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THE SOURCES OF URBAN DEVELOPMENT: WAGES, HOUSING, AND AMENITY GAPS ACROSS AMERICAN CITIES*

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ABSTRACT. This paper asks whether worker utility levels—composed of wages, rents, and amenities—are being equalized among American cities. Using microdata on U.S. urban workers in 1980 and 2000, little evidence of equalization is found. Comparable workers earn higher real wages in large cities, where amenities are also concentrated. Moreover, population growth between 1980 and 2000 has not been significantly different in low- and high-utility cities, suggesting that other forces are at work shaping the sorting processes that match workers and firms. We outline an alternative view of the drivers of change in the American urban system, and urban development more generally, by applying theory from economic geography.

1. INTRODUCTION

Over the last decades of the twentieth century, the economic fortunes of many American cities were transformed. Dense and prosperous urban regions in the country's onetime industrial core, such as Pittsburgh and Detroit, became poorer and smaller. Atlanta, Phoenix, and other formerly underdeveloped cities in the South and West grew considerably larger and richer; collectively they were named "the Sunbelt." And several large and dense metropolitan areas in the Northeast, especially Boston, Washington, and New York, overcame their economic difficulties; during the 1990s they regained positions at the top of the United States' urban income hierarchy.

Urban economists and regional scientists, from Graves (1976) through Roback (1982) and most recently Glaeser (2008), argue broadly that urban change is the result of spatial arbitraging of amenities, housing, and wages. Applying this logic to the changing American urban system, they suggest that individual workers relocated from the Frostbelt to the Sunbelt because loose land regulation in the South, combined with the advent of air conditioning, permitted them to better satisfy their deeply-held preferences for cheap suburban housing and warm, sunny climates. In addition, they argue that New York and other large metropolitan areas resurged because highly skilled workers began to demand more interactions with each other, and because urban crime rates declined, thereby raising quality of life in those urban areas.

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These researchers are, of course, not alone in observing that many Americans enjoy sunshine and suburbs, that New York is now much safer than it was during the 1970s, and that workers are more productive when clustered together. What is distinctive about the explanation put forth by these urban economists is the way they tie these processes together. They argue that urban wage levels, housing prices, and populations are determined by decisions of firms to hire workers, builders' decisions to supply housing, and these individual or household locational choices. Precisely because workers can relocate so easily, the utility of similar workers—where their utility is composed not only of nominal (or gross) wages but also spending on housing and the availability of local amenities—will tend toward equalization across urban areas. In this particular equilibrium, which we follow Glaeser (2008) in labeling "general spatial equilibrium," a worker cannot be made better off by moving from one city to another. Although some workers prefer a larger home while others care most about sunny pleasant winters, utility is a zero-sum game. New Yorkers may earn higher nominal wages because of the concentration of skill-demanding industries there, but the reason why the residents of Phoenix do not migrate to New York en masse is that New Yorkers are not better off once we account for their icy winters and the relatively high cost of their apartments.

According to this view, the Sunbelt grew because many workers chose sunshine and housing, in exchange for lower nominal wages, while certain highly productive workers opted for higher wages accompanied by higher housing costs, as well as a mix of good and bad amenities such as cultural activities, traffic, crime, and so on. And although air conditioning and lax land regulation might temporarily make certain locations more attractive, the utility levels of workers in the Sunbelt, Rustbelt, and those on the two coasts ought to tend toward equalization, at least in between further shocks to amenities, productivity, or housing markets.

This vision has become increasingly dominant in discussions about the causes and consequences of the transformation of the American urban system. This is no doubt because it is mathematically elegant, analytically sophisticated, and because it makes considerable intuitive sense. For instance, we know that American workers are quite mobile, much more so than, say, Europeans. And it seems sensible that they might move in order to better satisfy their preferences, whether they privilege larger homes, plentiful sunshine, or good opera. Nonetheless—and it is worth laying our cards on the table upfront—in this paper we approach this body of research as disciplined skeptics. Adherents of general spatial equilibrium admit that it requires a leap of faith because it integrates worker, firm, and builder choices into a single system of generalized spatial arbitraging over time, which determines prices (incomes and wages) and quantities (population and output) over the whole spatial system (Glaeser and Gottlieb, 2009). At the same time, researchers continue to produce partial empirical findings that are interpreted with reference to this broader theoretical system. This paper takes a step back from such work. While an infallible test of general spatial equilibrium may indeed require data about the world that one cannot hope to have, we think it useful to use the data that are available to determine if the central predicted outcome of this way of thinking stands up to empirical scrutiny. That outcome is the movement toward utility equalization over space, achieved through households' search for housing and bundles of amenities.

