City Air or City Markets: productivity gains in urban areas.

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Abstract: Persistent productivity gains to rural-urban migrants have been documented by a number of researchers. One interpretation of this result is that individuals learn higher value skills in cities than they would have learned in less dense areas. Another explanation for this result, however, is that thicker urban labor markets allow for better matches, which are realized slowly through a process of subsequent job searches. Surprisingly, there has been no empirical test of these two interpretations to this date. This paper uses NLSY79 geocode data to assess whether wage growth of urban workers is due primarily to time spent in the urban environment (and thus learning), or job changes. The evidence suggests that both these processes are probably at work.

I. Introduction

An old Germanic saying goes "*Stadtluft macht frei*."[1] Although the original saying concerned feudal obligations, the idea that city air is somehow different persists both in the broader culture and – more recently – in the urban economic literature. Glaeser (1999) and Glaeser and Mare (2001) offer theory and evidence suggesting that urban areas increase wages through a process of learning. However, Glaeser (1999) acknowledges that the pattern of evidence found in Glaeser and Mare (2001) is also consistent with the potential of better labor market matches in dense urban labor markets, which are realized gradually through more intensive job search.

In terms of our understanding of cities and their economic function the two theories offer very different views. While Glaeser (1999) makes a persuasive defense of his assumptions, the learning externality essentially assumes that there is something different about cities in the Marshallian or Jacobsian way: that city air somehow imparts knowledge to those who breathe it. On the other hand, the matching mechanism for enhanced productivity of urban workers requires only that city labor markets be thicker on both the supply and demand side, which is something we already know to be true.

This paper attempts to determine whether faster urban wage growth is a result of learning or matching. If learning is the prime factor leading to faster wage growth in cities, then residence and work experience in urban areas should increase wages whether that experience is gained at one employer or several. On the other hand, if the urban residents achieve their higher wages by seeking out

[1] "City air makes one free," in German.

jobs that better match their skills, then experience at one employer should have negligible or negative effects on wages.

The rest of the paper is organized as follows. Part II briefly discusses the literature and the two theories of urban wage premia we will be testing. Section III specifies the empirical model and describes the data. Section IV presents the results. Section V concludes with some further discussion of the results and their implications.

II. Background.

As has been noted by many authors, wages are higher in urban areas, and higher still in larger urban areas. From the labor supply side, it is not difficult to see why this would be the case. To attract workers to large cities, employers must compensate them for the high cost of living, and possibly also for congestion externalities associated with these areas. Looking at the question from the labor demand side does not yield as obvious an explanation. Why should profit-maximizing firms be willing to pay workers more in large cities than in smaller cities or rural areas? Clearly, it must be the case that workers in large cities are more productive than workers in smaller cities.

There are several possible explanations for this productivity differential. It could be the case that city workers are more able than rural workers. Glaeser and Mare (2001) find that controlling for AFQT score has little effect on their estimated urban wage premium. Furthermore, they also find that using panel data to estimate a fixed effects estimator (which would control for all unobserved individual characteristics) lowers but does not eliminate the urban wage premium (from about 25% to about 10% in the NLSY and down to about 5% in the PSID). Logic would also argue against this interpretation of the wage premium. If urban residents earn more because of their talents, and not because of their residence, then they should be able to move to the country or a smaller city (with lower costs of living) and have a higher material quality of life. For the omitted ability explanation to hold up in locational equilibrium, high-skill individuals would have to have an unobserved taste for urban areas. While such a taste does not seem infeasible, it is not an assumption we should rush to embrace in the absence of some direct evidence.

It may also be possible that urban wages are higher because of the large capital stocks that are at their disposal in urban employment, relative to smaller cities or rural areas. This would imply that migrants to urban areas should experience immediate wage gains, and urban-rural migrants should experience immediate wage losses. Glaeser and Mare (2001) do not find either of these effects. Urban migrants appear to increase their wage gradually, while the wage losses of urban-rural migrants are not persistent. Furthermore, they find that the urban wage premium is largest for workers with the most experience, an effect that does not seem consistent with a straight capital deepening story. Also, if capital is perfectly mobile, it is hard to see how a situation in which employers paid workers more in cities would persist when lower wages could be paid to rural workers if the capital were invested in the rural area instead of the city.

It could also be the case that firms in dense urban areas benefit from large stocks of unpriced inputs like public infrastructure. These roads, schools, ports and utilities could increase the productivity of firms that have access to them. If there are economies of scale in the provision of such inputs, then dense urban areas could retain their advantage over rural areas and the urban wage premium could constitute a locational equilibrium. However, the productivity of public capital on business productivity is in dispute, with some papers finding no net effect of public infrastructure expenditures (Holtz-Eakin and Lovely 1996). Even if public infrastructure was productive, this source of the urban wage premium would have identical implications of the private capital story above: immediate wage gains for urban in-migrants, immediate wage losses to urban out-migrants. As mentioned above, these patterns are not found by Glaser and Mare (2001).

