CITIES AND SKILLS

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Abstract

Workers in cities earn 33 percent more than their non-urban counterparts. A large amount of evidence suggests that this premium is not just the result of higher ability workers living in cities, which means that cities make workers more productive. Evidence on migrants and the cross-effect between urban status and experience implies that a significant fraction of the urban wage premium accrues to workers over time and stays with them when they leave cities. Therefore, a portion of the urban wage premium is a wage growth, not a wage level, effect. This evidence suggests that cities speed the accumulation of human capital.

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I. Introduction

Why are wages 33 percent higher in big cities than outside metropolitan areas? Figure 1 shows the relationship between metropolitan area size and average annual earnings for the thirty largest metropolitan areas: the positive relationship is not debatable. The relationship between wages and city size is neither new nor temporary.[1] Weber (1899) shows that the urban wage premium in 19th century Germany was over 50 percent (see also Kuznets, 1970, for early data). In 1970, the urban wage premium was slightly larger than it is today; families in SMSAs with over 1 million residents earned 36 percent more than families living outside of SMSAs.[2] While the premium from living in a central city has fallen over time, the earnings gap between those who work in a large city and those who work outside a large city is still larger than the earnings gaps between the races or between union and non-union members.

Higher costs of living and urban disamenities may explain why labor does not flock to this high pay, but if urban wages are so high, why do so many firms stay in cities?[3] After all, more than twenty-two percent of U.S. non-farm business establishments are in America's five largest metropolitan statistical areas. In the New York City area alone, which has the highest wages in the country, there are 555,000 establishments.[4] Firms, even those that sell their goods on the national market, appear willing to pay the high wages in cities. The best explanation for the continuing presence of firms in cities is that these higher wages are compensated for by higher productivity.[5] If productivity did not equal wages, firms would leave or hire fewer workers.

We ask two questions about the urban wage premium. The answers to both of these questions have important ramifications for understanding why cities exist. First, does the urban wage premium just reflect more able workers choosing to live in cities? If the urban wage premium is just ability bias, then urban theory should focus on explaining why cities attract more able workers and not on why cities are more productive. Second, if the urban wage premium is real, is it a wage level or a wage growth phenomenon? The bulk of urban models predict a wage level effect where workers who

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[1] High frequency shifts in local labor demand (see, e.g Hall, 1972, Topel, 1985) have little to do with the centuries old gap between urban and rural wages.

[2] The wage premium for living in a smaller SMSA was 21 percent. Both of these figures come from Current Population Reports *Wages by Metropolitan/Non-Metropolitan Residence*. These numbers are not directly comparable with our own since they are family, not worker figures.

[3] Firms do appear to leave areas with wages that are not compensated for by higher productivity (e.g. Carlton, 1983).

[4] Both the New York area and the five largest metropolitan areas taken as a whole have more non-farm establishments per capita than the country as a whole.

[5] Reductions in transportation costs in cities are one form of increased productivity.

come to the city immediately receive a wage gain and workers who leave the city immediately receive a wage loss. If the urban wage premium is a wage growth effect instead of a wage level effect, then urban models should focus more on why wages grow faster in cities.

There are many reasons why higher ability workers might come to cities. If cities speed the flow of information, then this might be more valuable to high human capital individuals. Alternatively, cities might be centers of consumption, which cater to the rich. If cities are full of high human capital workers then we should be able to see this in the sorting of high ability workers into cities. Since this hypothesis claims that urban workers are really more able, there should be an urban wage premium, even controlling for local prices. Furthermore, fixed effect estimates of the urban wage premium should be zero and we should not expect to see wage gains among migrants who enter large cities. Finally, factors that lead individuals to move into cities, but which are not correlated with individual ability should not be correlated with higher wages.

Standard urban theories predict that wages will be higher because of the presence of greater demand in cities or because inputs are cheaper when producers are close to other suppliers. Recent papers have argued that cities also have information externalities that increase the productivity of firms. All of these theories predict that the marginal product of labor is higher in cities, which explains why firms stay in cities despite the high wages. According to these theories, workers who move to cities will immediately receive wage gains and workers who leave cities will immediately receive wage losses. Alternatively, cities might act through human capital accumulation or labor market matching. These theories suggest that the benefits of cities might only accrue over time, and workers who leave cities might not face wage losses. We distinguish between these theories by examining recent migrants to urban areas. The wage growth theory predicts a positive interaction between labor market experience and working in an urban area.

We use a combination of city and metropolitan area data books, the 1990 census, panel data from the Panel Study of Income Dynamics (hereafter PSID) and the National Longitudinal Survey of Youth (hereafter NLSY) to test between these alternative hypotheses. The Census provides us with the largest and most representative data set. The PSID and the NLSY provide us with panels with which we can examine migrants and allow for individual fixed effects. We also use the Current Population Survey to further examine the urban wage premium. These data sets provide evidence suggesting that the urban wage premium is not primarily the result of urban workers being more able. First, the distribution of observable characteristics does not suggest that urban workers have much higher ability levels. For example, the wage gap falls by 6.5 percent when we control for education, experience and race. Controlling for job tenure, occupation and AFQT reduces the estimated the gap by only about a further three percentage points. If unobservable ability is distributed and rewarded like observable skills, then ability will not explain more than one-third of the urban wage premium.

Second, as Figure 2 shows, real wages do not appear to be higher in big cities. Third, migrants to big cities do seem to experience real wage gains. Finally, the urban wage premium is strongest for long-term urban residents than for recent migrants, which further suggests that urban wage gains come from living in the city, not from innate characteristics associated with urban residence.

The evidence on whether the urban wage premium is a wage level effect or a wage growth effect is mixed. In both the NLSY and the PSID, using both ordinary least squares and fixed effects estimates, workers who leave cities do not experience wage losses, just as predicted by the wage growth theory (but not by the wage level theory). In the NLSY, workers who come to cities experience relatively quick wage gains. In the PSID, workers who come to cities experience modest wage gains slowly over time. The differences between the data sets might be explained by the fact that the NLSY has younger workers. It also appears to be universally true that there is a positive interaction between labor market experience and urban status, as predicted by the wage growth hypothesis. Overall, we believe that while the evidence is not overwhelming, there is enough support for the wage growth hypothesis that further research is merited.

II. Wage Differences across Space

If workers with the same skills are being paid higher nominal wages in cities, then there are two puzzles to explain. First, we must understand why workers do not flock to these higher wages. Second, we must understand why firms do not flee these high wage areas. These two questions together can be thought of as explaining labor supply and labor demand in cities.

The labor supply question (why don't workers come to high wage cities) can be seen in the simple formalization. Assume that each individual (indexed k) is endowed with a quantity of efficiency units of labor to sell on the labor market (denoted ϕ_k), and the wage per efficiency unit, ω_i, is different in each location i. The price level P_i may also be different across locations. To ensure that workers don't flock to particular cities, it must be true that $\phi_k \omega_i / P_i$, which means that real wages must be constant over space. Thus, one half of explaining the urban wage premium requires showing that prices are higher in large cities.[6]

These arguments also imply that $\widetilde{W}_i - \widetilde{W}_j = \widetilde{\phi}_i - \widetilde{\phi}_j + Log(P_i / P_j)$, where $\widetilde{X}_i$ denotes the logarithm of the geometric mean of any variable X within city i.[7] Higher wages in an area must reflect either higher ability levels or higher prices (otherwise workers would have to respond to wage differences). This equation also means that if real wages are not higher in large cities, then ability levels are not higher in those cities either.

