UNDERSTANDING RETURNS TO EDUCATION WHEN WAGES AND PRICES VARY BY LOCATION

DAN BLACK, NATALIA KOLESNIKOVA, AND LOWELL TAYLOR

Abstract. In this paper we study whether location-specific price variation affects statistical inference and theoretical interpretation of human capital earnings functions. We demonstrate, in a model of local labor markets, that the "return to schooling" is constant across locations if and only if preferences are homothetic—a special case that seems unlikely to generally pertain. Examination of the U.S. Census data (for 1980, 1990, and 2000) provides evidence that the return to a college education, relative to a high school education, does indeed vary widely across cities, e.g., in 1990 the return in Houston is 0.54 while in Seattle it is only 0.33. We provide theoretical reasons to suspect that the returns to education are relatively lower in expensive high-amenity locations, and present evidence consistent with this prediction. Finally, we raise concerns about standard empirical exercises in labor economics which treat the returns to education as a single parameter.

Introduction

The development of human capital theory, and the application of this theory to the estimation of wage regressions, is a landmark contribution in applied economics. The central logic of human capital theory, as set out in the classic works of Becker (1964 and 1967) and Mincer (1974) and developed in such subsequent treatments as Willis (1986) and Card (1999 and 2001), is straightforward: Education is understood to entail an investment—in tuition, foregone earnings, and possibly loss of present-day utility—which has a return in the form of increased lifetime earnings in the labor market. As in the theoretical treatment of most financial investments, the only relevant prices are those that affect the cost of investment

Date: February, 2005. Black is affiliated with the Center for Policy Research, Syracuse University, Syracuse, NY 13244; Kolesnikova and Taylor are affiliated with the Heinz School, Carnegie Mellon University, Pittsburgh, PA 15213. Portions of the empirical work in this paper were conducted while the authors were Census Bureau research associates at the Carnegie Mellon Research Data Center. Research results and conclusions expressed are those of the authors and do not indicate concurrence by the Bureau of the Census. This paper has been screened to insure that no confidential data are revealed. We thank Stuart Rosenthal for providing us with his hedonic-adjusted housing price data, and Bill Horrace for calculating the critical values for our rank order test. Ashish Arora, Dennis Epple, and seminar participants at UC-Davis, University of Kansas, McGill University, University of Michigan, and Carnegie Mellon University provided helpful comments on earlier drafts.

(e.g., tuition) and those that affect the return (e.g., the education-wage locus); prices of other goods and services are ignored, either explicitly or implicitly.

In this paper we revisit the ubiquitous practice of ignoring the general price vector in applied human capital theory. Our concern about the potential role of "other prices" stems from the observation that unlike, say, returns on shares in General Electric, returns to investment in human capital are usually realized in a specific location, i.e., in a local labor market. We demonstrate that in an equilibrium in which prices vary across locations, education-wage gradients will generally vary across locations, and we show that in fact in the U.S. such variation does exist across local labor markets.

Our paper proceeds in five additional sections. First we demonstrate that in a model of local labor markets the "return to schooling" is a constant across locations if and only if preferences are homothetic—a special case that seems unlikely to generally pertain.

Second, we examine the return to college education (relative to high school education) for large cities in the U.S. in 1980, 1990, and 2000. We find substantial cross-city heterogeneity in the return to the college degree, and we find that this cross-city variation is generally persistent across decades. This heterogeneity does not appear to be the consequence of sampling variation, nor is it the result of differences across cities in the labor force age distribution nor differences in the industry or occupation mix.

Third, we return to our theory, asking if there is reason to believe that the return to education is correlated in systematic ways with other observable city characteristics. We present theoretical arguments suggesting that the observed returns to education will be particularly low in expensive cities (e.g., San Francisco, Seattle, and New York) and relatively high in inexpensive cities (e.g., Houston and Pittsburgh).

Fourth, we present evidence about the relationship between housing prices and the returns to education—evidence that convinces us of the value of further empirical explorations that focus on regional economic growth, the returns to human capital, and prices for local goods.

In the concluding section of the paper we raise concerns about empirical work on the returns to education which treats the return to education as a single parameter. We demonstrate, for example, that serious misunderstandings can arise when researchers adopt instrumental variable strategies designed to identify causal effects of education on earnings.

1. Education and Earnings in a Multiple-Location Model

We begin with a simple model that illustrates our main idea—that the education-wage locus will generally differ by location. In our set-up locations differ in attractiveness or in worker productivity. The consequence is that wages and prices differ across locations, e.g., some locations have relatively high housing prices by virtue of their high production or consumption amenities. Many such models exist in urban economics, for example, in pioneering papers by Haurin (1980) and Roback (1982). Our model differs from pervious work in its focus on worker heterogeneity in levels of human capital.[1]

To streamline our initial presentation of the key idea, we consider the simplest case, in which local price variation is due to underlying productivity differences across location (see, e.g., Acemoglu, 1996, Glaeser and Mare, 2001, and other work on agglomeration). In such a

[1]The paper closest in spirit to ours is innovative work by Beeson (1991), who documents a large variation in the returns to schooling. For instance, using data form the 1980 CPS she finds that the return to a year of schooling is only 0.024 in Seattle, but is 0.050 in Tampa. She also finds that these rates of return are correlated with various measures of location-specific amenities. It seems that very little other work examines regional variation in the return to education. In their study of black-white education and wage disparity, Card and Krueger (1992) notice that the return to education is lower in the South than elsewhere in the U.S. Card and Krueger credit Chiswick (1974) for first making this observation.

model, wages will generally be higher in high-productivity cities, as will the prices of locally-priced goods. Our question is whether the return to education is likely to be the same across locations in such a model.[2]

In our model individuals choose one of two levels of human capital, they make consumption decisions over two goods, and they choose to live in one of many cities, $i = 1, \ldots, n$. The price of one of the consumption goods is set by a national market and is thus the same in all cities. The price of the second consumption good, housing, varies across cities. Wages also vary across cities, of course. Throughout our analysis we assume, as is standard in models of human capital investment, that labor supply is fixed—at one unit—and assume further that there is no non-labor income.

Individuals have identical preferences except along one dimension: they differ in the extent to which they suffer disutility from acquiring education. In particular, preferences are characterized by a utility function $U = u(x, h) - c(E; \alpha)$, where x is the good that has a common price across the cities (and is the numeraire), h is housing, and $c(E; \alpha)$ is the utility cost of acquiring schooling. We let education be one of two levels, $E \in \{0, 1\}$, and let α be a parameter that scales the cost of acquiring education, with $\dfrac{\partial c(1; \alpha)}{\partial \alpha} > 0$. Utility maximization entails choosing the optimal education level (0 or 1) and location, and the best consumption bundle (x^*, h^*) given the education level and location.

In our analysis below we examine an equilibrium in which some, but not all, individuals optimally choose the higher level of education, and in which people of both education levels live in each city (so that we can study the nature of cross-city differences in the returns to education). In the equilibrium we describe shortly each individual is indifferent over which

[2]In Section 4 of our paper we also study a model in which price variation is due to a consumption amenity, i.e., we let utility depend on consumption of some location-specific amenity.

city to live in, i.e., the utility net of the education cost must be the same in each city. Given that the education cost component of utility $c(E;\alpha)$ is independent of the city of residence, the optimal education choice in such an equilibrium is trivial to characterize: There will be some critical value of α, say $\hat{\alpha}$, such that people with $\alpha < \hat{\alpha}$ acquire education $E = 1$ while people with $\alpha > \hat{\alpha}$ do not. Essentially we can then treat the two levels of human capital, 0 and 1, as predetermined. To simplify notation we henceforth omit the cost of education component from utility.

We find it useful to write equilibrium conditions—that workers of each education level are indifferent over their city of residence—using expenditure functions. Let p_i be the rental price per unit of housing in an arbitrarily chosen location, city i. Individuals with human capital 1 earn wage w_i^1 in this city, while workers with human capital 0 earn $w_i^0 < w_i^1$. Define the expenditure function for workers with human capital k ($k = 0$ or 1) living in city i: $e(p_i, u_i^k)$. The key equilibrium conditions then are that

$$e(p_i, u^0) = w_i^0 \quad \text{and} \quad e(p_i, u^1) = w_i^1, \tag{1}$$

where u^0 and u^1 are respectively utility levels for the poorly-educated and well-educated.