The remaining explanations for the urban wage premium are all forms of agglomeration economies. Fujita, *et al.*(1999) describe the three major agglomeration economies, which they attribute to Marshall, as access to customers, access to specialized inputs and human capital spillovers. Krugman (1991) models the first of these types of agglomeration economies. While Krugman (1991) is at the head of a very exciting literature, the implications for the urban wage premium are similar to the public and private capital interpretations, above. In these models, transport costs plus economies of scale make location near consumers valuable. Workers also find it attractive to locate near the production centers because that lowers their cost of living.[2] In all of this, the agglomeration forces rest completely within the firm. It is the firm's access to consumers and scale economies which give rise to the agglomeration tendencies. Mobile workers are homogenous. If this is the case, then any mobile worker can move to the site of agglomeration, take a job and earn a wage as high as any long-term resident of the agglomerated area. It is not the workers, but the firm and the agglomeration that raise productivity. Thus, the predictions of immediate wage gains and losses persist.

Glaeser (1999) models the third of the possible sources of agglomeration economies: human capital spillovers. He includes the oft quoted passage from Marshall that in big cities the "mysteries of the trade become no mystery: but are as it were, in the air." It is not simply the air's saturation with trade secrets that increases productivity in cities, however. In Glaeser's model learning is achieved through interactions with more skilled individuals. Cities foster more learning than rural areas because interactions are more frequent in cities. Given certain simplifying assumptions, Glaeser derives privately and "socially" optimal city sizes and skill distributions. Although the theory is in the context of long run equilibrium, Glaeser draws out the implications for the urban wage premium. If urban workers earn more because they have learned and are learning through interactions with peers, two implications are obvious. First, the wage premium should develop gradually as migrants to cities learn their skills from their seniors. Second, the urban wage premium should increase with experience. Glaeser and

[2] These models assume away costs to urban congestion. The model has been extended and modified to allow for such agglomeration costs by Tabuchi (1998) and Ottaviano *et al.* (2002), with no major change in the qualitative behavior of the model.

Mare (2001) take these predictions to several data sets, and find evidence that broadly supports the learning hypothesis. Results found by other authors support this interpretation as well.[3]

What Glaeser (1999) acknowledges is that these same patterns could be explained by Marshall's second source of agglomeration economies: thicker markets for specialized inputs. Specifically, if firms require certain kinds of labor, then having a larger labor market should improve the quality of the matches. Helsley and Strange (1990) model this kind of labor-matching, finding that privately optimal cities would be too large (have too many firms). For simplicity, Helsley and Strange assume a kind of perfect information: once a person moves to a city, it is costless for him to find the employer that will provide the highest quality match. This is probably a reasonably accurate description of a worker's situation in the long run. However, in the short-run, workers probably take some time to search out and discover this best match. Unless they are independently wealthy, this near-term search will be characterized by the kind of rapid job turnover documented in Topel and Ward (1992). This period of searching for better matches and accruing gradual wage increases through job mobility could take some years (indeed, an optimist might believe that there is always a better match somewhere out there). Thus, the Helsley and Strange (1990) model of agglomeration arising from thick city input markets would give

[3] Charlot and Duranton (2004) model communication and wage simultaneously and find that communication affects wages, at least among the French. Rauch (1993) finds that the average education in an SMSA increases wages and rents about equiproportionately, which is consistent with metropolitan human capital increasing productivity, but not being an amenity.

rise to wage patterns very similar to the learning model in Glaeser: wage premia should accrue gradually and should be increasing with time spent in the city.

The two models are not observationally equivalent, however. The means by which productivity (and thus wage) is increased differ markedly in these two models. In the Glaeser (1999) model, learning occurs simply through living and working – breathing the air – in the city. However, in the Helsley and Strange (1990) version, simply living and working in a city will have no effect on productivity. It is only through access to the thick labor market, and repeated sampling of employers that workers realize the urban wage premium. This differentiation of the models is at the heart of the empirical section to follow.

III. Empirical Framework and Data.

The empirical specifications will follow Glaeser and Mare (2001) closely. Glaeser and Mare estimate an urban wage premium via and equation of the form:

1) $$\ln(Wage_{it}) = \beta_X X_{it} + \beta_{Urb} Urb_{it} + \mu_i + \varepsilon_{it},$$

where *i* subscripts for individual workers and *t* subscripts for time. *X* is a vector of personal characteristics such as age, race, experience, and tenure, *Urb* is a dummy variable (or vector of dummy variables) representing urban status. Individuals are allowed to have a fixed wage-earning ability represented by μ. If μ is correlated with any of the other variables, the OLS coefficients estimated from equation 1 will not be consistent. Thus, I will present results from both OLS and fixed effects estimators. Part of the work done in Glaeser and Mare (2001) is to establish that the urban wage premium is not explained away by omitted observables (like experience, education, tenure or standardized tests) or even unobservables (like an individual-specific, time-invariant ability). The urban wage premium persists even controlling for all of these factors. I will not spend as much time on this matter, as Glaeser and Mare (2001) demonstrate sufficiently.