The labor demand question is more puzzling. Firms will remain in high wage areas if these areas either have higher prices for their products or if costs of production are lower. In big cities, firms may be able to command higher prices because transport costs to the large urban market are lower or because there are technological externalities in cities that foment productivity. To formalize this, we assume that firms maximize profits, or $A_i K^{\sigma} L^{1-\sigma} - \omega_i L - RK$, where K is capital (available everywhere at cost R), and L is labor measured in efficiency units. Local productivity (denoted A_i) includes both real externalities and higher prices. Combining optimal firm choice of capital-labor ratios and a free entry condition, which implies zero profits, it follows that $\omega_i = (1-\sigma)\sigma^{\frac{\sigma}{1-\sigma}} R^{\frac{-\sigma}{1-\sigma}} A_i^{\frac{1}{1-\sigma}}$. Comparing two locations implies:

$$\widetilde{W}_i - \widetilde{W}_j = \widetilde{\phi}_i - \widetilde{\phi}_j + \frac{1}{1-\sigma} Log(\frac{A_i}{A_j}) \tag{1}$$

For firms to stay in high wage areas workers in those areas must either have higher ability levels or productivity must be higher in those areas.[8] We see our work as attempting to understand whether there is a real productivity difference between dense urban areas and other areas, or whether dense urban areas just have higher wages because they have higher ability workers.

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[6] If real wages are high in some areas, then urban theory (see Roback, 1982) argues that amenities must be lower in those areas

[7] We define $\tilde{X}_i = \sum_{k=1}^{N_i} \frac{Log(X_{ki})}{N_i}$ where N_i is the population of city i, and X_{ki} are the levels of X for all of the residents (indexed with k) of city i.

[8] A complete model incorporating both traded and non-traded sectors is available in an appendix to Glaeser and Maré (1994).

Omitted Ability Bias: We are ultimately interested in estimating $Log(A_{urban} / A_{non-urban})$. As equation (1) suggests this may be difficult if workers in cities are simply "better" in some unobserved way (see, e.g. Johnson, 1953). Better workers may be attracted to the city because cities make types of consumption easier (in which case all of the urban wage premium may be omitted ability bias). Alternatively, there may be a skill-biased urban productivity premium. This skill-bias would then attract particularly skilled workers, and the measured urban wage premium would combine the effects of treatment and selection.

We will attempt to assess the importance of ability bias by controlling for a wide range of variables and by speculating that the effects of unobserved ability will be similar to the effects of observed ability (as argued by Murphy and Topel, 1988). Following the logic of the previous discussion, we examine whether wages corrected for prices are higher in cities. This would occur if cities have higher ability workers. We will also use individual fixed effects estimators and examine whether migrants to cities have wage gains. Finally, we will discuss the possible use of instrumental variables estimation, where the urbanization of parents' state of birth is used as an instrument.

An urban wage level effect or an urban wage growth effect: The central question of urban economics is why do cities exist? To understand why cities exist in spite of their well-known costs (i.e. pollution, congestion, crime), we must understand why density increases urban productivity. One standard explanation for greater urban productivity is that firms in dense areas save on transport costs. Density makes it easier to reach consumers (as in Krugman, 1991) and suppliers of intermediate goods (as in Ciccone and Hall, 1996). Newer literature on cities has emphasized the benefits in urban areas that come from firms acquiring ideas from their neighbors (see Lucas, 1988, and Rauch, 1993). Even if cities are no better educated than the hinterland, urban density will increase interactions and intellectual spillovers. These theories predict that the productivity of firms in cities will be higher and as a result workers will be paid more. These theories also predict that recent migrants to cities will receive immediate wage gains and migrants who leave cities will see their wages drop to the levels of rural workers.

Another possible explanation of urban productivity (and why cities exist) is that cities enhance the accumulation of human capital. Marshall (1890) argued that urban agglomerations spur skill accumulations because in cities "the mysteries of the trade become no mysteries; but are, as it were, in the air." Urban density can speed the rate of interactions with high skill individuals who can be imitated, or the rate at which agents have new experiences (Glaeser, 1999, provides a formalization). Cities may also broaden the range of experiences faced by an agent and expand the pool of potential role models (see also Chinitz, 1961, Jacobs, 1968). Cities may also facilitate coordination and allow individuals to specialize, which may lead to higher wages only over time (Becker and Murphy, 1992). Urban density may make it easier for workers to find the best jobs for themselves and urban wages may grow more quickly because of better coordination of labor markets.

The wage growth and the wage level effects can be distinguished by examining migrants. If the wage growth effect is correct, workers who come to cities may not receive large wage gains and workers who leave cities will not experience wages losses.[9] The wage level theory predicts both wage gains and wage losses. This wage growth view also predicts a positive interaction between labor market experience and urban residence. As older workers in cities have presumably lived in cities for a longer period, they will have had more of an opportunity to gain from urban wage growth.

III. Data Description

The primary data sources used in this paper are the 1990 Census 1 percent IPUMS, a version of the Panel Study of Income Dynamics (PSID), the Current Population Survey and the National Longitudinal Survey of Youth. In the CPS, the Census and the PSID, we look only at male heads of household between 18 and 65 in the civilian workforce. In the NLSY, we examine men between 17 and 36. In all cases, we required that the respondents be employed. We restricted our sample to prime-age males to examine a sample where issues of labor force participation (which might be influenced by urban residence) is less important.

Our PSID sample includes male heads of households from the first 16 waves of the survey. Topel (1991) describes this data set more fully. In the NLSY, we use data from the years 1983-1993 (incorporating some individual characteristics collected in earlier years). We restrict our sample to employed individuals who usually worked 35 hours of work per week or more over the previous year. We use the March 1990 version of the Current Population Survey and again restricted our sample to individuals employed at Census time who usually worked more than 35 hours per week. In the CPS, the Census and the PSID, we define wages by dividing annual wage and salary income by weeks

[9] Under the pure learning hypothesis migrants from cities do not lose wages. When cities increase specialization, workers who leave cities may lose as they perform a wider range of tasks.

per year times hours per week. In the NLSY, we define wages as the hourly rate of pay in the most recent job.[10]

We use the census because it is the largest data set available, and the most representative of the U.S. as a whole. We use the CPS only briefly to check the robustness of the urban wage premium in this well-known data set. The PSID and the NLSY provide the panel data, which we use to examine the wage patterns of migrants. The NLSY also provides us with Armed Forces Qualification Test (AFQT) data and information on parental background. These panel data sets are unfortunately smaller and less likely to be geographically representative of the U.S. as a whole.

Geographical Concepts: In order to analyze the issues presented in this paper, we wish to identify large dense urban areas. Unfortunately, it is not possible to use a definition that can be applied consistently across all of the data sets we use.[11] We therefore consider a range of alternative, but closely linked, definitions. We will ourselves use the term *metropolitan areas* to refer to (1) census-defined areas (PUMAs) that are contained within a MSA/PMSA[12] in the 1990 Census, (2) SMSAs in all of the other data sets.