The gross return to education in city i—the wage of the well-educated relative to the poorly-educated—is $R_i = \dfrac{e(p_i, u^1)}{e(p_i, u^0)}$. In general this latter ratio depends on the housing price p_i; the return to education generally differs across locations.

When are the returns to education independent of location-specific price variation? First note that if preferences are such that the expenditure function takes the form $e(p, u) = f(u)\psi(p)$, the return to education in location i is $R_i = \dfrac{f(u^1)\psi(p_i)}{f(u^0)\psi(p_i)} = \dfrac{f(u^1)}{f(u^0)}$, which does not depend on local prices. Second, and more importantly, note that the converse is true: by assuming that the returns are the same across locations, we implicitly assume that the expenditure function *must* take the form $e(p,u) = f(u)\psi(p)$. To see this last point, let $R_i = g(u^0, u^1)$, so that the return in location i does not depend on that location's prices. Without loss of generality we can take $u^0 = 1$, $u^1 = u$. Then $R_i = \dfrac{e(p_i,u)}{e(p_i,1)} = g(u,1)$ and $e(p_i,u) = g(u,1)\cdot e(p_i,1)$. Setting $f(u) \equiv g(u,1)$ and $\psi(p) \equiv e(p,1)$ we obtain an expenditure function of the specified form.

A standard result from price theory is that the expenditure function takes the form $e(p,u) = f(u)\psi(p)$ if and only if preferences are homothetic. We thus have a key proposition: *The returns to education are the same across locations if and only if preferences are homothetic.*

Behavior in our model is easily summarized: utility-maximizing individuals (i) choose their level of education, 0 or 1, (ii) choose their location from among several cities, and then (iii) given their earnings in the location of choice, choose consumption of a locally-priced good h and another good x. By assumption, the utility cost of education is independent of choices (ii) and (iii), so the first of these decisions is trivial: individuals with a sufficiently low utility cost acquire the higher level of education. In equilibrium individuals who make choice (iii) optimally find that they are indifferent over where they live, i.e., over choice (ii).

In the equilibrium characterized by the previous paragraph, wages will be higher in high-productivity cities than in the low-productivity cities, but so long as preferences are homothethic the *return to education*—the proportional increase in earnings one receives for having the higher level of human capital—is the same across cities. Figure 1 illustrates such a case. Suppose that workers with human capital 1 (and utility u^1), say financial analysts, sell their services to buyers who do not care where the analysts live. Suppose further that these analysts are more productive in city a than in city b, so that $w_a^1 > w_b^1$. If in equilibrium financial analysts live in both cities, obviously the price of housing must be higher in city a. Then consider workers with human capital 0 (and utility u^0), say janitors, who sell their labor in both city a and city b. Given the assumption of homotheticity, these workers are willing to locate in either city only when there is equality in the ratios $\frac{w_a^1}{w_a^0} = \frac{w_b^1}{w_b^0}$, i.e., when the return to education is the same in the two cities.

If, in contrast, preferences are non-homothetic, returns to education differ by location; the utility-wage gradients drawn in Figure 1 will not be parallel.

We could just as easily have explored a model in which location-specific differences in wages and prices are driven by differences in consumption amenities. Indeed, we find it helpful to develop this case in Section 4. To preview, the conclusion is the same as in our model with production amenities: a single return to education generally pertains across all cities only if preferences are homothetic.

Homotheticity is of course a strong restriction, implying that for all goods the income elasticity is equal to one. In fact a large literature suggests that for many goods the income elasticity is different than one. Hausman, Newey, and Powell (1995), for example, estimate income elasticities of demand of 0.7 for food, 1.4 for clothing, and 1.3 for recreation. More importantly for our analysis, a large literature suggest that the income elasticity of housing differs from one.[3] Even so, it is reasonable to wonder if the phenomenon we describe has empirical relevance. Before pursuing further theoretical explorations we turn to this important initial empirical question. Is there systematic variation in education-wage gradients across locations in the U.S.?

[3]The task of measuring an income elasticity of demand on housing is complicated (see Olsen, 1987, for a discussion). One widely cited study, Rosen (1985), reports an income elasticity of demand on housing of 0.76. Harmon (1988) reviews a large number of studies and concludes that an estimate of the income elasticity of demand of 0.7 may be appropriate for most applications.

2. An Empirical Examination of City-Specific Returns to Education

In exploring cross-city heterogeneity in the education-wage gradient we examine the return to a college education (relative to high school education). Our focus on the return to college stems in part from the fact that roughly 90 percent of young people now graduate high school, so that most of the meaningful variation in schooling is at the post-high school level. We take a nonparametric approach to estimation. Focusing on those with college completion exactly and high school exactly provides us with relatively large samples for carrying out this exercise.

2.1. Data.

Our analyses exploit the 1990 public use micro-samples (PUMS) of the U.S. Census, and the 1990 Census complete long form data.[4] We are interested to see if variation in city-specific returns persist over time, so we also present estimates using 1980 PUMS and 2000 PUMS data.[5]

We consider only respondents with exactly 12 or 16 years of reported schooling. We limit our analysis to men whose main job is a wage and salary position and who have no imputed values for variables used in this analysis. Due to concerns that arise with selection into the labor force, we restrict our sample to prime-age men, aged 25 to 55. We also restrict our sample to non-Hispanic white men, which allows us to abstract from any cross-city variation owing to race and ethnicity in labor market outcomes.[6]

---

[4]These latter data provide extremely large samples, representing an approximately a one-in-six sample of the US population. Use of the confidential version of the data is helpful for our purposes because recorded earnings are top coded at $1,000,000, rather than the $150,000 mark used in the public-use version of Census data.

[5]For 1980 we use the IPUMS (see King, Ruggles and Sobek, 2003).

[6]An additional consideration is that Hispanics and non-whites have much higher error rates than non-Hispanic whites in Census responses to education. See Black, Sanders, and Taylor (2003).

2.2. **Results.** We use a simple matching estimator to calculate, for each city i, the rate of return to college. We assume, as in the traditional Mincer set-up, that productivity is a function of education and experience X.[7] For an individual with experience $X = X^0$ in city i we would like to estimate the causal effect of having a BA:

$$\Delta(X^0, i) = E(y_1|X = X^0, BA = 1, i) - E(y_0|X = X^0, BA = 1, i), \tag{2}$$

where y_1 is the logarithm of the worker's wage if the individual receives a bachelor's degree, y_0 is the logarithm of the worker's wage if the individual stops his education at high school, and BA is an indicator variable equal to 1 if the respondent has a college education. Of course we cannot directly estimate the second term in this difference; for a person with a bachelor's degree we never observe what he would have earned if he had only a high school education.

If we are willing to assume away selection problems, though (including the issue of ability bias that has received close attention in the literature), we have

$$E(y_0|X = X^0, BA = 1, i) = E(y_0|X = X^0, BA = 0, i). \tag{3}$$

In implementing our estimation strategy we follow standard practice of using "potential experience," age minus schooling minus six.[8] Then the mean return in a particular city i, say $\Delta(i)$, is

$$\Delta(i) = \int \Delta(X|i) dF(X|i),$$

[7]Given concerns raised by Heckman, Lochner, and Todd (2003), though, we do not adopt parametric assumptions often used in estimating Mincer wage regressions, e.g., entering experience as a quadratic in the wage equation.

[8]We use potential experience rather than age because it is the variable implied by conventional human capital theory. There may be considerable measurement error in this variable, but our data do not allow us to improve on the measure. Because men with a high school degree only have more potential work experience than college-educated men, matching on potential experience implies that we typically match men with a bachelor's degree to men with a high school degree who are four years younger. Thus, we match men with a bachelor's degree aged 29 to 55 to men with a high school degree aged 25 to 51.

where $dF(X|i)$ is the distribution of X in the city.