In testing the Helsley and Strange (1990) interpretation of the urban wage premium against the Glaeser (1999) interpretation, I examine the interactive effect of metropolitan residence on the returns to experience and tenure:

2) $$\ln(Wage_{it}) = \beta_X X'_{it} + \beta_{Urb} Urb_{it} + \beta_{inter} Urb_{it} * H_{it} + \beta_H H_{it} + \mu_i + \varepsilon_{it}.$$

In equation 2, the new vector H has been separated out from the X vector and been interacted with urban status. Importantly, H includes not only experience (as in Glaeser and Mare (2001)), but also tenure with the specific employer. If an employee does not change jobs, these two measures will be perfectly correlated. However, if a worker changes jobs, experience will continue to grow, while tenure will fall. Work experience generally and tenure with a specific employer should have different effects, depending on whether city air or city markets are the source of the urban wage premium. If the thick urban labor market's rich set of opportunities is what drives the wage growth, we should see the interaction between urban status and experience have a positive coefficient, while the interaction between tenure and urban status should have a negative coefficient of similar magnitude. That is, the urban wage premium accrues to workers who gain experience, but gaining experience at only one firm negates the potential growth in wages. On the other hand, if urban wage growth occurs because workers learn from their betters, then this growth should occur whether or not the employee switches firms. Thus, we would expect the coefficient on the interaction between urban status and tenure to be insignificant, or even positive.[4]

I also include education in *H*, and interact it with urban status. Glaeser and Mare (2001) find this interaction is significant. The increased returns to human capital in urban areas could arise from several microfoundations. On the labor demand side, skilled workers may be particularly sensitive to urban congestion costs, and thus require a higher premium to be lured from smaller cities or rural areas than less skilled workers. On the labor demand side, urban employers may be willing to pay the higher wage premium demanded by educated workers because the kind of production skilled workers are used for is more cost effective in urban areas. This is one interpretation of Duranton and Puga'a (2001) model of nursery cities. In this model, research and development is undertaken in dense, diversified urban areas while mass production (which requires less skilled labor) takes place in rural areas or specialized cities. I thus expect the coefficient on the interaction of education and urban status to be positive.

I use the NLSY79 geocode data files to estimate the above equations. My vector of control variables includes cumulative experience (in weeks), tenure with current employer (in weeks), occupational dummies, age, sex, race, marital status (=1 for married individuals, =0 for separated, divorced, widowed or never married

[4] If both dynamics are at work, we might expect significant negative effects on the interaction between tenure and urban status, as long as the magnitude of that effect were smaller than the magnitude of the coefficient on the experience*Urban interaction. This would mean that even if a person who moves to a city never changes jobs, they will see their wage increase, but just not as much as they would have if they had changed jobs more often. This would be a situation where both explanations appear to have traction: long tenure reduces urban wage growth as in Helsley and Strange (1990), but even workers with no job mobility to speak of will see faster wage growth than in rural areas, as in Glaeser (1999).

individuals) and the percentile score on the AFQT. I also sometimes include a battery of year variables. I use data from the entire panel (1979-2004), with the requirement that a person-year work at least 35 hours per week, have valid geographic and occupational information and have a "reasonable" reported wage.[5] Occupation codes are reported in 1970's codes for all survey years except 2002. Comparing the 1970 and 2000 census occupation codes, I made an educated guess about assigning 2000 codes into 1970's bins. These assignment rules are available from the author for those interested.

To ensure comparability across the sample, I only counted work experience gained after the age of 18.[6] The experience variable was generated by summing the reported number of weeks worked since the previous interview. The interaction between urban status and occupation was done during the data processing: it is not simply the product of contemporaneous urban status and cumulative work experience. Rather, this interaction was generated by re-computing the cumulative experience variable assigning zero to any weeks where work was done outside an urban area.[7] The interactions of tenure and education with urban status, on the other hand, were computed in the standard way.

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[5] Reasonability of the reported wage was determined in the following manner. For each individual, I computed their average reported log wage in years they reported working over the 25 years (21 panels) of the data collection. I also computed the standard deviation of the reported log wage. From this, I computed a person-year specific z-score of the reported log of wage. Person-years whose z-score was greater in magnitude than 2 were dropped from the sample. This prevents the inclusion of several individuals who (one time each) reported hourly wages in excess of $10,000. The results are not terribly sensitive to the inclusion of these observations.

[6] Age is measured approximately: birth year was subtracted from interview year. So, this measure is slightly noisy.

[7] This process was necessarily an approximation. If a respondent worked 50 weeks in a year, 48 of them in a rural area, but the last two (including the interview) in an urban area, the entire 50 weeks would be counted as "urban" experience. While this is unfortunate, it represents a large improvement over simply multiplying the entire cumulative experience by one if the last interview occurred in an urban area, which could wrongly count several years of rural work as urban.

Urban status of county of residence was derived from the reported county of residence, in conjunction with the USDA ERS's rural/urban continuum scale.[8] These data are convenient because they provide measures of urbanity derived from the 1970-2000 censuses. For the years 1979-1985, 1980 county urbanity were used. For 1986-1995, 1990 county urbanity codes were used. For the remainder of the data, urbanity codes from the 2000 census were used. The 2000 codes are presented in Figure 1. These codes allow for three gradations of urban status which I use throughout the rest of the paper. The most restrictive includes only metropolitan areas with populations of more than one million (represented in black in figure 1). The next category includes all those large cities, plus counties in cities with populations greater than 250,000, but less than one million (darkish yellow in figure 1). The most inclusive includes all metropolitan areas (light yellow in figure 1). Table I presents the sample means for the sample of worker-years in the NLSY from 1979 through 2004, as well as some comparisons across kinds of urban areas. Note that the urban wage premium is apparent in the group averages: big cities residents make 18 log points more than medium city residents, 23 log points more than small city residents and 34 log points more than rural residents in this sample.