Since SMSA status provides a very broad definition of city and we are particularly interested in large or dense urban areas, we also consider a range of city-based definitions. Urban theory focuses on the benefits of dense agglomerations, which theorists often loosely call cities. However, when urban economists write about cities they are not generally thinking of small towns, which are still technically urban areas. Furthermore, most theories, that suggest benefits to all cities, also predict that those benefits should show up particularly in the largest cities. Therefore, we will differentiate between rural areas, metropolitan areas surrounding small cities (less than 500,000 inhabitants) and metropolitan areas surrounding large cities.

Using the PSID, we can identify whether an individual lives in a county that contains a city of more than 500,000 people, and we use this as our definition of a *dense metropolitan area.*[13] In the Census and NLSY data, we will define as residents of *dense metropolitan areas* anyone living in a metropolitan area that contains a city of more than .5 million people. For comparison with PSID, the urban wage premium is also presented for the Census data using the PSID (county based) definition. *Non-Dense Metropolitan Area*

[10] The results are not sensitive to alternative definitions of wages.

[11] For example in 1990 the Census stopped using SMSAs (Standard Metropolitan Statistical Areas) and started using MSAs (Metropolitan Statistical Areas).

[12] Metropolitan Statistical Area or Primary Metropolitan Statistical Area.

[13] Ideally we would want to use metropolitan areas not counties.

residents are those in either data set who are living in a metropolitan area but not in a *dense metropolitan area*. The Census also allows us to identify whether the PUMA of residence is contained in the *central city* of a MSA/PMSA.[14] We also observe central cities of SMSAs in the CPS. Place of work data are available only for the Census, and we examine commuters into and out of large cities.

Tables One and Two: Table One compares different measures of the urban wage premium found using different definitions of "city" and different data sets. All tables are based on appropriately weighted data.[15] The first panel shows the urban premium when urban status is based on place of residence. Ideally, we would consider only the effect of workplace location. However, workplace location is available only in the census and even there it is an imperfect measure. Instead, we focus on living in a metropolitan area or a dense metropolitan area.

In all samples, the definition of metropolitan is meant to be the same. However, the proportion of the samples living in metropolitan areas differs significantly across samples.[16] The proportion of the Census sample recorded as living in a *metropolitan area* is 77.4 percent. The urban wage premium for this group is 0.274.[17] In the PSID 64.8 percent of respondents live in a metropolitan area and the wage premium for this group relative to non-metropolitan residents is 0.221. In the NLSY, 77.4 percent of residents live in a metropolitan area. The urban residence premium for this group is 0.203. The CPS shows the lowest metropolitan population, accounting for only 62.6 percent of the sample. The metropolitan wage premium in the CPS is 0.204.

The low level of the urban wage premium in the NLSY can be explained by the NLSY's particularly young sample (as we will see later, the urban wage premium is larger for older men). The CPS is a bit more mystifying. Possibly, the small size of the metropolitan area population in that data set explains some of the discrepancy. We have investigated this, but can find no reason why this occurs.[18] One interpretation of this fact is that the urban status identifiers in the CPS are probably off in some way.

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[14] A central city is any city within a MSA or PMSA that has a population of at least 25,000, and some smaller cities within MSA/PMSAs if they are classified as an employment center.

[15] Our coefficient estimates are not sensitive to weighting or not weighting the regressions.

[16] The PSID has a 12.6 percent lower share in metropolitan areas than the Census because (1) it is a sample primarily from the 1970s and early 1980s when metropolitan population was lower and (2) the PSID uses the older, less inclusive, definitions of SMSAs rather than the 1992 MSA definitions. The Census figures may be slightly understated because 3 percent of the population lived in PUMAs that spanned metropolitan and non-metropolitan areas and were excluded from the metropolitan count.

[17] All of the wage premia reported in this paper are log point difference, although they are sometimes referred to as percentage premia.

[18] The relatively low premium in the CPS data does not appear to be due to sample composition. It is evident for a wide range of education, experience, sector, and industry sub-populations. Primarily, it

The next panel shows results when urban status is defined by living in a metropolitan area or a county with a city of more than 500,000 inhabitants. We believe that this measure gets closer to the idea of working in a big city labor market. We look at residents of both counties and metropolitan areas surrounding cities because the PSID contains the county-based measure and the NLSY allows us to use the metropolitan area measure (which we prefer). In this case, the urban wage premium rises significantly relative to the previous definition of metropolitan status. The urban wage premium based on metropolitan areas in the census is higher than the urban wage premium based on counties. The reason for this difference is that workers who live in outlying counties of big city metropolitan areas are typically wealthy commuters.

The third panel examines living in a central city itself. Within the census, we consider two separate definitions of central city status. The inclusive definition includes all PUMAs that contain any space within a central city, where central city boundaries are the political boundaries of a city with more than 50,000 inhabitants (the NLSY has the same definition). The restrictive definition includes only those PUMAs that are entirely within a central city. Central city residents are generally less well paid than residents of the metropolitan area who live outside of the central city (i.e. commuters are generally richer). Again, the CPS shows a significantly different, and smaller, urban wage premium, which is based, perhaps, on a slightly different definition of central city status.

The final panel uses only the 1990 census and examines workplace location. The Census shows a large premium associated with working in a central city (0.33 log points). However, the largest beneficiaries of this premium are commuters. Individuals who both live and work in the central cities earn a premium relative to persons who do not live in metropolitan areas, but they earn a similar premium to metropolitan area residents who live and work outside of the central city.

Table Two gives the means and standard deviations for the variables in our regressions. We have 39,485 person-year observations on 4.534 individuals in the PSID. The wage variable we chose to use was the log of hourly earnings (described in Topel, 1991) in 1985 dollars. Our primary individual level variables are "experience" (age minus schooling minus six) and education (years of schooling). We will also use racial status (a non-white dummy) and job tenure (described extensively in Topel, 1991). We have

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occurs because non-metropolitan earnings are high for this sample. The relative growth in non-metropolitan earnings in the CPS occurred between 1967 and 1979.

also created an occupational index based on the average education level in the individual's one-digit SIC occupation.

Our Census sample contains 332,609 observations, and contains the same variables as the PSID, except for job tenure. The NLSY has 40,194 person-year observations on 5,405 individuals. This sample contains the same basic control variables and the 1981 Armed Forces Qualification Test as a variable, which is basic ability test (see e.g Johnson and Neal, 1994).

In these tables, workers in dense urban areas generally have more years of education. They are also more likely to be in high education occupations. However, the AFQT scores are higher in low-density metropolitan areas. Experience is always highest in non-metropolitan areas, and urban workers are least likely to be white. These patterns are not surprising, but they do not support the idea that the mean level of human capital variables is much higher in urban areas.

IV. Is the urban wage premium the result of omitted ability bias?

Under the omitted ability hypothesis, we expect to see a relationship between wages and population even when we have controlled for local price levels. Big city workers are, under that hypothesis, more able and they should have higher real wage. As price differences between cities and non-cities grouped together are not measured well, we have focused on real wage differences across metropolitan areas. Figure 1 shows the strong positive relationship between the logarithms of *metropolitan area* population and *metropolitan area* wages in 1992. The correlation between wages and log of population is over 75 percent (as is the correlation between log of wage and log of population or the correlation between wages and population).