In principle, $\Delta(i)$ might vary across cities owing simply to differences in the age distributions in these cities. Those differences would be of little interest to us, so we "standardize" our estimates using the national cumulative distribution function of X, i.e., calculate

$$\Delta_n(i) = \int \Delta(X|i) dF_n(X), \tag{4}$$

where $F_n(X)$ is derived from the national data.[9]

Table 1 presents our initial evidence about the mean return to college education in 21 large U.S. cities. We use PUMS data for this exercise, including in our analysis all metropolitan statistical areas (MSAs) with a sample of at least 1500 men with a bachelor's degree. (For cities that were a part of a large consolidated metropolitan area, when possible we retain only the principle city in the CMSA.) In the table, cities are ordered, from low to high estimated returns in 1990. There is substantial heterogeneity in the return to a college education: in 1990, the year for which we conduct our more detailed analysis, the log wage return varies from 0.33 in Seattle to over 0.54 in Houston. Our estimates are quite precise, with standard errors typically in the 0.01 to 0.02 range; this variation is not likely due to sampling variation. Using test procedures described in Horrace and Schmidt (2000), we conclude that in 1990 the lowest returns to college are in San Francisco or Seattle, and the highest returns are in the subset: Houston, Pittsburgh, Dallas, Phoenix, Atlanta and Tampa (based on a one-sided test, with a 0.95 critical value).

In two other columns of Table 1 we list also measured returns to college in each of these cities in 1980 and 2000. We notice that there is a fair amount of persistence in the variation in the returns to college. The correlation is 0.55 for returns 1980 to 1990, 0.67 for returns

[9]As a practical matter this practice of standardizing on age makes virtually no difference to our city-specific estimates of the return to education.

1990 to 2000, and 0.55 for returns 1980 to 2000. Two other features of the data are readily apparent. First, over the two decades the return to college generally increased. This fact about higher education is well known and has been widely studied. Second, although there is clearly some persistence in the returns to education there is also a fair amount of idiosyncratic heterogeneity. For example, San Francisco has a relatively low return in both 1980 and 1990, but a quite high return in 2000 (at the peak of the "dot com" boom).

The estimates we report in Table 1 are based on means. One potential source of bias stems from the fact that income data in the PUMS (used for 1980 and 2000 calculations) are top-coded at $150,000. We can base our estimates on median regression, though, and when we do so results are unchanged; the correlation between the means-based estimates and the median-based estimates is 0.97. Similarly, it makes little difference whether we use the wage as our object of study or "weekly earnings" or "annual earnings."[10] For interest sake we also examined how our estimates would differ had we used the usual OLS approach to estimating returns to education. In fact, OLS estimates are nearly identical to our nonparametric estimates if we allow experience to be entered in a flexible way (with a dummy for each level of the 31 experience levels).

A more interesting question concerns the possibility that cross-city variation in the returns to education is due to differences across cities in industry and occupation. Fortunately, the Census does provide reasonably detailed industry and occupation description (over 240 industries and over 480 occupations). The Appendix describes a simple semi-parametric approach to standardizing across cities on industry and occupation.

[10]The correlation between estimates based on wage and annual earnings is 0.96, and the correlation between estimates based on wage and weekly earnings is 0.97.

To conduct these more-detailed analyses we use the complete long-form data of the 1990 Census. This allows us to substantially increase the number of cities we can study. In particular we calculate the returns to college in 286 metropolitan statistical areas (MSAs). Table 2 provides our key findings. Column (1) shows that when we include smaller cities in our analysis, there are very large differences in the returns, ranging now from 0.17 to 0.70. As mentioned above, adjusting for the age structure makes virtually no difference in our estimates (column 2). Conditioning on the industry (column 3) or occupation (column 4) distribution decreases the variation in our estimated returns, but cross-MSA differences are still substantial: from 0.26 to 0.64. The variation in the measured returns is not being driven by a few outliers. Even after conditioning on occupation, for example, the mean return is less than 0.35 in 10 percent of cities and it exceeds 0.51 in 10 percent of cities.

In sum, our empirical investigation indicates that there are large persistent differences in cross-city returns to education, and indicates that these differences are not due to differences in the industry or occupation mix across these cities. Returning to Table 1, moreover, there is an apparent regularity: Among the cities with low returns are Seattle, San Francisco, and New York—known to be among the most expensive in the country, presumably owing to high levels of local consumption or production amenities. The highest-return cities—Dallas, Pittsburgh, and Houston—are cities with relatively low housing prices. This casual observation is backed by evidence. If we take a measure of quality-adjusted housing prices for these cities in 1990 (from Rosenthal, 2004), we find a Spearman rank-order correlation with the return to education of -0.54 (p-value < 0.01).

Before further systematic evaluation of this empirical regularity we turn to a theoretical investigation of this question: under what circumstances might we expect to find a negative correlation across cities between housing prices and the return to education?

3. The Theoretical Relationship Between Property Prices and the Returns to Education

We return to our model. We continue to assume that there are two levels of education, and we continue to be interested in an equilibrium in which people of both educational levels live in each city. We now conduct two separate analyses. First, we consider the case in which wages and housing prices vary across cities because of variation in city-specific productivity. Second, we examine the case in which local price variation stems from differences in a consumption amenity across locations.

A Model with Location-Specific Productivity Differences

As discussed in Section 2, wages in general will be higher in a high-productivity city than in a low-productivity city, and the housing price will of course be higher in high-productivity city. We are interested in comparing the returns to education in these two locations.

As in Section 2, let u^1 and u^0 be utility levels, respectively, of individuals with high and low education (so that $u^1 > u^0$). The return to education in a city with a housing price p is $R = \dfrac{e(p,u^1)}{e(p,u^0)}$. To streamline notation we denote the expenditure function $e^k = e(p, u^k)$ for an individual with education k.

We want to know how the return in the low-price low-productivity city compares to the return in a higher-price city. We conduct this thought experiment by evaluating the derivative,

$$R_p = \frac{\partial R}{\partial p} = \frac{e_p^1 e^0 + e^1 e_p^0}{(e^0)^2},$$

which has the same sign as the numerator,

$$e_p^1 e^0 - e^1 e_p^0,$$

or, after we divide by a positive quantity $e^1 e^0 / p$, as

$$e_p^1 \frac{p}{e^1} - e_p^0 \frac{p}{e^0}.$$

Using Shephard's lemma—the derivative of the expenditure function with respect to p gives housing demand—we can convert to relevant budget shares:

$$s_h^1 - s_h^0,$$

which is negative if the share of income allocated to housing decline as income increases.

We conclude that if the income elasticity of housing is less than one, as suggested in the literature, then $R_p < 0$. The return to education is lower in cities that are more expensive, i.e., in the higher-productivity cities.

A Model with Location-Specific Consumption Amenities

The case with a location-specific consumption amenity is only slightly more complicated. In this case the price of housing is a function of the amenity, say A, and the amenity level is also an argument in the expenditure function. So the return to education is written $R = \frac{e(p(A), u^1, A)}{e(p(A), u^0, A)}$. Now our interest is comparing the return in a given city to an alternative location with a higher level of the amenity. Thus we evaluate the derivative $R_A \equiv \frac{\partial R}{\partial A}$. The return to education is lower in the higher-amenity city, i.e., the more expensive city, when this derivative is negative. We are interested, therefore, in the conditions on preferences that relate to this latter inequality.

