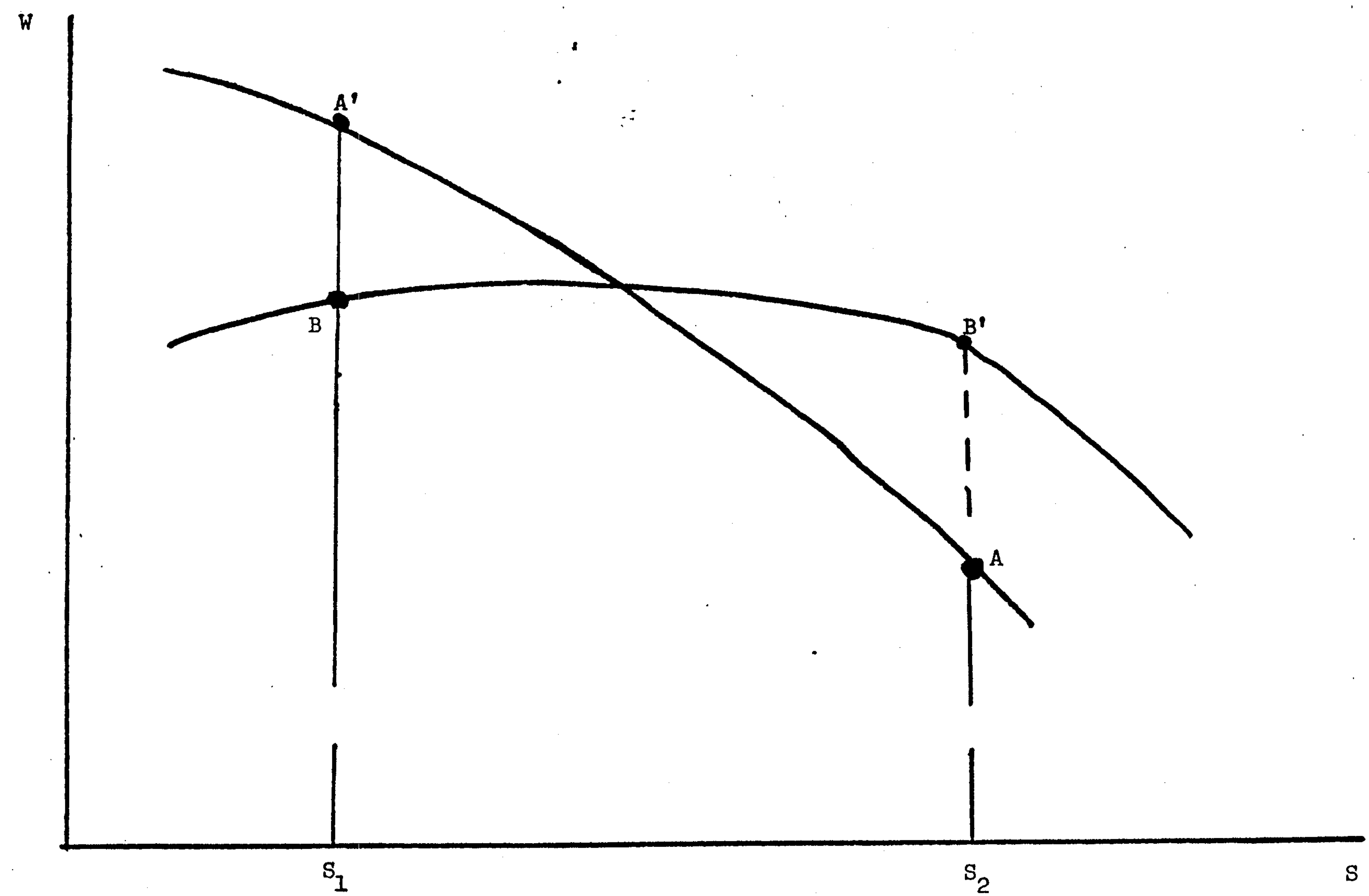

FIGURE 2

Table 1: Regression of log of weekly earnings on personal characteristics

	coefficient	t-statistic
intercept	3.7418	105.60
household head	.1457	9.94
white	.0272	2.14
married	.0776	6.86
veteran	.0274	3.07
school	.0446	28.52
experience	.0285	26.57
exp sq.	-.0005	-24.85
hours	.0101	20.42
part-time	-.2869	-17.90
private	.0129	.89
professional	.3263	24.48
white collar	.1189	8.51
blue collar	.1092	9.52
poverty incidence	-.9063	-18.05
construction	.1333	6.19
durables	-.0519	-2.52
nondurables	-.0589	-2.69
transport	.0192	.90
trade	-.1463	-7.22
services	-.2085	-11.49
union	.1213	14.70

Data is from the May 1973 CPS

$R^2 = .4881$

F ratio = 543.9

N = 12001

The omitted occupation is laborers; the omitted industry is pub. admin.