IV. Results.

The results are presented in four tables. Table II reports results from regressions of log wage on the control variables, allowing the different city sizes to have

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[8] These data are available at http://www.ers.usda.gov/Data/RuralUrbanContinuumCodes/ .

different effects. It shows that the wage differences apparent in the comparison of means are partly due to observable characteristics. When controlling for occupation, some demographic information, work history and measured skill, residents of the largest cities earn 14% more than residents of medium sized cities, about 18.5% more than residents in small cities, and about 23% more than rural residents (compared to 18, 23 and 34 percent in the conditional means). Looking at the fixed effects estimators in columns two and three of table II we see that unmeasured factors also appear to be playing a role. Controlling for these unobserved determinates of wage lowers the estimated big city wage premium down to about six *percent* over medium sized cities, and around nine or ten *percent* compared with smaller cities and rural areas. Tables III, IV and V present results for these different size cut-offs.

Table III presents simple OLS estimates of equation 2. The columns of results are paired so that the first two columns represent regressions run with an urban measure (and interactions) that considers all urban areas equally urban. Columns three and four only count mid-sized or larger cities as urban for the dummies and interaction terms, while columns five and six represent results when only the largest metropolitan areas are coded as urban. My interpretations of the predictions of the Helsley and Strange (1990) model is that the interaction between urban residence and experience should be positive, while the coefficient on the interaction with tenure with one employer should be negative and of similar magnitude. My interpretation of Glaeser's (1999) argument is that the tenure/urban interaction would be insignificant or positive. If both dynamics are at work, I would expect a negative and significant coefficient on the tenure-urban interaction, but one that is considerably smaller in magnitude than the coefficient on the urban experience interaction.

The results in table III suggest that this last case appears to be the most likely situation. The negative coefficient on the tenure interaction is between about 15 and 40 percent as large as the positive coefficient on urban experience. This means that an urban worker will experience fast wage growth relative to a rural worker, whether he stays in one job or shops around. This is consistent with the learning channel of urban wage growth. However, the negative effect of tenure at urban jobs means that these workers can (and do) earn more if they avail themselves of the rich opportunities available in the thick urban labor market. This is consistent with the matching channel of urban wage growth.

Tables IV and V are parallel to table III, except they attempt to control for unobserved individual characteristics through the use of fixed effects estimators. Table IV presents results computed without year-by-year fixed effects, while table V presents results obtained when yearly fixed effects are controlled for. The inclusion of the year fixed effects does not change the results substantially. Once the individual fixed effects are dealt with, we see the same qualitative pattern as with the OLS estimates. Urban workers experience more rapid wage growth, and staying at the same employer for a long period of time slows these wage gains, but does not stop or reverse them. The magnitude of the negative effect of tenure at urban jobs now lies in the range between about a quarter and a half of the effect of urban experience, so you might characterize these results as more favoring the matching interpretation than the OLS results. However, it is still the case that urban workers who do not change jobs will experience wage growth that is fast by rural standards. It appears that the dynamics at work behind both the urban learning model and the urban matching model are at work.

There are some differences between the OLS and fixed effects results. First, in the OLS estimation, the urban level effect is reduced to insignificance (both statistical and substantive) when the interactions are brought into the estimation. This results suggests that urban productivity gains owe more to the dynamic processes outlined by Glaeser (1999) and Helsley and Strange (1990) than the static agglomeration effects outlined by Fujita *et al*. (1999) and others. However, in the fixed effect regressions, the urban level effect stays solidly in the .05-.1 range, whether interactions are included or not. Although the significance of the urban level effect is marginal in these models, this is a result of larger standard errors.

Another difference between the OLS and fixed effect models is the significance of the interaction between urban status and education. In the OLS models, this coefficient is significant and positive as expected. In the fixed effect models, the education interaction term is generally insignificant or negative. This *suggests* a differential selection of high ability individuals into cities, by education: high ability people with education are more likely to find there way into cities than high ability people with less education, relative to their respective lower ability peers.

As our focus shifts to larger cities (cities with populations of over a million), some intriguing patterns come into focus. First, the introduction of the interaction terms change the relationship between the urban wage premium (the level effect) and city size. Looking across the models that exclude interaction terms, in every case the urban wage premium increases as we focus on larger and larger cities. However, once the interaction terms are included, this relationship either disappears entirely (OLS) or actually reverses itself. This raises the possibility that the dynamic effects of urban areas as described by Helsley and Strange (1990) and Glaeser (1999) are more important relative to level effects in big cities.