The derivative of interest is

$$R_A = \frac{\left(e^1_p \frac{dp}{dA} + e^1_A\right) e^0 - \left(e^0_p \frac{dp}{dA} + e^0_A\right) e^1}{(e^0)^2},$$

which is negative when

$$e^1_p \frac{dp}{dA} + e^1_A - R\left(e^0_p \frac{dp}{dA} + e^0_A\right) < 0.$$

Rearranging, we obtain

$$\frac{dp}{dA}\frac{1}{r}\left(e^1_p \frac{p}{e^1} - e^0_p \frac{p}{e^0}\right) + \frac{1}{A}\left(e^1_A \frac{A}{e^1} - e^0_A \frac{A}{e^0}\right) < 0,$$

which can be written in terms of relevant elasticities or budget shares (again using Shephard's lemma):

$$\eta_A(\varepsilon^1_p - \varepsilon^0_p) + (\varepsilon^1_A - \varepsilon^0_A) = \eta_A(s^1_h - s^0_h) + (\varepsilon^1_A - \varepsilon^0_A) < 0, \quad (5)$$

where for utility levels $k = 0$ and 1, ε^k_r are the elasticities of the expenditure function with respect to the price of housing (which in turn equal housing budget shares s^k_h), ε^k_A are elasticities of the expenditure function with respect to the amenity level, and η_A is the elasticity of the price of housing with respect to the amenity level.

Theoretical considerations as well as empirical studies suggest that amenities are at least partially capitalized into housing values; we expect $\eta_A > 0$. Thus, for equation (5) to hold it is sufficient that $0 < s^1_h \leq s^0_h$ and $\varepsilon^1_A \leq \varepsilon^0_A < 0$, with strict inequality holding for one condition. The condition $0 < s^1_h < s^0_h$ simply requires that the share of income allocated to housing decline as income increases; housing is a *necessity.* Notice that the condition $\varepsilon^1_A < \varepsilon^0_A < 0$ can be written $|\varepsilon^1_A| > |\varepsilon^0_A| > 0$, which requires that the value placed on the amenity be higher at the higher utility level; the amenity is a *luxury.*

To summarize, in our model people are essentially endowed with one of two "real wealth levels" in the form of innate ability to acquire education. The relatively fortunate acquire education level 1 and subsequently have higher utility than those who have education level 0. Then our analysis shows the following: If the amenity is a luxury good relative to housing—in the sense that individuals with the higher wealth level also have a higher "marginal willingness to pay for the amenity" relative to housing—then high-amenity locations will also have low returns to education. It is easy to think of location-specific amenities, like an ocean view, that are almost certainly luxury goods; wealthy people are willing to sacrifice a higher fraction of their wealth to purchase these amenities than are poor people. Our theory suggests, then, that places with high levels of such amenities—places that in turn have high housing prices—will have relatively low returns to education.

To build intuition for this finding we refer to Figure 2, which depicts the theoretical relationship between an individual's earnings and utility in each of two cities, a high-amenity city, a, and a lower-amenity city, b (so that $A_a > A_b$). An individual with the high education level 1 has utility level u^1. For simplicity, we illustrate an example in which this utility is achieved by locating in either city and receiving w^1 in either city. To modify the example given above, now suppose that financial analysts, who have education level 1, are equally productive in both cities (so their wages must be the same in each city), but they prefer to live in city a. A person with education level 1 enjoys the relatively high amenity level if she locates in the high-amenity city a, but "pays" for the amenity by facing higher housing prices in that city. A janitor, with education level 0, also has the same utility level (in his case u^0) in either city. Because the amenity is a luxury good relative to housing, however, this poorly-educated individual has a lower "willingness to pay" for the amenity than does the well-educated individual, and he is indifferent between living in the high- or low-amenity city only if his wage is higher in the high-amenity city. In short, the education-wage gradient must be flatter in the high-amenity city.[11]

4. The Relationship Between the Education-Wage Gradient and Housing Prices: Empirical Evidence

Our theory provides reasons to expect that there will be an inverse relationship between education-wage gradients and local amenities. We do not have measures of city-specific amenities, either in consumption or production, and indeed the problem of measuring location-specific amenities is a difficult one.[12] If, as in our model above, production or consumption amenities are capitalized in the housing price, our reasoning leads us to anticipate a negative correlation across locations between the return to education and the price of housing.

Before presenting empirical evidence, we turn to an issue that bears brief discussion. In our theoretical development we assume that all individuals have the same preferences with respect to location. We also assume perfect mobility. Together these assumptions lead to the long-run equilibrium condition (1). A more general specification might introduce heterogeneity in preferences by supposing that some individuals—call them "homebodies"—hold a special attraction to their home city. The equilibrium predictions of our model would then pertain for locations with a sufficient number of mobile individuals who are indifferent about relocation. (The "homebodies" would then earn positive rents from remaining in their

[11]The preferences illustrated in Figure 2 are quasi-homothetic. For such preferences it is easy to show condition (5) boils down to the following: the return to education must be lower in the city where the "minimum consumption bundle"—the bundle consumed at the lowest defined utility level—is more expensive.

[12]See, for example, Gyourko, Kahn and Tracy (1999) for a discussion of consumption amenities, and Glaser and Mare (2001) for some evidence about the presence of production amenities in large cities.

home city.) We raise this issue here because our theoretical prediction—that the education-wage gradient will generally be flatter in expensive cities—is likely to show up empirically in cities with a large number of individuals who are mobile. Growing cities, which are continuously drawing new residents, would seem to be likely candidates for evaluating our theory.

In contrast, it is difficult to know what to expect in declining cities. In these cities, residents who remain—as their neighbors depart—may be drawn from a highly idiosyncratic pool that includes many individuals who remain only because of unusually strong preferences for their present location (i.e., ties to neighboring friends and family). We return to the question of dying cities shortly, but for the moment focus solely on the returns to education in growing cities.

Returns to Education in Rapidly Growing Cities

Figure 3 presents our first piece of evidence about the relationship between the city-specific return to college and the price of housing. The figure graphs this relationship for cities in which an especially high proportion of residents are new arrivals—cities that grew by at least 30 percent from 1980 through 1990. The vertical axis shows the return to college (standardizing on cities' expected-experience structure and occupation mix) while the horizontal axis has the local housing price, as measured by the mid-point of the median housing value interval reported in the MSA's Census data. Estimates use the complete long-form Census data.

Among these rapidly growing, mostly medium-size cities, the local return to college is generally much lower in cities with high housing prices. The lowest return to college is in Napa, California, a location with a mild climate and world-renown beauty, and, not surprisingly, extremely high real estate prices. The highest return is in Fort Walton Beach, a relatively low-cost MSA in the Florida panhandle about 80 miles east of Mobile, Alabama.

In Table 3 we present results from a more systematic evaluation of the 1990 data. We use as our housing price measure a quality-adjusted housing price index developed by Rosenthal (2004). In the first column of this table we continue to focus on rapidly growing cities. We estimate the correlation between housing values, as measured by this index, and each of our four measures of the return to college: the mean return in the city, the return standardized by a common experience distribution, the return standardized by experience and industry, and the return standardized by experience and occupation. We find the relationship between the housing price and the return to college to be significant for each measure. Estimated correlations are quite high (-0.65 to -0.70) when we use a measure of the return to college that controls for city-specific differences in industry or occupation mix.

Columns (2) and (3) expand our list of cities to include slower-growing cities, and for sake of comparison, column (4) gives the relationship for all cities. As long as we restrict attention to cities that are growing at a moderate pace—10 percent or more over the previous decade—the evidence appears to be broadly consistent with our theory: high amenity cities have flatter education-wage gradients than lower-amenity cities.

Returns to Education in Declining Cities

Comparison across columns in Table 3 suggests that the relationship between the city-specific returns to education and housing prices is quite different for slow-growing and declining cities than for rapidly-growing cities in the U.S. Table 4 confirms this observation. The correlation between the return to college and the housing price index for the 42 declining cities is *positive* and statistically significant. After adjusting for the industry or occupation mix the correlation is also positive, though weak; we cannot reject, at the 0.05 level, the hypothesis that the correlation is zero.

While there is heterogeneity in the returns to schooling across these cities, apparently our theory is not pertinent. We note that these cities have the following characteristics: (1) They have disproportionately low quality-adjusted housing prices. 30 of the 42 cities have prices that fall in the lowest quartile of U.S. housing prices.[13] (2) Among these declining cities, there is a very strong positive correlation, 0.83 (p value < 0.001), between housing prices and the average level of human capital, as measured by the fraction of non-Hispanic white men holding a BA or higher. Cities with declining populations and very low housing values tend to have very few college-educated people.[14] (3) Among declining cities, there is a strong negative correlation, -0.53 (p value < 0.001), between the housing price and the faction of well-educated residents who were born outside their current state of resident.