Table 2

Coefficients of city characteristics from log earnings regressions in 98 cities.

	1	2	3	4
TCRIME 73	$.94 \times 10^{-5}$ (2.58)	$.44 \times 10^{-5}$ (1.17)	$.74 \times 10^{-5}$ (1.93)	$.86 \times 10^{-5}$ (2.21)
UR 73	$.36 \times 10^{-2}$ (1.29)	$.12 \times 10^{-2}$ (.43)	$.32 \times 10^{-2}$ (1.14)	$.27 \times 10^{-2}$ (.97)
PART 73	$.24 \times 10^{-3}$ (1.55)	$.13 \times 10^{-3}$ (.86)	$.37 \times 10^{-3}$ (2.33)	$.34 \times 10^{-3}$ (2.15)
POP 73	$.16 \times 10^{-7}$ (7.97)	$.15 \times 10^{-7}$ (7.74)	$.16 \times 10^{-7}$ (8.04)	$.16 \times 10^{-7}$ (8.11)
DENSSMSA	$.81 \times 10^{-6}$ (.29)	$.24 \times 10^{-5}$ (.86)	$.20 \times 10^{-5}$ (.73)	$.38 \times 10^{-5}$ (1.40)
GROW 6070	$.21 \times 10^{-2}$ (7.84)	$.14 \times 10^{-2}$ (5.66)	$.15 \times 10^{-2}$ (6.06)	$.17 \times 10^{-2}$ (6.47)
HDD	$.20 \times 10^{-4}$ (8.48)			
TOTSNOW		$.72 \times 10^{-3}$ (3.54)		
CLEAR			$-.64 \times 10^{-2}$ (-4.80)	
CLOUDY				$.72 \times 10^{-2}$ (5.21)
R^2	.4980	.4955	.4960	.4962
F-ratio	424.2	420.0	420.8	421.1
N = 12001				

NOTE: Regressions include all personal characteristics. Sample includes all 98 cities. T-statistics are in parentheses.

Table 3

Correlations of population size with other variables in the sample of 98 cities

DENNSSMSA	.40035
PART 73	.17356
UR 73	.16736
TCRIME 73	.14007
GROW 6070	-.07348

Table 4 Coefficients of region dummies and city characteristics

NRTHEAST	-.0218 (-2.25)	-.0095 (-.74)
SOUTH	-.0669 (-6.51)	-.0138 (-.87)
WEST	-.0354 (-3.46)	-.0579 (-3.41)
TCRIME 73		$.13 \times 10^{-4}$ (2.82)
UR 73		$.92 \times 10^{-2}$ (2.60)
PART 73		$.29 \times 10^{-3}$ (1.87)
POP 73		$.16 \times 10^{-7}$ (7.77)
DENSSMSA		$-.13 \times 10^{-5}$ (-.42)
GROW 6070		$.23 \times 10^{-2}$ (8.41)
HDD		$.16 \times 10^{-4}$ (4.86)
R^2	.4900	.4986
F-ratio	479.4	384.0

Note: Regressions include all personal characteristics. Sample includes all 98 cities. T-statistics are in parentheses.

Table 5 Results of regression of residuals on the ten year growth rate of population from equations including city attributes.

INTERCEPT	21.26 (12.27)	14.72 (4.42)
RESIDUAL	58.18 (2.81)	57.44 (3.24)
POP 73		$-.70 \times 10^{-6}$ (-.69)
SOUTH		11.03 (2.74)
WEST		22.37 (4.99)
NRTHEAST		-2.22 (-.53)
R^2	.0761	.3580
F-ratio	7.904	10.26
N = 98		

Note: T-statistics are in parentheses.

Table 6

Regressions of the log of average residental site price per square foot on city characteristics.