However, Figure 2 shows that there is no correlation between wages adjusted for local prices and SMSA population -- the slope of this line is not statistically different from zero. In these regressions, we have used the American Chamber of Commerce Research Association measures of local prices. While there are doubts about any index of this kind, these measures the most available and reliable local price levels. Using these measures to correct for local area prices eliminates the city size effect. This evidence suggests that the urban wage premium is not the result of omitted ability variables.[19]

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[19]A stronger conclusion cannot be reached because local prices may include higher prices that compensate for a variety of urban amenities (as in Roback, 1982). We also are not comparing big cities and small cities as we are throughout the rest of this paper.

Ideally, we would examine the difference between urban and non-urban prices more thoroughly, but standard price indices are not available for spatial comparisons. We know of no generally available set of local price indices that are more reliable and generally available than the ACCRA price indices. Housing prices are available and they a more reliable means of examining the urban wage premium, but they are only a fraction of the total budget and cannot tell us the complete picture about local price levels.[20] Furthermore, if there are positive amenities beyond higher prices, then real wages of equally able employees might be lower in cities to equalize utility levels across space. Since we can measure neither urban prices nor urban amenities perfectly, it makes sense to seek out other evidence on whether the urban wage premium is the result of omitted ability variables.

Our next approach is to use individual level data to estimate the regression:

$$Log(W_{kt}) = X'_{kt}\beta + L'_{kt}\Gamma + \phi_k + \varepsilon_{kt} \tag{3}$$

where W_{kt} is the log of the hourly wage for individual k at time t, X_{kt} is a vector of individual characteristics and β is the price of those characteristics in labor market. L_{kt} includes a dummy variable describing whether the individual lives in a metropolitan area that has a city of more than .5 million inhabitants and a dummy variable capturing residence in a metropolitan area without a large city. The vector Γ represents the productivity increase from living in different locations. The term ϕ_k represents individual specific productivity effects (individual ability).

Many of the results that follow are from ordinary least squares regressions that constrain ϕ_k to be zero. Omitting ϕ_k will bias the coefficients on location if the ϕ_k are not randomly distributed across locations. We investigate this possible bias in two ways. First, we examine the impact of variables, which are correlated with urban status, but may not be correlated with omitted ability variables. Second, we estimate individual fixed effects regressions, treating ϕ_k as an individual-specific time-invariant factor. This removes omitted ability bias (at least that portion that is individual-specific and time-invariant), but we lose a great deal of the relevant cross-individual variation.

Table Three: Table Three presents our basic regression results. All regressions contain dummy variables for a complete set of experience (by five year intervals) and education

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[20] Adequate handling of housing prices requires some treatment of the heterogeneity of housing prices within a metropolitan area which is beyond the scope of this paper.

classes (shown in Table Five). Using 1990 Census data, regression (1) shows that the premium from living in a *dense metropolitan area* is 28.7 log points, when controlling for experience, education and race. The premium from living in a *non-dense metropolitan area* is 19.1 percent. The *dense metropolitan area* effect is 5.2 percent less when we control for these other variables than in Table 1.

Regression (2) repeats regression (1) with the same data and includes our index of occupational education levels. The big city SMSA premium falls to 26.9 percent, (and the returns to schooling drop considerably). The small city SMSA premium falls by just over 1 percentage point. Controlling for occupation (at least at the rough 1-digit level) does not seem to move the SMSA premium significantly[21].

Equation (3) repeats equation (1) using the PSID. There the big city premium in the PSID is 28.2 percent. The SMSA premium outside of big cities is 14.8 percent. Equation (4) includes the PSID's labor market variables and the big city premium falls to 25.9 percent. The PSID has a better labor market outcome variable (tenure) but controlling for labor market outcomes still does not seem to influence the estimated premium much. In other regressions, we have found that controlling for industry dummies does not have a significant impact on the urban wage premium.[22]

Regression (5) examines the urban wage premium in the NLSY. Controlling for basic variables reduces the urban wage premium slightly from 25.6 to 24.9 percent. Regression (6) shows that including labor market variables again makes little difference to the estimated urban wage premium. Regression (7) shows that including the AFQT also makes little difference in the estimated magnitude of the urban wage premium.

Controlling for observable characteristics does not eliminate the urban wage premium. Of course, it is possible that unobservable human capital characteristics are much higher in large urban areas. To examine the plausible importance of these variables, we follow Murphy and Topel (1988) and assume that the gap in observable characteristics is of the same magnitude as the gap in unobservable characteristics. The dense city—non-metropolitan difference in years of education is .9 years. If the gap in unobservables was about the same size, then unobservable characteristics would contribute 6.3 percent to the wage gap (the returns to a year of schooling in our sample is approximately 7

[21] Using occupation dummies instead of average education within occupational group produces similar results but is less readily interpretable.
[22] For example, controlling for 1-digit industries causes the urban wage premium to decline by less than one percentage point.

percent). Even making this correction, the dense city—non-metropolitan wage gap remains over 20 percent.

Regression (8) estimates an individual fixed effects specification with the NLSY data, which provides another indication of the role of unobservables. The individual fixed effects includes multiple observations for the same individual, estimates a person-specific wage-intercept term and identifies the urban wage premium from individual who move between urban and non-urban areas.[23] In the PSID, we have 1,117 individual who make at least one move out of a metropolitan area and 641 individuals who make at least one move into a metropolitan area. In the NLSY, there are 1,073 individuals who make at least one move into a metropolitan area and 783 individuals that make at least one move out of a metropolitan area. Significant numbers of respondents (491 in the PSID and 562 in the NLSY) make two moves (both into and out of a metropolitan area) while they are members of these samples.[24]

Controlling for person-specific fixed effects in the NLSY reduces the big city wage premium to 10.9 percent. Controlling for person-specific fixed effects in the NLSY reduces the big city wage premium to 4.5 percent. In both cases, the urban wage premium is substantially reduced by this fixed effects procedure. One interpretation of these results is that the urban wage premium is all omitted ability factors. An alternative interpretation is that the urban wage premium is not closely tied (temporally) to moving to a city. Indeed, the wage growth hypothesis suggests that fixed effects estimates should find much smaller urban wage effects. The next section investigates the wage growth hypothesis more closely.

Ideally, one would like to instrument for urban resident with variables that predict urban status and are orthogonal to unobserved ability. We know of no such variables. Instead, we have run regressions using the urbanization of the states in which ones' parents were born as instruments for current urban residence.

When urbanization of parents' states of residence is used as an instrument for current urban residence, the urban wage premium rises significantly. Unfortunately, this potential instrument fails standard specification tests; it is correlated positively with current wages even with we control for current urban residence. One explanation of this correlation is that this instrument is correlated with omitted ability, perhaps because more able grandparents were more likely to have children in dense urban areas.

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[23] Freeman (1984) uses a similar methodology to look at the union wage premium.

[24] Our results are robust to including only those individuals who made exactly one move.