Glaeser and Gyourko's (forthcoming) analysis of urban decline provides proper intuition for the first two of our empirical regularities. Their theory stems from the sensible observation that housing is durable, so that when a city suffers a negative labor market or amenity shock, the consequence can be a very large blow to the value of housing (often pushing prices below construction costs), but a modest population decline. Indeed, extremely low housing values can be seen as a leading indicator of a dying city. In the Glaeser and Gyourko model,

[13]The 42 declining cities, listed in order of housing prices (from the least to most expensive) are: Altoona, PA; Johnstown, PA; Sharon, PA; Terre Haute, IN; Duluth, MN; Florence, AL; Beaumont-Port Arthur, TX; Muncie, IN; Battle Creek, MI; Lima, OH; Decatur, IL; Waterloo-Cedar Falls, IA; Saginaw-Bay City-Midland, MI; Anderson, IN; Jamestown-Dunkirk, NY; Jackson, MI; Huntington-Ashland, WV-KY-OH; Youngstown-Warren, OH; Erie, PA; Mansfield, OH; Alexandria, LA; Flint, MI; Peoria, IL; Davenport-Rock Island, IA-IL; Canton,OH; Benton Harbor, MI; Toledo, OH; Pittsburgh; Cedar Rapids, IA; Louisville; Gary-Hammond, IN; Niagara Falls, NY; Akron, OH; Lorain-Elyria, OH; Detroit; Utica-Rome, NY; Cleveland; Buffalo; New Orleans; Jersey City; Newark; and Bergen-Passaic, NJ.

[14]The positive correlation between human capital and housing prices is *not* found in growing cities; for cities that grew at the rate of 0.10 or more over the decade there is instead a modest negative correlation between housing values and the fraction of working-age white men with a BA (-0.26 with p value < -0.01).

declining cities are particularly susceptible to loss of the well-educated if skilled people place a relatively high value on a strong labor market or on local amenities. We thus expect to see a disproportionately large number of poorly-educated individuals in declining cities with especially low housing prices. In light of these predictions, it is hardly surprising that in the most distressed cities—cities with declining population and very low housing values—among the well-educated, relatively few have migrated from out of state.

Because "history" matters in dying cities—certainly in the form of the size and composition of the existing housing stock, and possibly also in the form of the the distribution of tastes and skills of the city's population—there are several reasons why our long-run equilibrium theory might not pertain. First, as we mention above, many well-educated individuals who choose to live in a dying city are likely "homebodies" who have strong local ties. Those relatively few well-educated individuals who stay on as a city declines may be willing to do so despite the poor labor market. Second, in declining cities, the existing mix of housing need not match up very well with the current education (and thus income) mix. For example, a dying city that was previously quite wealthy might have a large stock of lovely old mansions that well-educated individuals can now live in for very low prices, and in exchange for which they might be willing to accept quite low wages. Third, there is certainly unobserved heterogeneity in skill among individuals with BAs, and it may be that those BA-educated individuals who choose to remain in a dying city have relatively poorer skills than those who move on.[15]

[15]We are reluctant to raise this last possibility, as "unobserved heterogeneity" can be used to explain just about any phenomenon, including the negative relationship between the return to education and housing prices we estimate in Table 3. Notice, though, that the analogous argument for the results in Table 3 would require that among those with a BA, a disproportionate fraction of unobservably low-skill people would have to locate to *expensive* cities like San Francisco or Seattle. Such sorting is opposite to the prediction of Glaeser and Gyourko's model, and seems most unlikely.

5. Concluding Remarks

We have described a simple model in which the equilibrium monetary returns to education differ by location. Empirical evidence suggests that the monetary reward to a college education does indeed vary widely across U.S. cities. This variation is persistent over decades, and is clearly systematic. In particular, the return to education is relatively low in expensive high-amenity cities. An interesting exception to this generalization is dying cities.

On the empirical front, our work has a number of implications that bear further investigation. It is especially clear that care must be taken in estimating returns to schooling using data that span locations. We provide two examples in which attention to the issues raised above may affect inferences in empirical work.

Estimating the Return to College in 1980 and 1990

The U.S. experienced a well-documented increase in the return to college over the 1980s. The underlying causes of this increase are widely studied, and there is considerable concern on the policy front about the effects of this continuing trend for societal inequality.[16] Our work raises two important points about research evaluating such trends.

First, even in one is willing to assume homotheticity in preferences—so that the return to education is a single parameter—OLS estimates of this parameter may be systematically biased if location is ignored in the estimation procedure. In particular, there will generally be differences in wage levels over locations (as illustrated in Figure 1 above), so one would need to include a dummy variable for each labor market. Consider the return to college in 1980 and in 1990. In the Census PUMS for non-Hispanic white men, regressing log wage on a vector of dummies for potential experience and education—restricting attention to

[16] Work on this topic includes include important contributions of Murphy and Welch (1992), Katz and Murphy (1992), Bound and Johnson (1992), and Juhn, Murphy, and Pierce (1993). Policy issues are discussed in, e.g., the Council of Economic Advisers (1997).

individuals with exactly 12 and 16 years of schooling—we estimate an annual 0.088 in 1980 and 0.118 in 1990, giving an approximately 3.0 percentage point increase. Conducting that same exercise but in a regression that includes also location indicators for city of residence (or state of residence for those not residing in large and medium-size cities), we estimate returns of 0.082 and 0.104 respectively for 1980 and 1990, giving a 2.2 percentage point increase. Omitting location dummies causes us to overestimate the change in the mean return to college by 36 percent.[17]

Second, note that some of the increase in nominal earnings inequality might stem from the reallocation of workers between regions with differing education-earnings gradients. Consider, for instance, Figure 2. In this example, if population grows more rapidly in the low-amenity city than the high-amenity city, measured inequality increases, even though there are no welfare changes for either the poorly-educated (u^0) or well-educated (u^1).

One could undertake a location-based decomposition of changes in the returns to education in the U.S. Here we simply note that despite the sharp increase in the returns to college from 1980 to 1990, in the 21 large cities listed in Table 1 there was virtually no increase in the average return to college over this decade.[18] Apparently the increase can be attributed primarily to changes in returns in other cities and rural areas, and in migration between areas.

Estimating the Causal Returns to Education

There are many papers that rely on natural experiments that exogenously influence individuals' schooling decisions (e.g., variation in institutional features in the provision of

[17]Our regressions have over 300 location indicators. Standard errors in the estimated returns were very small (0.0005 or less) owing to sample sizes in excess of 500,000. Of course, given our discussion above, we are not particularly enamored of these estimates. Including location dummies does not deal with the more fundamental issue that returns to education vary across locations. A more palatable alternative might be to evaluate changes in the *distribution* of returns to education.

[18]In our 21 large cities, the average total return to 4 years of college was 0.43 in 1980 and 0.44 in 1990.

education) to identify the causal effect of schooling on earnings. Our work argues that the monetary return to education will vary across locations. So the "causal return to education," measured as the relationship between schooling and wages, is not a single parameter. With this in mind, one might wonder how instrumental variable (IV) approaches will be affected if they fail to account for localized differences in returns to education.

A typical OLS estimate of "the return to education" will give an average of education-earnings gradients for many locations. An IV estimator re-weights observations—placing increased weight on those observations where the exogenous variation influences schooling outcomes. To take a specific instance, consider work by Angrist and Krueger (1991). In that paper, the authors noticed that because of the specifics of compulsory school attendance laws, children born in the fourth quarter of the calendar year receive more education than children born earlier in the year. In principle, their IV estimator identifies the causal effect of additional schooling for increments of education around the compulsory schooling level. They find that in various specifications IV estimates are similar to or higher than corresponding OLS estimates. This outcome might occur if OLS estimates are downward biased (e.g., because of measurement error in education).[19] It would also occur, though, if compulsory schooling laws have a disproportionate impact on completed education in locations that have high location-specific returns, for example if individuals affected by the laws tend to live in low-amenity locations.[20]

[19]While issues have been raised about "weak instruments" in Angrist and Krueger's original work, the central idea—that compulsory schooling laws can provide useful variation for estimating causal effects of education—has been highly influential (see Card, 1999).