	1	2	3	4
TCRIME 73	2.5×10^{-5} (.65)	1.5×10^{-5} (.38)	-4.5×10^{-7} (-.01)	7.0×10^{-6} (.16)
UR 73	8.9×10^{-2} (3.45)	8.8×10^{-2} (3.35)	9.2×10^{-2} (3.53)	9.1×10^{-2} (3.52)
PART 73	2.2×10^{-4} (.15)	1.1×10^{-4} (.08)	-3.8×10^{-5} (-.02)	1.4×10^{-4} (.09)
POP 73	6.8×10^{-8} (1.80)	6.9×10^{-8} (1.78)	6.8×10^{-8} (1.76)	6.8×10^{-8} (1.76)
DENNSSMSA	1.9×10^{-4} (3.02)	2.0×10^{-4} (3.12)	2.0×10^{-4} (3.17)	2.0×10^{-4} (3.18)
GROW 6070	1.1×10^{-2} (4.34)	1.0×10^{-2} (4.11)	9.9×10^{-3} (4.03)	1.0×10^{-2} (4.00)
HDD	3.5×10^{-5} (1.44)			
TOTSNOW		1.3×10^{-3} (.69)		
CLEAR			1.2×10^{-4} (.09)	
CLOUDY				3.2×10^{-4} (.21)
INTERCEPT	-1.73 (-5.92)	-1.54 (-5.99)	-1.44 (-6.51)	-1.53 (-3.32)
R^2	.5741	.5650	.5623	.5625
F - ratio	14.44	13.92	13.77	13.78

NOTE: Data is from FHA Homes, 1973 . N = 83

Table 7

Implicit prices of city attributes
computed from Tables 2 and 6.

	1	2	3	4
TCRIME 73 (crimes/10,000 pop.)	-8.5×10^{-6}	8.1×10^{-7}	-7.4×10^{-6}	-8.4×10^{-6}
UR 73 (fraction unemployed)	-5.1×10^{-4}	1.9×10^{-3}	-6.4×10^{-6}	4.6×10^{-4}
PART 73 (micrograms/cubic meters)	-2.3×10^{-4}	-1.3×10^{-4}	-3.7×10^{-4}	-3.4×10^{-4}
POP 73 (person)	-1.4×10^{-8}	-1.3×10^{-8}	-1.4×10^{-8}	-1.4×10^{-8}
DENSSMSA (persons/sq. mile)	5.8×10^{-6}	4.5×10^{-6}	4.9×10^{-6}	3.1×10^{-6}
GROW 6070 (% change in pop)	-1.7×10^{-3}	-1.1×10^{-3}	-1.2×10^{-3}	-1.4×10^{-3}
HDD (1^{o}F colder for 1 day)	-1.9×10^{-5}			
TOTSNOW (inches)		-6.7×10^{-4}		
CLEAR (days)			6.4×10^{-3}	
CLOUDY (days)				-7.2×10^{-3}

N = 98
average budget share of land = .035.

Units of measurement shown under variable name. All numbers are in terms of percentage change in income net of land payments or, from equation (5):

$$\frac{p_s^*}{w} = k_\ell \frac{d \log r}{ds} - \frac{d \log w}{ds}$$

Table 8

Rank Correlations between various measures
of Quality of life Index

	QOL 1	QOL 2	QOL 3	QOL 4
QOL 1	1.000 (0.0)	.7846 (.0001)	.2480 (.0138)	.2902 (.0037)
QOL 2	.7846 (.0001)	1.000 (0.0)	.3568 (.0003)	.2701 (.0072)
QOL 4	.2480 (.0138)	.3568 (.0003)	1.000 (0.0)	.8219 (.0001)
QOL 4	.2902 (.0037)	.2701 (.0072)	.8219 (.0001)	1.000 (0.0)

NOTE: Probabilities in parentheses.

The indices are computed from columns 1 - 4 of Tables 2 and 6. Thus QOL 1 uses HDD; QOL 2 uses TOTSNOW; QOL 3 uses CLEAR and QOL 4 uses CLOUDY.