Alternatively, this variable might influence wages, holding current urban residence constant, because it is correlated with longer urban residence on the part of both children and parents. If longer urban residence creates more skill accumulation, then we would predict that urbanization of parents' state of birth would increase wages even holding current urban residence constant.

Overall, the evidence suggests that omitted ability is not driving the bulk of the urban wage premium. Observable ability variables are only somewhat correlated with urban status. Controlling for these variables only slightly changes the urban wage premium. Correcting for local prices appears to explain much of the urban wage premium. Only our individual fixed effects estimates suggest a role for omitted ability. However, these estimates may also be compatible with the "wage growth" view of the urban wage premium. The next section investigates the wages of migrants to better understand what these fixed effects estimates mean.

V. Is the Urban Wage Premium a Wage Level Effect or a Wage Growth Effect?

We now investigate whether the urban wage premium is a wage growth or a wage level effect by examining the wage patterns of migrants (in Table 5) and the cross-effect between education and experience (in Table 6). Our work on wage growth using NLSY the follows authors such as Topel and Ward (1992) and Light and McGarry (1998) respectively. Topel and Ward (1992) establish that changing employers is a major source of wage growth for young adults. Our work can be seen as asking whether changing locations plays a similar role.[25]

Table Four: In Table Four, we examine the fixed effects estimates more closely, by examining in detail the migrants that give us identification. In our regressions we have run a basic wage equation, but allowing for dummies that capture the exact path of migration to a metropolitan area in the PSID.[26] Specifically, we estimate:

$$Log(W_{kt}) = X'_{kt}\beta + L'_{kt}\Gamma + \phi_k + \sum_j \gamma_j^{enter} I_{t+j}^{enter} + \sum_j \gamma_j^{exit} I_{t+j}^{exit} + \varepsilon_{kt} \qquad (4)$$

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[25] Other authors question Topel and Ward's emphasis on the positive effects of job changing. Light and McGarry (1998) find that wage growth is slower among the highly mobile. Altonji and Williams (1992) emphasize the gains to tenure relative to the gains from mobility.

[26] The omitted category in the migration dummies are those individual who did not move and who reside outside the city. We report the coefficient of non-movers living in the city. All other individuals are picked up by one of the moving dummies reported in table 5. Movers who remain either metropolitan or non-metropolitan are treated as non-movers. If an individual moves more than once, they may "score" on more than one of the mobility dummies.

where I_{t+j}^{enter} is a dummy variable which takes on a value of one if the person will move from a non-metropolitan area into a metropolitan area at time t+j and I_{t+j}^{exit} is a dummy variable which takes on a value of one if the person moved from a metropolitan area to a non-metropolitan area at time t+j. The parameter estimates γ_j^{enter} and γ_j^{exit} reflect the extent to which wages rise or decline immediately before a move and when wages rise or decline after a move. In specification (1) and (3), we include a battery of individual specific controls. In specifications (2) and (4), we also include individual fixed effects.

Regressions (1) and (2) show our results from the NLSY. The metropolitan area wage premium in the NLSY is 16.8 percent. Rural-urban migrants also experience significant wage gains. In the five years prior to moving, those moving into a metropolitan area earn 2 to 4 percent less than those who remain in a non-metropolitan area. After moving, their wages increase by around 15 percent, and they earn 8 to 12 percent more than those remaining outside a metropolitan area. This is still, however, less than the 16.8 percent earned by those whom we observe staying within a metropolitan area.

Interestingly, urban-rural migrants in the NLSY experience only small wage losses. While in a metropolitan area, rural-urban migrants earn a premium of 4 to 6 percent, much less than the full urban wage premium. After moving, their relative earnings drop by between one and five percent, which is a small fraction of the urban wage premium. While this small reduction in wages is one implication of the wage growth hypothesis, it can also be explained by the selection of which workers choose to leave the city. If workers only leave if they are expecting solid wages outside of the city, this would explain the absence of a wage decline.

Regression (2) shows the estimates for an equation similar to that in (1), but allowing for a time-invariant individual-specific fixed effect.[27] This controls for unobserved ability, and for the composition of movers observed before and after a move. The coefficients show the individual's wage level for various periods before and after a move, relative to their wage in the year prior to moving. The time pattern is similar to that of the OLS estimates. Using fixed effects in regression (2) shows that rural-urban migrants do not

[27] More precisely, we always have individual specific fixed effects but when we have missing location data we take the further step of having a separate individual fixed effect for each continuous time period when location data is available. To understand this, consider the case of a person lives in a city in periods one through four, has missing residence data in periods five through seven and lives outside a city after period eight. In this case, we drop the years for which data is missing, and include separate individual fixed effect for each of the time periods when data is continuously available. For individuals who move more than once, we code all moves.

appear to earn as much as long term urban residents, but they earn a 12 percent wage premium 1 to 3 years after their arrival.

Regressions (3) and (4) show results with the PSID. The basic metropolitan area premium is higher for this sample (in part because of it being composed of older men). In the PSID ordinary least squares regression, the urban wage gain is 7 percent if we compare 1-3 years after arrival with 1-3 years before arrival. The wage gain increases to 10 percent 3-5 years after arrival. The individual fixed effects estimates show a gain of 8 percent comparing migrants 3-5 years after arrival with the same migrants 1-3 years before arrival. Both estimation procedures suggest that the urban-rural wage premium is increasing with the amount of time is spent in cities. Again, the PSID shows no wage losses for migrants leaving the city.[28]

The overall picture from the migrants data is complex. The NLSY suggests that there are major gains that accrue quickly to rural-urban migrants. The PSID suggests that the gains show up more slowly over time. Both data sets suggest that urban-rural migrants lose little when they leave the city. Overall, there is some support for both the wage level and wage growth views of the city.

One natural question is to compare the effects of changing locations with the effects of changing jobs. Topel and Ward (1992) find that the typical job change for workers with less than ten years of experience brings a 12 percent increase in quarterly wage. There is a much smaller change among older workers. This data is helpful for two reasons. First, it suggests that the immediate gains that accrue when migrants move to the city are modest relative to most job changes (even in the NLSY). Second, the smaller wage growth of older workers at job changes suggests that the greater wage growth for rural-urban migrants in the NLSY can be readily understood as a result of younger workers in that sample.

Table Five: One implication of the wage growth effect hypothesis is that the urban wage premium would be larger for older workers. We test for this possibility by estimating:

$$Log(W_{kt}) = X'_{kt}\beta + L'_{kt}\Gamma + b_{kt}\widetilde{X}_{kt}'\Theta + \phi_k + \varepsilon_{kt}\,, \qquad (5)$$

where b is a dummy variable that takes on a value of one if the agent lives in a metropolitan area and $\widetilde{X}_{kt}$ is a subset of X_{kt} that contains a full set of experience

[28] We also estimate these regressions allowing for an individual wage growth fixed effect as well as an individual wage level fixed effect. The results were robust to this alternative specification.

dummies, as well as education dummies. The parameter Γ again represents the basic urban wage premia which occur regardless of individual characteristics. The returns to individual experience and education attributes yield $\beta+\Theta$ in *metropolitan areas*, but only β outside of *metropolitan areas*.