[20]Similar concerns might arise with many IV approaches. Institutions that generate variation in schooling outcomes are invariably location-specific. One might be particularly concerned about research strategies explicitly based on location, such as studies that exploit variation in individuals' proximity to a college or university.

Our work surely raises concerns for other empirical work in labor economics. As a last example, consider the literature that studies earnings differentials between races and ethnic groups. The geographic patterns of residence of minority groups are very different than for non-Hispanic whites. For example, 53 percent of blacks but only 33 percent of whites now live in the South, while 20 percent of whites but only 9 percent of blacks live in the West. Given substantial regional differences in levels and slopes of schooling-earnings gradients, racial and ethnic differences in earnings and returns to education will appear, even if when in each location all workers with a given schooling level have the same earnings.

As for future theoretical development, there are a number of potentially interesting paths that might be worth following. Notice that in our model the equilibrium "utility return" to education is the same in each location, while the "monetary return" is lower in high-amenity cities. Put another way, as is readily apparent in Figure 2 (when one flips the axes), the marginal utility of money is lower for individuals in low-amenity cities than for individuals in the high-amenity cities. This feature of a location-based economy might well have interesting implications for a variety of behaviors, including investment in human and non-human capital,[21] fertility decisions, labor supply, and interpretation of evidence concerning agglomeration economies.

[21]In the stripped-down version of human capital investment we use in this paper, the only relevant return for the schooling decision is the utility return to education, but there are additional complexities worth exploring in models in which human capital accumulation entails both a utility cost and a monetary cost.

Appendix. Description of the Parametric and Semi-Parametric Estimation

Let y_1 be the logarithm of the worker's wage if the individual receives a bachelor's degree, y_0 be the logarithm of the worker's wage if the individual stops his education at high school, and BA is an indicator variable equal to 1 if the respondent has a college education. Our "unadjusted estimates" of the return to schooling examine, for an individual with potential experience $X = X^0$ in city i,

$$\Delta(X^0, i) = E(y_1|X = X^0, BA = 1, i) - E(y_0|X = X^0, BA = 1, i), \tag{6}$$

where we make the key identifying assumption,

$$E(y_0|X = X^0, BA = 1, i) = E(y_0|X = X^0, BA = 0, i). \tag{7}$$

Essentially we are assuming that the data generating process for the wage y_1 is

$$y_1 = g_1(X, i) + \varepsilon_1, \tag{8}$$

where $g_1(X, i)$ is an unknown function of potential experience and ε_1 is a mean zero error term that is independent of X and the vector of cities. Similarly, we assume that the data generating process for the wage y_0 is

$$y_0 = g_0(X, i) + \varepsilon_0, \tag{9}$$

where again $g_0(X, i)$ is an unknown function and ε_0 is an independent error term.

Our estimate then simply matches within each city, and within each potential experience cell, college-educated individuals to high school-educated men. The city-specific return averages across potential experience cells within the city.

The Census provides detailed occupation and industry codes. We could, of course, match workers on their industry and/or occupation as well. Our goal, however, is *not* to compare, say, accountants in Bakersfield with a four-year college degree and 14 years of potential experience to the accountants of Bakersfield with a high school degree and 14 years of potential experience. (Indeed, a portion of the returns to a college education is surely captured by entry into higher paying occupation.) Rather, we wish to "control for" the occupation distribution across cities.[22]

We thus pursue a semiparametric approach, using a relatively flexible functional form.[23] In particular, we re-specify our equations (8) and (9) as

$$y_1 = \tilde{g}_1(X, i, Z) + \varepsilon_1 = g_1(X, i) + Z\gamma_1 + \varepsilon_1, \tag{10}$$

$$y_0 = \tilde{g}_0(X, i, Z) + \varepsilon_0 = g_0(X, i) + Z\gamma_0 + \varepsilon_0, \tag{11}$$

where functions $g_0(X, i)$ and $g_1(X, i)$ are left unspecified as before, and Z is a vector of occupation or industry indicators. Then in estimating local returns to education, we replace y_1 and y_0 with $\tilde{y_1}$ and $\tilde{y_1}$, where

$$\tilde{y_1} = g_1(X, i) - Z\gamma_1 + \overline{Z_1}\gamma_1 + \varepsilon_1, \tag{12}$$

$$\tilde{y_0} = g_0(X, i) - Z\gamma_0 + \overline{Z_0}\gamma_0 + \varepsilon_0, \tag{13}$$

and $\overline{Z_j}$ is the mean of the industry or occupation controls for the jth group. While much less restrictive than most wage equations, our specification of equations (12) and (13) requires an occupation or industry to shift the wage profile by an equal amount for each potential

[22]Moreover, given the extremely large number of cities and occupations (or industries), we would undoubtedly suffer from severe support problems. For instance, we doubt that there are any employed coal miners residing New York City or Los Angeles.

[23]See Horowitz (1998) for an excellent discussion of the relative merits of semiparametric estimation.

experience level and city. Conceptually we are asking what would be the observed return to education in each city had the same distribution of workers' expected experience and the same industry or occupation mix.

References

Acemoglu, Daron, 1996. "A Microfoundation for Social Increasing Returns in Human Capital Accumulation," *Quarterly Journal of Economics*, 111(3): 779-804.

Angrist, Joshua and Alan Krueger, 1991. "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics*, 106(4), 979-1014.

Becker, Gary S., 1964. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education. New York: National Bureau of Economic Research.

———, 1967. Human Capital and the Personal Distribution of Income: An Analytic Approach. Ann Arbor, Michigan: University of Michigan Press.

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

Black, Dan, Seth Sanders, and Lowell Taylor, 2003. "Measurement of Higher Education in the Census and CPS," *Journal of the American Statistical Association*, 98.

Bound, John and George Johnson. 1992. "Changes in the Structure of Wages in the 1980's: An Evaluation of Alternative Explanations," *American Economic Review*, 82(3): 371-92.

Card, David, 1999. "The Casual Effect of Education on Earnings" in Orely C. Ashenfelter and David Card, eds., *Handbook of Labor Economics*, 3A. Amsterdam: Elsevier Science, 1801-63.

———, 2001. "Estimating The Returns to Schooling: Progress on Some Persistent Econometric Problems," *Econometrica*, 69(5) 1127-60.

Card, D. and Kruger, A., (1992), "School Quality and Black-White Relative Earnings: A Direct Assessment," *Quarterly Journal of Economics* 107, 151-200.

Chiswick, B (1974), *Income Inequality: Regional Analysis within a Human Capital Framework*, New York: Columbia University Press.

Council of Economic Advisers (1997), *Economic Report of the President*, Washington D.C.

Glaeser, Edward L. and Joseph Gyourko, forthcoming, "Urban Decline and Durable Housing," *Journal of Political Economy.*

Glaeser, Edward L. and David C. Mare, 2001. "Cities and Skills," *Journal of Labor Economics*, 19(2): 316-342.

Gyourko, Joseph, Matthew Kahn, and Joseph Tracy, 1999. "Quality of Life and Environmental Comparisons" in Edwin S. Mills and Paul Cheshire, eds., *Handbook of Regional and Urban Economics.*

Harmon, Oskar, 1988. "The Income Elasticicities of Demand for Single-Family Owner-Occupied Housing: An Empirical Reconciliation," *Journal of Urban Economics*, 24: 173-185.

Haurin, Donald R., 1980. "The Regional Distribution of Population, Migration, and Climate," *Quarterly Journal of Economics*, 95(2): 293-808.