Table 9

Cities in Order of QOL3 (which Uses CLEAR as the Climate Variable)

Rank	Name	Population Rank	QOL3
1	Fresno	71	2.0607
2	Bakersfield	92	2.0514
3	Phoenix	35	2.0463
4	El Paso	83	2.0107
5	Tucson	85	1.9875
6	Sacramento	42	1.9493
7	San Bernardino-Riverside-Ontario	29	1.8321
8	Albuquerque	97	1.7964
9	Los Angeles-Long Beach	2	1.7517
10	Anaheim-Santa Ana-Garden Grove	19	1.7363
11	San Francisco-Oakland	6	1.5841
12	San Jose	31	1.5397
13	San Diego	24	1.4892
14	Oklahoma City	51	1.3954
15	Fort Worth	44	1.3915
16	Dallas	17	1.3378
17	Oxnard-Ventura	80	1.2791
18	Wichita	76	1.2673
19	Tulsa	69	1.2573
20	Salt Lake City	58	1.2388
21	Columbia	94	1.2013
22	Little Rock	93	1.1632
23	Kansas City	27	1.1514
24	Memphis	43	1.1328
25	Omaha	60	1.0929
26	Greensboro-Winston-Salem	57	1.0929
27	New Orleans	32	1.0833
28	San Antonio	39	1.0759
29	Charlotte	74	1.0759
30	Jersey City	56	1.0683
31	Norfolk-Portsmouth	48	1.0630
32	Chattanooga	98	1.0520
33	Denver	28	1.0441
34	Providence	37	1.0351
35	Bridgeport	77	1.0296
36	Baltimore	12	1.0244
37	New Haven	84	1.0210
38	Richmond	66	1.0192
39	Nashville	61	1.0140
40	Davenport-Rock Island-Moline	82	1.0112
41	Atlanta	21	1.0090
42	Mobile	79	1.0040

Cities in Order of QOL3 (cont.)

Rank	Name	Population Rank	QOL3
43	Nassau-Suffolk	9	1.0010
44	Peoria	89	.9882
45	Patterson-Clifton-Passaic	23	.9594
46	Allentown-Bethleham-Eaton	59	.9566
47	Birmingham	45	.9545
48	Jacksonville	65	.9544
49	Knoxville	75	.9493
50	St. Louis	11	.9407
51	Milwaukee	20	.9386
52	Boston	8	.9296
53	Beaumont-Port Arthur-Orange	96	.9289
54	Louisville	41	.9245
55	Lancaster	95	.9210
56	Worcester	87	.9176
57	Minneapolis	16	.9047
58	Wilmington	67	.8997
59	Orlando	70	.8993
60	New York	1	.8962
61	Honolulu	54	.8940
62	Washington D.C.	7	.8910
63	Newark	15	.8853
64	Gary-Hammond-East Chicago	53	.8812
65	Indianapolis	30	.8658
66	Harrisburg	73	.8598
67	Tampa	33	.8555
68	York	91	.8414
69	Philadelphia	4	.8038
70	Springfield-Chicopee-Holyoke	64	.7807
71	Houston	14	.7708
72	Dayton	40	.7554
73	Cincinnati	22	.7543
74	Hartford	50	.7437
75	Chicago	3	.7416
76	Wilkes-Barre-Hazleton	88	.7019
77	Columbus	36	.6879
78	Lansing	78	.6876
79	Toledo	47	.6837
80	Albany-Schenectady-Troy	46	.6744
81	Utica-Rome	90	.6715
82	Canton	81	.6692
83	Youngstown	63	.6484
84	Akron	49	.6395
85	Detroit	5	.6347
86	Miami	26	.6345
87	Cleveland	13	.6227
88	Syracuse	52	.6107

Cities in Order of QOL3 (cont.)

Rank	Name	Population Rank	QOL3
89	Grand Rapids	62	.6062
90	Portland	34	.5957
91	West Palm Beach	86	.5955
92	Seattle-Everett	18	.5871
93	Flint	68	.5833
94	Rochester	38	.5667
95	Ft. Lauderdale	55	.5406
96	Buffalo	25	.5176
97	Pittsburg	10	.4961
98	Tacoma	72	.4519

Definitions of Variables

NRTHEAST	dummy variable = 1 if person lives in the Northeastern region
SOUTH	dummy variable = 1 if lives in the south
WEST	dummy variable = 1 if lives in the west
TCRIME 73	total crimes/10,000 population in 1973
UR 73	unemployment rate of adults in 1973
PART 73	particulates; micrograms/cubic meter in 1973
POP 73	total SMSA population in 1973
DENSSMSA	density in the SMSA in 1970
GROW 6070	the growth rate of population from 1960 to 1970
HDD	heating degree days; 30 year average
TOTSNOW	total annual snowfall; 30 year average
CLEAR	total number of clear days/year; 30 year average
CLOUDY	total number of cloudy days/yr; 30 year average

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