Another patterns that emerges is that the Helsley and Strange (1990) interpretation of urban wage growth seems to be more supported by large cities than in smaller cities. Since $\beta_{Urban*Tenure} + \beta_{Urban*Experience} = 0$ implies that the entire wage effect of urban residence is due to matching and $\beta_{Urban*Tenure} = 0$ implies that the effect is due entirely to learning, the quantity: $(\beta_{Urban*Tenure} + \beta_{Urban*Experience})/ \beta_{Urban*Experience}$ could be interpreted as the relative importance of learning in the growth of urban wages. Table VI reports this value across the nine interaction models presented in Tables III – V. It is clear from these results that the importance of learning is declining in city size.

The declining (with city size) relative importance of learning seems to make sense in terms of the models Helsley and Strange (1990) and Glaeser (1999) advance. Glaeser's learning externalities arise in large cities because there is a higher probability of having a learning interaction with someone in a populous area. However, it would seem reasonable that the returns to city size, in this regard, diminish rapidly after a certain city size is reached. It is said that Dante may well have known all the 50,000 or so Florentines of his era, and perhaps Chopin knew all the thousands of Parisians worth knowing when he flourished, but after some point a person's interaction schedule fills up. An extra hundred thousand residents in a metropolitan area, on top of the hundreds of thousands of people who already live there, is unlikely to impact the probability of meeting someone who can teach you something. Given the scale of most cities (even relatively small metropolitan areas), a resident's access to his city's better minds will be limited by the desire to keep close contact with a relatively stable group of friends, relatives and colleagues. The interactions which lead to learning in such a situation will more probably be being driven by a person's own motivation to learn and gain higher wages. This motivation for higher wages will also be the factor behind a person's decision to continue searching for a better job.

As a city grows, however, the number of potential jobs grows roughly proportionately, which increases the expected quality of match. If the matching quality depends more on specific occupations, or occupation/industry combinations (as opposed to a match with a specific employer) then there is reason to expect that these matches will improve rather steadily with city size. The relatively constant returns to city size for the matching of employees to jobs and the declining returns to city size for the potential to learn from ones betters would suggest that as we focus on bigger and bigger cities, the matching dynamic of urban wage growth should become more important. Such an interpretation is consistent with the results presented here.

V. Conclusion.

Intuitively, we all know that there is something different about cities. How and why they are different is the subject of perennial debate. Recent economic research has begun to be able to formalize the intuitions laid out by Alfred Marshall in the 19th century and Jane Jacobs in the mid-twentieth century. This paper has attempted to shed light on the source of one of these aspects of cities: the fast wage growth urban workers experience.

We find that two plausible explanations for this phenomenon are supported by the data. The persistently significant coefficient on the un-interacted urban status variables suggest that agglomeration economies deriving from scale economies in the production of goods, services and/or public infrastructure may also be contributing to high urban wages. However, it is likely that at least some of these level effects are deriving from the matching and learning dynamics discussed in the text. The wage data used in the paper comes from surveys conducted some time after respondents would have moved to or from the city. If urban-rural migrants are able to find better matches in cities, even with their first job, then some of the urban level effect would come from a matching effect. Similarly, if the respondents have had time to live and learn in the city before the survey was conducted, some of the urban level effect could be coming from learning as modeled by Glaeser (1999).

One objection to the methodology used in this paper is that urban residence is not assigned randomly, and thus there is the possibility of endogeneity bias in these estimates. While the focus on migrants between cities and rural areas through the use of fixed effects estimators addresses this to some extent, it is of course still likely that urban-rural and rural-urban migration is not exogenous, either. The effects of such endogeneity would likely be to bias all of the estimated urban and urban interaction coefficients away from zero: those who do not expect (or realize) a large urban wage premium will be less likely to move to cities. Those who have lived in the city, but failed to learn or find a good match will be more likely to return back to their small town homes. On the other hand, those getting very low wage increases at their current employer will be more likely to move on to another employer, so that tenure is not exogenous, either. Ideally, one would find compelling instruments for urban status, job changes and labor market participation. At least for the case of urban status, I do not feel such a compelling instrument exists in the NLSY data. These results are thus best interpreted as a first, best cut at the question.

Much of the paper has concerned a comparison of two models of urban wage growth. Of course, models can be interpreted in various ways. For instance, the learning model could be interpreted as meaning that in large cities it is easier to learn about better job opportunities. Conversely, one could think of the matching taking place as a match to the firm that employs people from whom a person can learn the most. These models are not necessarily mutually exclusive, as the empirical results show. There is plenty different about cities, be it air, markets or some third factor. It should not be surprising that the measurable differences, such as wage differences, are made up of many small factors.