Hausman, J. A., Newey, W. K., and Powell, J. L., 1995. "Nonlinear Errors in Variables Estimation of Some Engel Curves," *Journal Of Econometrics*, 65: 205-233.

Heckman, J. J., Lochner, L., and Todd, P. (2003), "Fifty Years of Mincer Earnings Regressions," Working Paper 9732, National Bureau of Economic Research.

Horowitz, Joel L., 1998. *Semiparametric Methods in Econometrics.* Berlin: Springer-Verlag.

Horrace, William C. and Peter Schmidt, 2000. "Multiple Comparisons with the Best, with Economic Applications," *Journal of Applied Econometrics*, 15(1): 1-16.

Juhn, Chinhui, Kevin M. Murphy, and Brooks Pierce, 1993. "Wage Inequality and the Rise in Returns to Skill," *Journal of Political Economy*, 101(3): 410-442.

Katz, Lawrence F. and Kevin M. Murphy, 1992. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *Quarterly Journal of Economics*, 107(1): 35-78.

King, Miriam, Steven Ruggles, and Matthew Sobek, 2003. "Integrated Public Use Microdata Series, Current Population Survey: Preliminary Version 0.1," Minneapolis: Minnesota Population Center, university of Minnesota, www.ipums.org/cps.

Mincer, Jacob, 1974. *Schooling, Experience, and Earning.* New York: National Bureau of Economic Research.

Murphy, Kevin M. and Finis Welch, 1992. "The Structure of Wages," *Quarterly Journal of Economics*, 107(1): 285-326.

Olsen, Edgar, 1987. "The Demand and Supply of Housing Service: A Critical Survey of the Empirical Literature" in Edwin S. Mills, ed.,*Handbook of Regional and Urban Economics*, Elsevier Science.

Roback, Jennifer, 1982. "Wages, Rents, and the Quality of Life," *The Journal of Political Economy*, 90(6): 1257-1278.

Rosen, Harvey S., 1985. "Housing Subsidies: Effects on Housing Decisions, Efficiency, and Equity," in *Handbook of Public Economics*, North-Holland: 375-420.

Rosenthal, Stuart, 2004. "What Drives Migration: Quality of Life or Quality of the Business Environment?" working paper, Syracuse University.

Willis, Robert J., 1986. "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions," in Orely C. Ashenfelter and Richard Layard, eds., *Handbook of Labor Economics* 1. Amsterdam: Elsevier Science, 525-602.

FIGURE 1. Earnings-Education Profiles when Preferences are Homothetic

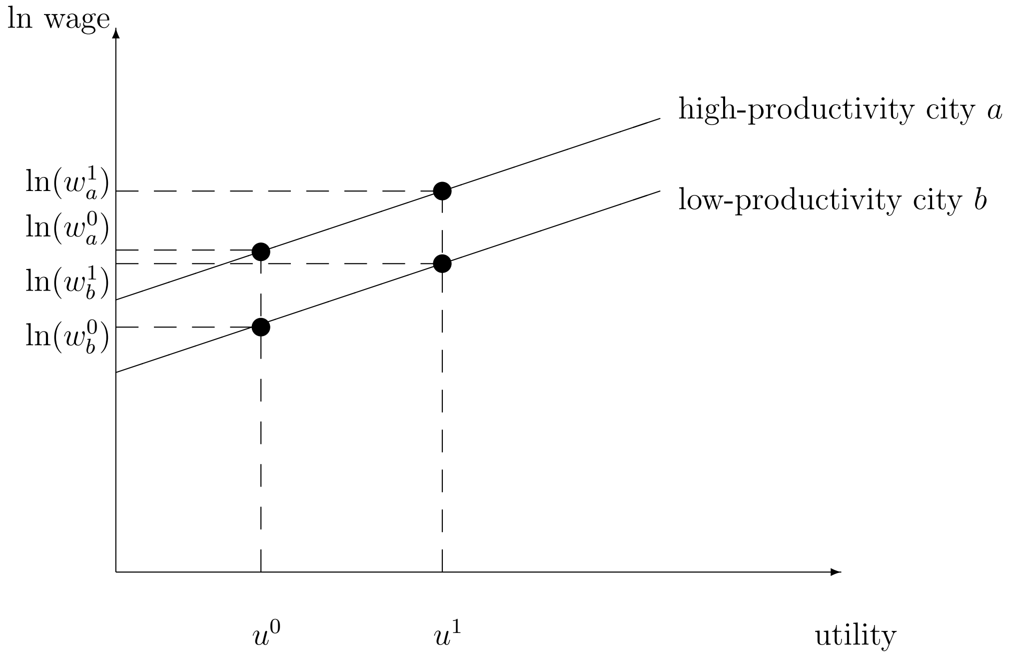

FIGURE 2. Earnings-Education Gradients when Cities Have Different Consumption Amenities