We approach this problem in several ways. First, we examine the extent to which inter-metropolitan aggregate utility levels might plausibly be equalized in 1980 as well as in 2000. We cannot directly observe utility levels, but we estimate them with data on housing costs, wages, and amenities. We use Decennial Census samples that allow us to calculate household real income, which is defined as annual wages net of yearly expenditures on housing and tax liabilities. Second, median real income data are combined with the results of surveys and secondary data regarding amenity differences among

U.S. metropolitan areas. Although these indicators are imperfect, they are consistent across multiple sources, and they broadly match recent quality of life estimates gained through hedonic methods (such as Albouy, 2008). Using these indicators, we investigate whether amenities act as a compensating differential for real income. Third, we explore the extent to which real wage gaps are the product of compositional differences in urban labor markets, by estimating whether expected real wages differ for households in different cities whose members share similar levels of skill and other demographic and housing characteristics. Last, we examine changes in population to see if workers are moving to take advantage of any extant inter-urban utility differences.

Our results raise questions about the spatial equilibrium interpretation of changes in the American urban system. We find that households in larger American cities enjoy greater access to amenities, higher nominal wages, and most importantly, higher incomes after accounting for differences in housing costs. These real income gaps are evident when we examine city-median real incomes, and they remain when we estimate the wages of individual households, controlling for a host of demographic and housing differences. Moreover, we detect no movement toward equalization at the margin: population growth rates over the 20-year period between 1980 and 2000 are not significantly different in cities with low and high real wages and amenities.

Before beginning our empirical analysis, we turn to a more detailed examination of general spatial equilibrium theory in the context of the changing American urban system.

2. SPATIAL INDIFFERENCE AND THE THEORY OF GENERAL SPATIAL EQUILIBRIUM

As noted by Partridge (2010), a great deal of North American regional science and urban economics is rooted in neoclassical theory, at the center of which are locational choices. Individuals, firms, and households seek to maximize utility, and can do so through mobility. They assume some set of constraints (such as budgets for households or skills for workers or supplier structures for firms) and then determine the equilibrium spatial distribution of population and output. Stemming from the work of Graves (1976) and Roback (1982), North American regional scientists have emphasized that preferences for amenities have strongly influenced the choices of individuals and households. These models are mostly within the partial equilibrium tradition, in that resulting spatial patterns can involve real income differences across places if some of the factors do not enjoy complete mobility or have very low elasticities of substitution with respect to price (e.g., if skilled workers can only exercise their skills in cold places).

Glaeser (2008) and Glaser and Gottlieb (2009) take things further, offering a "General Spatial Equilibrium" framework, in which factors are fully mobile and there are high elasticities of substitution across locations. In this conception of things, the locational decisions of firms, migration decisions by individual workers, and developers' choices to construct housing are jointly determined. Consumers seek to maximize utility, which is a function of their wages, housing expenditures, and amenities; firms seek to maximize profits, and they have the possibility of full factor substitution across locations. Builders supply housing in response to demand and regulation, substituting between quantity of space and price of land, with the latter determined more by the level of regulation than by natural differences between regions.

Housing prices, wages, and city sizes are outcomes of this interaction between workers, firms, and developers, thus simultaneously determining city sizes, income levels, and rates of population and income growth. As distinct from international development models, which incorporate strong barriers to income convergence among nations, these general spatial equilibrium models assume that inter-regional utility will tend strongly toward equalization in the short to medium run (Helpman, 2011). After some shock disturbs any of the key variables, workers and firms change locations, and builders adjust housing stocks until they collectively bring the system back into the general equilibrium. If workers in city *x* enjoy higher utility levels—a function of either differences in amenities, productivity levels, or housing costs—workers in city *y* will migrate to *x* and ultimately eat into those premiums. Assuming urban economies are at or near equilibrium, this means that the presence of high nominal wages should be bid down by some combination of high housing prices and disamenities, while cities with low nominal wages must offer some compensating advantage—cheap housing and/or some bundle of desirable amenities. Given this framework, population growth is the most relevant yardstick for economic performance, as individuals vote with their feet, and real income—as the index of utility—is equalized among locations.[1]

Employing this reasoning, many North American regional scientists claim that a shock to urban amenities—the widespread commercialization of air conditioning—set off a major, long-term transformation of the American urban system (Borts and Stein, 1964; Graves, 1983; Oi, 1997; Rappaport, 2007; Partridge, 2010). Air conditioning, combined with the construction of the Interstate Highway System, permitted many individuals to act upon their inbuilt preferences for living in a pleasant climate or being near mountains and seashore. Large groups of workers therefore moved from cold, dense locations in the Northeast to warmer and less dense Southern ones. Though the theory is always constructed around the endless circular interaction of labor demand and labor supply over space, in practice, empirical work has stressed the locational choices of individuals and households in setting off the sequence of major change. Responding to Muth's (1971) classical question of whether migration is "chicken or egg," they argue that it is the chicken. According to Partridge (2010), building on Graves (1976, 1983), people first went to housing and climate, jobs then went to people, and housing has gone to places that are less restrictive, which are usually the less developed places. Moreover, whatever the initial shock and interactions, the theory argues that an economy is "spatial putty"—in the sense that firms, households, and builders can make significant tradeoffs between the quantity and price of employment, work, and housing across locations—and that the observable outcome that supports the theory is spatial utility equalization.