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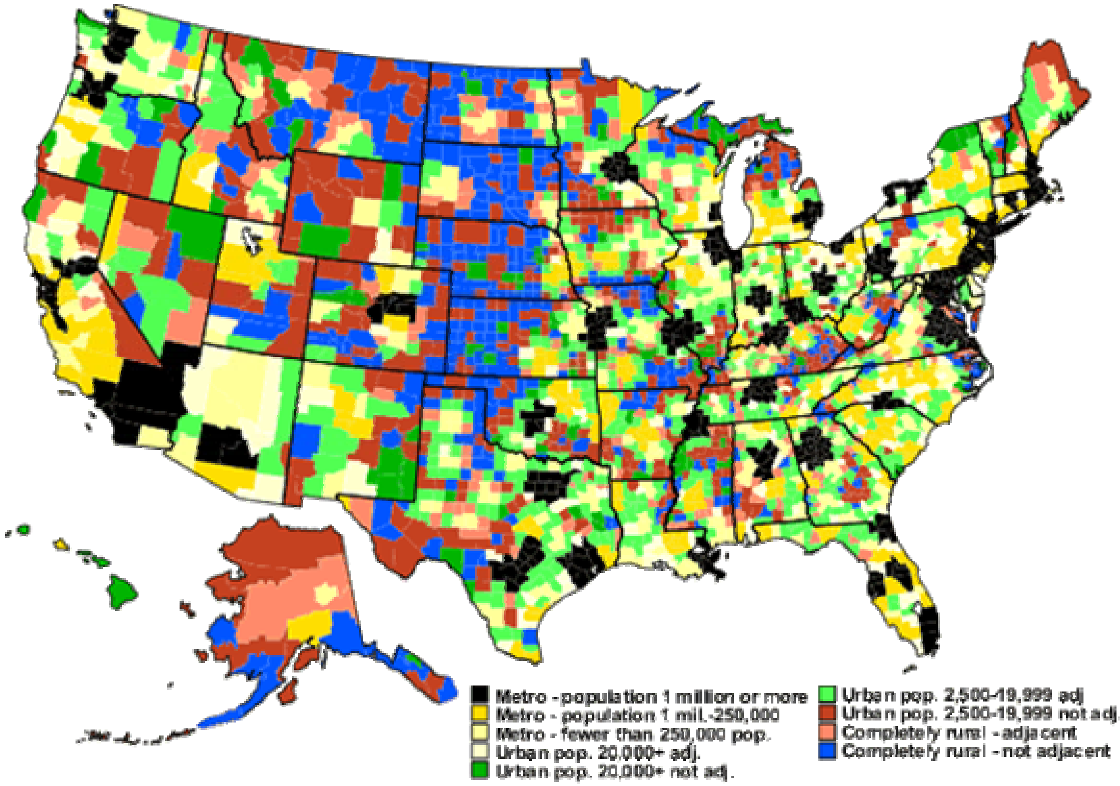
Figure I: 2000-Census-based urban-rural codes.

Rural-urban continuum codes, 2003



Source: USDA, Economic Research Service.

Table I: Descriptive Statistics.

Variable Name	full sample	Metropolitan areas Big	medium	Small	non-metro
logwage	2.09	2.22	2.04	1.99	1.88
	0.63	0.63	0.59	0.60	0.60
Any Urban	0.800	1	1	1	0
	0.400	-	-	-	-
Medium Urban	0.696	1	1	0	0
	0.460	-	-	-	-
Large Urban	0.475	1	0	0	0
	0.499	-	-	-	-
Total Expereince	470.30	489.81	461.49	468.59	434.63
	308.20	309.21	299.92	317.40	306.36
Weeks worked	56.55	57.98	55.44	56.98	54.18
	25.75	25.75	25.10	26.90	25.60
Tenure	183.24	185.46	181.04	188.81	177.51
	213.98	214.92	209.95	226.09	209.54
Education	12.93	13.17	13.02	12.66	12.40
	2.30	2.36	2.33	2.15	2.12
Male	0.560	0.56	0.55	0.54	0.58
	0.496	0.50	0.50	0.50	0.49
Black	0.251	0.28	0.24	0.20	0.21
	0.434	0.45	0.43	0.40	0.40
Age	28.19	28.50	28.05	28.30	27.56
	6.35	6.36	6.16	6.58	6.36
AFQT	42.40	43.71	42.65	41.87	39.31
	28.49	28.68	28.56	27.68	28.14
Hours per week	42.96	42.78	42.90	42.99	43.45
	7.53	7.23	7.26	7.63	8.42
Marital	0.47	0.43	0.47	0.51	0.52
	0.50	0.50	0.50	0.50	0.50
NoChild	0.97	0.91	0.98	1.11	1.03
	1.20	1.18	1.18	1.25	1.20
Observations (approx)	87,000	41,000	19,000	9,000	17,500

Note: Standard Deviations in small font below each average.

Table II: Regression with all three urban dummies, no interactions.

Dep. Var: logwage	OLS		FE		FE	
Urban	0.04510	***	0.00746		0.00804	
Med. Urban	0.04744	***	0.03823	***	0.02281	***
Big Urban	0.13988	***	0.06660	***	0.06449	***
Experience	0.00068	***	0.00075	***	0.00075	***
Tenure	0.00027	***	0.00015	***	0.00017	***
Education	0.04998	***	0.07906	***	0.07038	***
Male	0.15193	***	-		-	
Black	-0.03559	***	-		-	
Age	0.01613	***	0.01724	***	0.01828	***
AFQT	0.00191	***	-		-	
Marital	0.07189	***	0.06318	***	0.04798	***
No Children	0.00903	***	0.00795	***	-0.00281	
Professional	0.15116	***	0.15192	***	0.05184	***
Management	0.11831	***	0.15428	***	0.04993	***
Sales	0.03709	**	0.09232	***	-0.00531	
Clerical	-0.00339		0.07174	***	-0.02496	*
Craft	0.12221	***	0.15112	***	0.05351	***
Military	0.17862	*	-0.05519		-0.13349	*
Operator	0.05074	***	0.12861	***	0.03446	**
Laborer	-0.00420		0.10453	***	0.01019	
Farm-related	-0.29683	***	-0.05409	***	-0.14147	***
Services	-0.10064	***	0.02776	**	-0.06509	***
Private HH	-0.95829	***	-0.58191	***	-0.67654	***
Constant	0.24770	***	-0.00176		Year Dummies	
Adj R-squared	0.59580		0.55610		0.5603	
Obs	84615		86480		86480	

Note: * signifies the coefficient is significant at the .1 level, ** signifies significance at the .05 level and *** signifies significance at the .01 level.