Table Five allows interactions between metropolitan area residence, experience and education. We have not separately attempted to estimate interactions for big city metropolitan areas and small city metropolitan areas because of the preponderance of coefficients that this would create.[29] The first regression in this table shows results from the census. In this sample, both the returns to experience and the returns to education are higher in urban areas. The urban wage premium is 8 percent higher for workers with 21-25 years of experience than it is for workers with less than 5 years of experience. The census shows a particularly large gain to being college educated and living in a *metropolitan area*.

Regression (2) repeats this exercise for the PSID and also finds a positive cross-effect between experience and urban status. In the PSID there is a 13 percent increase in the urban wage premium between individuals with 0-5 years experience and those with 21-25 years of experience. In the PSID, we do not find the same cross-effect between schooling and urban status.[30] Regression (3) duplicates regression (2) with individual fixed effects and again finds a strong cross-effect between urban location and experience (again a 13 percent increase in the urban wage premium over 20 years).[31]

Regression (4) shows results for the NLSY. The basic cross-effect between experience and urban status remains. The increase in the urban premium between 0-5 years experience and 16-20 years experience is 14 percent in the ordinary least squares regression.[32] The results also support the results of the census: there is a positive cross-effect between urban status and education. Regression (5) shows results using the fixed effects methodology. Again there is a substantial cross-effect between urban status and experience.[33] Overall, we must conclude that across three different data sets there is

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[29] These regressions are run without intercepts and without a dummy variable for living in a metropolitan area because the experience dummies are comprehensive. The big metropolitan dummy variable equals one for only a subgroup of metropolitan area residents, so all the coefficients are identified in this equation.

[30]The discrepancies between the two data may be because of the difference in years (1990 vs. five to fifteen years earlier) or because of the small sample size of the PSID. The higher returns to schooling in cities in the later data set may be an outcome of the rise in returns to schooling.

[31] Fixed effects results for education make little sense because there is little individual variation in the amount of education. We include education controls for consistency.

[32] The results on workers with more than 20 years make little sense because of small sample sizes for older workers in the NLSY.

[33] The finding that there are differential age-earnings profiles across space parallels the well-known heterogeneity in age-earnings profiles across establishments (see Bronars and Famulari, 1997).

strong evidence that the urban wage premium grows over time. Furthermore, over at least two data sets, the urban wage premium is highest among the most skilled workers.

VI. Conclusion

The urban wage premium does not seem to be the result of omitted ability variables, which are correlated with urban status. Four pieces of evidence suggest this finding. Urban residents are not that much better endowed with observable human capital characteristics. The urbanization of parents' states of birth also predicts higher wages, so the wage premium is not just the result of post-birth selection of high ability workers into cities. When we examine cross-metropolitan area variation in real wages (as opposed to nominal wages) there is little connection with city size. Finally, even with individual fixed effects, migrants who come to cities experience visible wage gains. Thus, we feel quite confident that there is a substantial urban wage premium, which is not simply the result of omitted ability factors.

The urban wage premium appears to be a combination of a wage level and wage growth effect. The data on migrants, especially the NLSY, provides some support for the wage level hypothesis. However, in the PSID there is evidence of continuing wage growth over time. In both data sets, workers who leave cities do not experience wage declines. Both of these findings support the existence of a wage growth effect. The cross-effect between experience and urban status is quite robust and supports the idea that age-earnings profiles are steeper in cities. Both a wage level and a wage growth effect appear to be operating.

Hopefully future work will attempt to understand if urban wage growth has to do with better coordination of labor markets or faster learning in cities. Future theoretical work will hopefully focus on explaining why a sizable portion of the urban wage premium comes from faster wage growth in cities.

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TABLE ONE: THE URBAN WAGE PREMIUM

Location definition	Percentage of Sample living in the specified area	Wage Premium relative to non-Metropolitan workers *(log point difference)*
BASED ON RESIDENCE		
Living in a metropolitan area		
1990 Census [MSA/ PMSA]	77.4%	0.274
PSID (1968-1985)	64.8%	0.221
NLSY (1983-1993) [SMSA]	77.4%	0.203
CPS (March 1990) [SMSA]	62.6%	0.204
Living in a dense metropolitan area		
Definition 1: MSA/PMSA with a city over .5 million		
• 1990 Census	25.3%	0.339
• NLSY (1983-1993)	25.8%	0.256
Definition 2: County with a city of over .5 million		
• 1990 Census	16.9%	0.285
• PSID (1968-1985)	27.4%	0.283
Living in a central city		
1990 Census: Central City of a MSA/PMSA *(inclusive definition)*	42.6%	0.200
1990 Census: Central City of a MSA/PMSA *(restrictive definition)*	16.1%	0.197
NLSY (1983-1993)	13.5%	0.151
CPS (March 1990)	22.9%	0.071
BASED ON WORKPLACE		
(1990 Census - Using restrictive Central City definition)		
Works in a Central City	21.0%	0.330
Works outside a Central City	79.0%	0.181
Lives & works in a Central City	10.0%	0.208
Lives & works outside a Central City	72.9%	0.181
Commutes out of a Central City	6.1%	0.179
Commutes into a Central City	11.0%	0.441

TABLE TWO: SAMPLE STATISTICS

	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
	Total		Dense Metro Area		Non-dense Metro Area		Non-Metro Area	
PSID 1968-1985								
Number of Observations	39485		11428		14316		13741	
Log of Hourly Earnings deflated by year ($1985)	2.254	*(0.55)*	2.434	*(0.54)*	2.276	*(0.52)*	2.091	*(0.54)*
Experience	21.4	*(13.13)*	21.8	*(13.0)*	20.6	*(13.0)*	21.9	*(13.4)*
Education	12.8	*(3.6)*	13.2	*(3.5)*	13.0	*(3.5)*	12.2	*(3.8)*
Non-White	0.113	*(0.32)*	0.153	*(0.36)*	0.106	*(0.31)*	0.088	*(0.28)*
Job Tenure	8.0	*(8.2)*	8.5	*(8.7)*	7.9	*(8.1)*	7.7	*(7.9)*
Average Education in (one-digit) Occupation	12.8	*(1.8)*	13.2	*(3.5)*	12.9	*(1.8)*	12.4	*(1.7)*
1990 CENSUS								
Number of Observations	332609		76105		165132		91372	
Log of Hourly Earnings	2.549	*(0.67)*	2.675	*(0.67)*	2.579	*(0.65)*	2.337	*(0.66)*
Experience	20.8	*(11.2)*	20.6	*(11.3)*	20.6	*(11.1)*	21.3	*(11.2)*
Education	13.5	*(3.0)*	13.8	*(3.3)*	13.7	*(2.9)*	12.9	*(2.8)*
Non-White	0.140	*(0.35)*	0.223	*(0.42)*	0.127	*(0.34)*	0.077	*(0.27)*
Average Education in (one-digit) Occupation	13.5	*(1.7)*	13.8	*(1.7)*	13.6	*(1.7)*	13.1	*(1.6)*
NLSY 1983-1993								
Number of Observations	40194		10717		20084		9393	
Log of Hourly Earnings	2.437	*(0.53)*	2.542	*(0.53)*	2.454	*(0.52)*	2.279	*(0.52)*
Experience	8.7	*(4.2)*	8.4	*(4.1)*	8.7	*(4.2)*	9.0	*(4.3)*
Education	12.8	*(2.4)*	13.1	*(2.5)*	12.9	*(2.4)*	12.3	*(2.1*
Non-White	0.191	*(0.39)*	0.270	*(0.44)*	0.178	*(0.38)*	0.131	*(0.34)*
Job Tenure (Weeks)	161.3	*(167.2)*	149.5	*(157.1)*	164.8	*(167.5)*	166.7	*(176.7)*
Average Education in (one-digit) Occupation	12.8	*(1.4)*	13.0	*(1.5)*	12.9	*(2.4)*	12.4	*(1.2)*
AFQT Score in 1981	49.1	*(29.5)*	49.3	*(30.7)*	50.9	*(29.1)*	44.9	*(28.6)*

Notes: See the discussion in the text for definitions of the various geographical components.