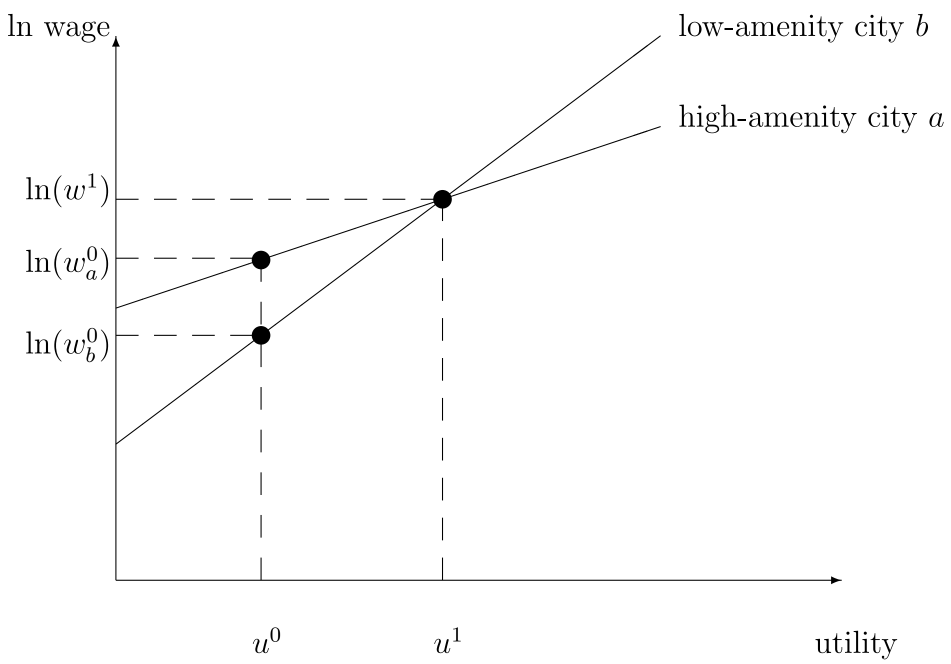

FIGURE 3. Rapidly Growing Cities

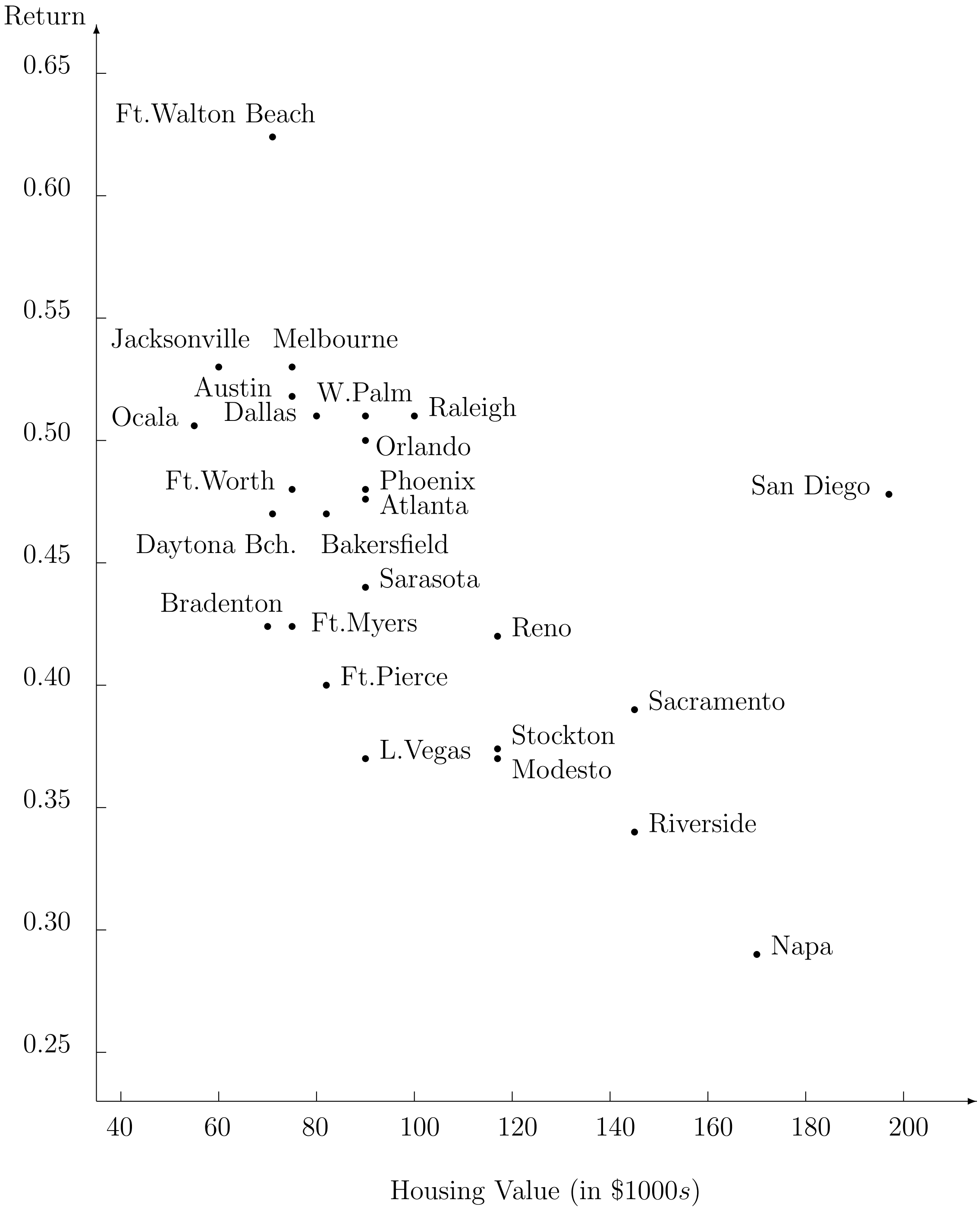

Table 1. Local Variation in the Returns to a Bachelor's Degree, PUMS

City	2000	**1990**	1980
Seattle	0.405 (0.0182)	**0.331** **(0.0147)**	0.335 (0.0171)
San Francisco	0.573 (0.0360)	**0.378** **(0.0296)**	0.341 (0.0146)
Minneapolis	0.457 (0.0154)	**0.386** **(0.0146)**	0.395 (0.0131)
New York	0.497 (0.0186)	**0.388** **(0.0142)**	0.450 (0.0098)
Chicago	0.434 (0.0116)	**0.389** **(0.0107)**	0.390 (0.0087)
St. Louis	0.436 (0.0176)	**0.404** **(0.0149)**	0.438 (0.0155)
Detroit	0.472 (0.0135)	**0.421** **(0.0120)**	0.396 (0.0117)
Los Angeles	0.497 (0.0184)	**0.429** **(0.0118)**	0.438 (0.0110)
Washington	0.551 (0.0136)	**0.430** **(0.0119)**	0.459 (0.0120)
Boston	0.536 (0.0140)	**0.437** **(0.0124)**	0.420 (0.0147)
Philadelphia	0.482 (0.0121)	**0.438** **(0.0100)**	0.444 (0.0099)
Baltimore	0.473 (0.0162)	**0.439** **(0.0132)**	0.453 (0.0160)
Cleveland	0.474 (0.0168)	**0.442** **(0.0151)**	0.389 (0.0153)
Denver	0.471 (0.0194)	**0.447** **(0.0191)**	0.408 (0.0161)
San Diego	0.577 (0.0210)	**0.458** **(0.0169)**	0.489 (0.0195)
Tampa	0.547 (0.0180)	**0.491** **(0.0176)**	0.436 (0.0214)
Atlanta	0.556 (0.0152)	**0.497** **(0.0140)**	0.483 (0.0158)
Phoenix	0.506 (0.0163)	**0.518** **(0.0176)**	0.396 (0.0223)
Dallas	0.617 (0.0181)	**0.524** **(0.0155)**	0.487 (0.0128)
Pittsburgh	0.529 (0.0177)	**0.530** **(0.0159)**	0.399 (0.0147)
Houston	0.609 (0.0179)	**0.542** **(0.0142)**	0.472 (0.0124)

Notes: Author's calculations, Five-Percent PUMS of the 2000, 1990, and 1980 Census. Workers are white, non-Hispanic males who have either a high school degree or bachelor's degree with between seven and 33 years potential experience (aged 25 to 55 years). Workers are matched within cities to workers with exactly the same number of years of potential experience. For each city, distribution of potential experience variable standardized to national average of bachelor's degree holders. Bootstrapped standard errors using 499 replications reported in parentheses.

Table 2. Estimated Returns to a Bachelor's Degree, 1990 Census Long Form

	Mean Return	Standardizing on Experience	Standardizing on Experience and Industry	Standardizing on Experience and Occupation
Mean	0.413	0.414	0.422	0.425
Std. Deviation	0.077	0.076	0.063	0.062
Lowest MSA	0.168	0.197	0.261	0.263
10th Percentile	0.318	0.321	0.341	0.351
25th Percentile	0.362	0.363	0.384	0.385
Median MSA	0.413	0.414	0.420	0.422
75th Percentile	0.461	0.457	0.463	0.466
90th Percentile	0.505	0.507	0.498	0.506
Highest MSA	0.701	0.703	0.642	0.636

Notes: Results are from semiparametric estimation. The data are from the 1990 Census complete long form. Data are weighted to account for sample stratification. Our sample consists of 1,032,629 non-Hispanic white men aged 25 to 55 years with high-school or college degrees, reporting positive earnings for the year, with non-imputed data on earnings, weeks worked, and usual hours of work per week. The unit of observation is the MSA. The 286 MSAs used had population greater than 100,000 and had all the age groups present in the sample.

Table 3. Correlation Coefficients Between Housing Values and Alternative Estimates of the Returns to a Bachelor's Degree

	Growth Rate>0.3	Growth Rate>0.2	Growth Rate>0.1	All MSAs
Mean Return	-0.543	-0.318	-0.144	0.021
	(0.0025)	(0.0102)	(0.0757)	(0.6276)
Standardizing on Experience	-0.554	-0.339	-0.144	-0.003
	(0.0021)	(0.0065)	(0.0654)	(0.5199)
Standardizing on Exp. and Industry	-0.697	-0.466	-0.329	-0.192
	(0.0001)	(0.0002)	(0.0002)	(0.0011)
Standardizing on Exp. and Occupation	-0.646	-0.473	-0.305	-0.107
	(0.0003)	(0.0002)	(0.0006)	(0.0446)
N (number of cities)	25	53	111	253

Notes: One-tailed p-values are in the parentheses. We exclude from analysis 33 cities for which Rosenthal's (2004) quality-adjusted housing values are unavailable.

Table 4. Correlation Coefficients Between Housing Values and Alternative Estimates of the Returns to a Bachelor's Degree in the Declining Cities

	Growth Rate≤ 0
Mean Return	0.409
	(0.0071)
Standardizing on Experience	0.334
	(0.0305)
Standardizing on Exp. and Industry	0.176
	(0.2663)
Standardizing on Exp. and Occupation	0.268
	(0.0860)
N (number of cities)	42

Notes: Two-tailed p-values are in the parentheses.