Table III: OLS Regressions with and without interactions, by "urban" measure

Dep. Var: logwage												
	All Urban				Medium Urban or bigger				Big Urban			
	Main Only		Interactions		Main Only		Interactions		Main Only		Interactions	
Urban	0.16361	***	0.01744		0.16902	***	0.01204		0.18247	***	0.00462	
Experience	0.00070	***	0.00050	***	0.00069	***	0.00054	***	0.00068	***	0.00058	***
Urban Experience	-		0.00025	***	-		0.00022	***	-		0.00020	***
Tenure	0.00026	***	0.00030	***	0.00027	***	0.00032	***	0.00027	***	0.00031	***
Urban Tenure	-		-0.00005	**	-		-0.00007	***	-		-0.00008	***
Education	0.05065	***	0.04556	***	0.04979	***	0.04414	***	0.05072	***	0.04588	***
Urban Education	-		0.00573	***	-		0.00736	***	-		0.00920	***
Male	0.15945	***	0.16124	***	0.15638	***	0.15743	***	0.15287	***	0.15277	***
Black	-0.02500	***	-0.02438	***	-0.02990	***	-0.02987	***	-0.03350	***	-0.03319	***
Age	0.01570	***	0.01603	***	0.01605	***	0.01622	***	0.01602	***	0.01620	***
AFQT	0.00189	***	0.00189	***	0.00192	***	0.00192	***	0.00190	***	0.00191	***
Marital	0.06458	***	0.06626	***	0.06715	***	0.06839	***	0.06959	***	0.07019	***
No. Children	0.00677	***	0.00658	***	0.00803	***	0.00835	***	0.00913	***	0.00909	***
Professional	0.15774	***	0.16190	***	0.15422	***	0.15819	***	0.15374	***	0.15618	***
Management	0.12874	***	0.13254	***	0.12505	***	0.12773	***	0.11977	***	0.11941	***
Sales	0.04402	***	0.04949	***	0.04165	**	0.04555	***	0.04001	**	0.04208	**
Clerical	0.00930		0.01417		0.00451		0.00882		-0.00022		0.00142	
Craft	0.11834	***	0.12366	***	0.11745	***	0.12189	***	0.12173	***	0.12493	***
Military	0.18286	*	0.19341	*	0.17071	*	0.17599	*	0.17969	*	0.19943	*
Operator	0.04139	***	0.04656	***	0.04540	***	0.04914	***	0.04693	***	0.04844	***
Laborer	-0.01040		-0.00698		-0.01048		-0.00795		-0.00702		-0.00698	
Farm-related	-0.32428	***	-0.31663	***	-0.31719	***	-0.31605	***	-0.31661	***	-0.32321	***
Services	-0.09910	***	-0.09484	***	-0.10016	***	-0.09710	***	-0.10034	***	-0.09952	***
Private HH	-0.95733	***	-0.95746	***	-0.95793	***	-0.95694	***	-0.96088	***	-0.96076	***
Constant	0.24350	***	0.35437	***	0.26265	***	0.37071	***	0.28849	***	0.37204	***
adj R-sq	0.584		0.587		0.588		0.591		0.594		0.597	
Obs	84,615		84,560		84,615		84,538		84,615		84,507	

Note: * signifies the coefficient is significant at the .1 level, ** signifies significance at the .05 level and *** signifies significance at the .01 level.

Table IV: Fixed Effect Regressions with and without interactions, by "urban" measure