TABLE THREE
BASE REGRESSIONS

	(1) 1990 Census Basic Wage Equation	(2) 1990 Census - Basic Wage Equation with occupational education	(3) PSID - Basic Wage Equation	(4) PSID - Basic Wage Equation with Labor Market Variables
Dense Metropolitan Premium	0.287 *(0.00)*	0.269[a] *(0.00)*	0.282[a] *(0.01)*	0.259[a] *(0.01)*
Non-dense Metropolitan Premium	0.191[a] *(0.00)*	0.179[a] *(0.00)*	0.148[a] *(0.01)*	0.133[a] *(0.01)*
Experience Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Education Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Non-White	-0.169[a] *(0.00)*	-0.156[a] *(0.00)*	-0.193[a] *(0.01)*	-0.173[a] *(0.01)*
Average Education in (one-digit) Occupational Group		0.055[a] *(0.00)*		0.039[a] *(0.00)*
Tenure				0.015[a] *(0.00)*
Time Dummies	*No*	*No*	*Yes*	*Yes*
Adjusted R-Squared	20.4%	21.6%	30.2%	34.7%
N	332,609	332,609	39,485	39,485

TABLE THREE (CONTINUED)

	(5) NLSY - Basic Wage Equation	(6) NLSY – Basic Wage Equation with occupational education	(7) NLSY - Basic Wage Equation	(8) NLSY - Fixed Effects Estimator	(9) PSID - Individual Fixed Effects Estimator
Dense Metropolitan Premium	0.249[a] *(0.01)*	0.245[a] *(0.01)*	0.243[a] *(0.01)*	0.109[a] *(0.01)*	0.045[a] *(0.01)*
Non-dense Metropolitan Premium	0.153[a] *(0.01)*	0.147[a] *(0.01)*	0.141[a] *(0.01)*	0.070[a] *(0.01)*	0.026[a] *(0.01)*
Experience Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Education Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Non-White	-0.159[a] *(0.01)*	-0.137[a] *(0.01)*	-0.087[a] *(0.01)*	N/A	N/A
Average Education in (one-digit) Occupational Group		0.034[a] *(0.00)*	0.027[a] *(0.00)*	0.009[a] *(0.00)*	0.016[a] *(0.00)*
Tenure		0.001[a] *(0.00)*	0.001[a] *(0.00)*	0.000[a] *(0.00)*	0.010[a] *(0.00)*
AFQT			0.002[a] *(0.00)*	N/A	*Yes*
Time Dummies	*Yes*	*Yes*	*Yes*	*Yes*	20.6%
Adjusted R-Squared	29.4%	33.0%	33.7%	28.4%	39,485
N	40,194	40,194	40,194	40,194	

Notes: a) significant at 1% level; b) significant at 5% level; c) significant at 10% level. Numbers in brackets are standard errors.

TABLE FOUR
ANALYSIS OF MOVERS

	(1) NLSY OLS	(2) NLSY Individual (spell) Fixed Effects	(3) PSID OLS	(4) PSID Individual FE
Non-movers living in a Metropolitan Area	0.168[a]	N/A	0.203[a]	N/A
	(0.01)		*(0.01)*	
Move To A Metropolitan Area				
Observed 5 or more years before a move	0.069[a]	0.093[a]	-0.138[a]	-0.067[a]
	(0.02)	*(0.02)*	*(0.01)*	*(0.02)*
Observed 3 to 5 years before a move	-0.021	0.028	-0.141[a]	-0.056[a]
	(0.02)	*(0.02)*	*(0.02)*	*(0.02)*
Observed 1 to 3 years before a move	-0.040[b]	-0.010	-0.151[a]	-0.048[a]
	(0.02)	*(0.02)*	*(0.02)*	*(0.02)*
Observed within 1 year before a move	-0.022	N/A	-0.092[a]	N/A
	(0.02)		*(0.02)*	
Observed within 1 year after moving	0.079[a]	0.073[a]	-0.113[a]	-0.036[b]
	(0.02)	*(0.02)*	*(0.02)*	*(0.02)*
Observed 1 to 3 years after moving	0.111[a]	0.114[a]	-0.082[a]	-0.008
	(0.01)	*(0.02)*	*(0.02)*	*(0.02)*
Observed 3 to 5 years after moving	0.125[a]	0.123[a]	-0.053[a]	0.030[c]
	(0.01)	*(0.02)*	*(0.02)*	*(0.02)*
Observed 5 or more years after moving	0.118[a]	0.105[a]	-0.050[a]	0.019
	(0.01)	*(0.02)*	*(0.01)*	*(0.02)*
Leave a Metropolitan Area				
Observed 5 or more years before a move	0.049[b]	0.021	0.188[a]	0.018
	(0.02)	*(0.02)*	*(0.01)*	*(0.01)*
Observed 3 to 5 years before a move	0.039[c]	-0.001	0.148[a]	-0.006
	(0.02)	*(0.02)*	*(0.01)*	*(0.01)*
Observed 1 to 3 years before a move	0.053[a]	-0.002	0.165[a]	0.010
	(0.02)	*(0.02)*	*(0.01)*	*(0.01)*
Observed within 1 year before a move	0.062[a]	N/A	0.150[a]	N/A
	(0.02)		*(0.02)*	
Observed within 1 year after moving	0.050[b]	-0.036[c]	0.128[a]	-0.024[c]
	(0.02)	*(0.02)*	*(0.02)*	*(0.01)*
Observed 1 to 3 years after moving	0.005	-0.068[a]	0.116[a]	-0.041[a]
	(0.02)	*(0.02)*	*(0.01)*	*(0.01)*
Observed 3 to 5 years after moving	0.028	-0.023	0.097[a]	-0.035[b]
	(0.02)	*(0.02)*	*(0.02)*	*(0.02)*
Observed 5 or more years after moving	0.006	-0.027	0.148[a]	-0.008
	(0.02)	*(0.02)*	*(0.01)*	*(0.01)*
Regressions contain Education, Experience, Non-white and Time dummies and occupational education	*Yes*	Yes	*Yes*	*Yes*
Adjusted R-Squared	*26.6%*	25.9%	*34.4%*	19.3%
N	40,822	40,822	39,485	39,485

Notes: a) significant at 1% level; b) significant at 5% level; c) significant at 10% level. Numbers in brackets are standard errors.