Dep. Var: logwage	All Urban				Medium Urban or bigger				Big Urban			
	Main Only		Interactions		Main Only		Interactions		Main Only		Interactions	
Urban	0.06210	***	0.13213	***	0.07606	***	0.08196	**	0.08785	***	0.07514	**
Experience	0.00076	***	0.00060	***	0.00075	***	0.00063	***	0.00075	***	0.00067	***
Urban Experience	-		0.00018	***	-		0.00016	***	-		0.00015	***
Tenure	0.00015	***	0.00020	***	0.00015	***	0.00018	***	0.00015	***	0.00019	***
Urban Tenure	-		-0.00006	***	-		-0.00004	**	-		-0.00008	***
Education	0.08062	***	0.08426	***	0.07993	***	0.07914	***	0.07934	***	0.07781	***
Urban Education	-		-0.00526	*	-		-0.00055		-		0.00127	
Age	0.01714	***	0.01743	***	0.01722	***	0.01763	***	0.01727	***	0.01766	***
Marital	0.06302	***	0.06298	***	0.06281	***	0.06235	***	0.06340	***	0.06319	***
No. Children	0.00716	***	0.00726	***	0.00739	***	0.00749	***	0.00803	***	0.00788	***
Professional	0.15398	***	0.15727	***	0.15252	***	0.15552	***	0.15282	***	0.15601	***
Management	0.15632	***	0.15811	***	0.15512	***	0.15682	***	0.15510	***	0.15659	***
Sales	0.09422	***	0.09679	***	0.09343	***	0.09517	***	0.09307	***	0.09412	***
Clerical	0.07328	***	0.07695	***	0.07208	***	0.07554	***	0.07266	***	0.07557	***
Craft	0.15232	***	0.15398	***	0.15099	***	0.15270	***	0.15208	***	0.15419	***
Military	-0.04801		-0.04026		-0.04937		-0.04611		-0.05595		-0.04522	
Operator	0.12983	***	0.13126	***	0.12878	***	0.12968	***	0.12905	***	0.13011	***
Laborer	0.10521	***	0.10671	***	0.10430	***	0.10530	***	0.10491	***	0.10561	***
Farm-related	-0.05367	***	-0.05591	***	-0.05432	***	-0.05858	***	-0.05589	***	-0.06137	***
Services	0.02851	**	0.03031	**	0.02747	**	0.02861	**	0.02861	**	0.02985	**
Private HH	-0.57994	***	-0.57622	***	-0.58172	***	-0.57732	***	-0.58101	***	-0.57697	***
Constant	-0.00861		-0.06263		-0.00303		0.00037		0.01548		0.02590	
overall R-sq	0.5456		0.5506		0.5494		0.5551		0.5542		0.5605	
Obs	86480		86423		86480		86395		86480		86364	
Individuals	9208		9201		9208		9198		9208		9196	

Note: * signifies the coefficient is significant at the .1 level, ** signifies significance at the .05 level and *** signifies significance at the .01 level.

Table V: Fixed Effect Regressions with and without interactions, by "urban" measure, with Year Dummies

Dep. Var: logwage	All Urban				Medium Urban or bigger				Big Urban			
	Main Only		Interactions		Main Only		Interactions		Main Only		Interactions	
Urban	0.05034	***	0.10636	***	0.05985	***	0.04829		0.07822	***	0.05948	*
Experience	0.00076	***	0.00059	***	0.00076	***	0.00063	***	0.00075	***	0.00067	***
Urban Experience	-		0.00020	***	-		0.00017	***	-		0.00016	***
Tenure	0.00017	***	0.00022	***	0.00017	***	0.00020	***	0.00017	***	0.00021	***
Urban Tenure	-		-0.00006	***	-		-0.00004	**	-		-0.00008	***
Education	0.07158	***	0.07404	***	0.07121	***	0.06920	***	0.07047	***	0.06854	***
Urban Education	-		-0.00419		-		0.00075		-		0.00160	
Age	0.01820	***	0.01872	***	0.01825	***	0.01901	***	0.01832	***	0.01895	***
Marital	0.04750	***	0.04717	***	0.04760	***	0.04683	***	0.04796	***	0.04740	***
No. Children	-0.00372	*	-0.00367	*	-0.00337		-0.00326		-0.00285		-0.00309	
Professional	0.05164	***	0.05497	***	0.05133	***	0.05505	***	0.05200	***	0.05498	***
Management	0.04967	***	0.05133	***	0.04964	***	0.05194	***	0.05000	***	0.05117	***
Sales	-0.00551		-0.00296		-0.00529		-0.00297		-0.00521		-0.00443	
Clerical	-0.02553	*	-0.02173		-0.02568	*	-0.02142		-0.02476	*	-0.02190	
Craft	0.05253	***	0.05411	***	0.05230	***	0.05459	***	0.05370	***	0.05555	***
Military	-0.12827	*	-0.11963		-0.12894	*	-0.12431		-0.13416	*	-0.12373	
Operator	0.03367	**	0.03505	***	0.03358	**	0.03506	***	0.03436	**	0.03512	***
Laborer	0.00892		0.01037		0.00894		0.01063		0.01004		0.01045	
Farm-related	-0.14271	***	-0.14539	***	-0.14275	***	-0.14682	***	-0.14302	***	-0.14910	***
Services	-0.06630	***	-0.06450	***	-0.06640	***	-0.06460	***	-0.06490	***	-0.06393	***
Private HH	-0.67670	***	-0.67312	***	-0.67737	***	-0.67237	***	-0.67631	***	-0.67258	***
overall R-sq	0.5506		0.5566		0.5536		0.5603		0.559		0.566	
Obs	86480		86423		86480		86395		86480		86364	
Individuals	9208		9201		9208		9198		9208		9196	

Note: * signifies the coefficient is significant at the .1 level, ** signifies significance at the .05 level and *** signifies significance at the .01 level.

Table VI: Relative importance of learning effect across specifications.

		City size category		
		50k+	250k+	1,000k+
Specification	OLS	0.8132	0.6636	0.5839
	FE w/out year	0.6586	0.7570	0.4517
	FE w/ year	0.6762	0.7746	0.5188
	Avg.	0.7160	0.7317	0.5181