TABLE FIVE
INTERACTIONS OF METROPOLITAN RESIDENCE AND HUMAN CAPITAL VARIABLES

	(1) Wage Equation with labor market variables and with human capital interactions - 1990 Census		(2) Wage Equation with labor market variables and with human capital interactions - PSID		(3) Individual Fixed Effects Estimation - PSID	
	No interaction	Interaction with Metro dummy	No interaction	Interaction with Metro dummy	No interaction	Interaction with Metro dummy
Dense Metropolitan Premium (above metro premium)	0.089[a] *(0.00)*		0.124[a] *(0.01)*		0.020[a] *(0.01)*	
Experience Dummies						
0 – 5 years	1.197[a] *(0.01)*	0.076[a] *(0.01)*	1.186[a] *(0.03)*	0.062[a] *(0.02)*	N/A	-0.104[a] *(0.02)*
6 – 10 years	1.415[a] *(0.01)*	0.123[a] *(0.01)*	1.436[a] *(0.02)*	0.051[a] *(0.01)*	0.195[a] *(0.01)*	-0.080[a] *(0.01)*
11 - 15 years	1.542[a] *(0.01)*	0.139[a] *(0.01)*	1.503[a] *(0.02)*	0.156[a] *(0.01)*	0.228[a] *(0.02)*	0.006 *(0.01)*
16 - 20 years	1.618[a] *(0.01)*	0.149[a] *(0.01)*	1.557[a] *(0.02)*	0.182[a] *(0.02)*	0.249[a] *(0.02)*	0.017 *(0.01)*
21 - 25 years	1.680[a] *(0.01)*	0.158[a] *(0.01)*	1.583[a] *(0.03)*	0.192[a] *(0.02)*	0.230[a] *(0.02)*	0.037[b] *(0.02)*
26 - 30 years	1.722[a] *(0.01)*	0.162[a] *(0.01)*	1.598[a] *(0.03)*	0.173[a] *(0.02)*	0.214[a] *(0.02)*	0.036[b] *(0.02)*
31 - 35 years	1.725[a] *(0.01)*	0.173[a] *(0.01)*	1.579[a] *(0.03)*	0.193[a] *(0.02)*	0.157[a] *(0.03)*	0.068[a] *(0.02)*
36 - 40 years	1.701[a] *(0.01)*	0.175[a] *(0.01)*	1.590[a] *(0.03)*	0.151[a] *(0.02)*	0.123[a] *(0.03)*	0.060[a] *(0.02)*
More than 40 years	1.667[a] *(0.01)*	0.197[a] *(0.01)*	1.464[a] *(0.03)*	0.192[a] *(0.02)*	0.055 *(0.04)*	0.046[b] *(0.02)*
Education Dummies						
0 - 9 years	-0.265[a] *(0.01)*	-0.037[a] *(0.01)*	-0.234[a] *(0.01)*	0.016 *(0.02)*	0.037[c] *(0.02)*	0.003 *(0.02)*
10 - 11 years	-0.169[a] *(0.01)*	0.023[a] *(0.01)*	-0.112[a] *(0.01)*	-0.021 *(0.02)*	-0.034[c] *(0.02)*	0.049[a] *(0.02)*
13 - 15 years	0.066[a] *(0.01)*	0.025[a] *(0.01)*	0.104[a] *(0.01)*	-0.050[a] *(0.01)*	-0.010 *(0.01)*	0.044[a] *(0.01)*
16 years	0.209[a] *(0.01)*	0.095[a] *(0.01)*	0.231[a] *(0.01)*	-0.008 *(0.02)*	0.091[a] *(0.02)*	0.060[a] *(0.02)*
More than 16 years	0.316[a] *(0.01)*	0.131[a] *(0.01)*	0.268[a] *(0.02)*	0.002 *(0.02)*	0.096[a] *(0.02)*	0.054[a] *(0.02)*
Non-White	-0.153[a] *(0.00)*		-0.174[a] *(0.01)*		N/A	
Average Education in (one-digit) Occupational Group	0.055[a] *(0.00)*		0.039[a] *(0.00)*		0.016[a] *(0.00)*	
Tenure			0.014[a] *(0.00)*		0.010[a] *(0.00)*	
Time Dummies	*No*		*Yes*		*Yes*	
Adjusted R-Squared	21.6%		35.0%		20.9%	
N	332,609		39,485		39,485	

Notes: a) significant at 1% level; b) significant at 5% level; c) significant at 10% level. Numbers in brackets are standard errors.

TABLE FIVE (CONTINUED)
INTERACTIONS OF METROPOLITAN RESIDENCE AND HUMAN CAPITAL VARIABLES

	(4) Wage Equation with labor market variables and with human capital interactions - NLSY		(5) Individual Fixed Effects Estimation NLSY	
	No interaction	Interaction with Metro dummy	No interaction	Interaction with Metro dummy
Dense Metropolitan Premium (above metro premium)	0.102[a] *(0.01)*		0.039[a] *(0.01)*	
Experience Dummies				
0 - 5 years	1.494[a] *(0.03)*	0.109[a] *(0.01)*	N/A	0.006 *(0.02)*
6 - 10 years	1.639[a] *(0.03)*	0.132[a] *(0.01)*	0.039[a] *(0.01)*	0.042[b] *(0.02)*
11 - 15 years	1.643[a] *(0.03)*	0.158[a] *(0.01)*	-0.050[a] *(0.02)*	0.060[a] *(0.02)*
16 - 20 years	1.548[a] *(0.03)*	0.250[a] *(0.02)*	-0.190[a] *(0.03)*	0.094[a] *(0.03)*
21 - 25 years	1.709[a] *(0.14)*	0.181 *(0.15)*	-0.144 *(0.13)*	-0.002 *(0.14)*
Education Dummies				
0 - 9 years	-0.085[a] *(0.02)*	-0.046[b] *(0.02)*	-0.054 *(0.05)*	0.004 *(0.04)*
10 - 11 years	-0.063[a] *(0.02)*	-0.038[b] *(0.02)*	-0.112[a] *(0.03)*	0.051[c] *(0.03)*
13 - 15 years	0.011 *(0.01)*	0.022 *(0.02)*	-0.038 *(0.02)*	0.081[a] *(0.02)*
16 years	0.144[a] *(0.02)*	0.070[a] *(0.02)*	0.306[a] *(0.03)*	0.064[b] *(0.03)*
More than 16 years	0.310[a] *(0.03)*	-0.075[b] *(0.03)*	0.424[a] *(0.04)*	0.000 *(0.04)*
Non-White	-0.087[a] *(0.01)*		N/A	
Average Education in (one-digit) Occupational Group	0.027[a] *(0.00)*		0.009[a] *(0.00)*	
Tenure	0.001[a] *(0.00)*		0.000[a] *(0.00)*	
AFQT	0.002[a] *(0.00)*		N/A	
Time Dummies	*Yes*		*Yes*	
Adjusted R-Squared	33.5%		28.2%	
N	40,822		40,822	

Notes: a) significant at 1% level; b) significant at 5% level; c) significant at 10% level. Numbers in brackets are standard errors.