Table 1 seems consistent with this general story. The list of cities that most rapidly increased their per capita income between 1980 and 2000 include some resurgent Northeastern metropolitan areas and their suburbs, wealthy parts of Silicon Valley, and a group of Sunbelt newcomers. The 10 cities with highest rates of population growth are all in the Sunbelt, except for San Bernardino-Riverside, a satellite of the Los Angeles region.[2] Declining industrial hubs dominate the list of cities at the bottom of the population ranking. A group of fairly small urban areas in interior California and in Texas share the dubious distinction of having the lowest rates of income growth.

[1]Thus, Glaeser and Gottlieb (2009) write: ". . . since the pioneering work of Mills (1967), Rosen (1979) and Roback (1982), cross-city work has almost always assumed that the free migration of workers creates a spatial equilibrium where utility levels are equalized." They also write: "The high mobility of labor leads urban economists to assume a spatial equilibrium, where elevated New York incomes do not imply that New Yorkers are better off. Instead, welfare levels are equalized across space and high incomes are offset by negative urban attributes such as high prices or low amenities." And: "By assuming that workers choose their locations, urban economists gain at least the possibility of explaining the large concentrations of people in urban areas."

[2]Though Los Angeles is certainly sunny, it is not typically included in the Sunbelt, because California has followed a very distinctive development trajectory, as compared with the Southern states that usually receive this moniker. We discuss the peculiarities of California in more detail below.

TABLE 1: Population and Income Growth, U.S. Metropolitan Areas, 1980–2000

	Population Growth Rate	Nominal Income Growth Rate
Top 10	Las Vegas, NV	San Jose, CA
	Fort Myers-Cape Coral, FL	Norwalk, CT
	Austin, TX	Stamford, CT
	Ocala, FL	Bridgeport, CT
	Riverside-San Bernardino, CA	Boston, MA
	Orlando, FL	Raleigh-Durham, NC
	Phoenix	Austin, TX
	McAllen-Edinburg TX	Charlotte-Gastonia, NC
	West Palm Beach, FL	Fort Walton Beach, FL
	Atlanta, GA	San Francisco-Oakland, CA
Bottom 5	Decatur, IL	Odessa, TX
	Johnstown, PA	Bakersfield, CA
	Duluth-Superior, MN/WI	Fresno, CA
	Pittsburgh-Beaver Valley, PA	Visalia-Tulare-Porterville, CA
	Youngstown-Warren, OH-PA	Riverside-San Bernardino, CA

Notes: Population growth rates based on authors' calculations from U.S. Census data ($N = 331$); income growth rates based on authors' calculations from Bureau of Economic Affairs data on nominal metropolitan per capita gross domestic product ($N = 387$). Nominal refers to gross income, as opposed to income net of expenditures (real income). Unless otherwise stated, income data have not been adjusted to reflect inflation.

3. EVIDENCE ON SPATIAL UTILITY EQUALIZATION

According to general spatial equilibrium theory, income is a principal measure of utility, but nominal income fails to measure relevant living cost differences, as well as (priced and unpriced) quality of life factors. As Glaeser (2008, p.4) suggests, "since high wages might just reflect the compensating differential that a firm needs to pay to locate in an unattractive environment, wages are a dangerous measure of urban success." Thus, much research since Graves (1976) and Roback (1982) has been devoted to accounting for these fuller dimensions of utility, in an attempt to show that it tends to be equalized across locations. This logic is also used to argue that changes in population are a sufficient indicator of urban development, since utility equalization incorporates real and nominal income, employment, and all other possible meaningful indicators of urban performance.

Is there an Aggregate Real Wage Premium in Large Cities?

To provide empirical support for the general spatial equilibrium hypothesis, Glaeser and Maré (2001) compare the nominal and real wages of 37 metropolitan areas in 1990. They estimate real wages by dividing average nominal wages by the ACCRA Cost of Living Index, a measure produced by The Council for Community and Economic Research. Glaeser and Maré conclude that firms in large cities pay higher nominal wages, but after accounting for inter-metropolitan differences in the cost of living, the observed wage premium in large cities disappears. They argue that this is why more workers do not currently move to New York and San Francisco.

In order to see whether Glaeser and Maré's result holds over a broader range of U.S. cities, we build a measure of median metropolitan real household income, and examine its relationship to population in 1980 and in 2000. Our units of observation are Metropolitan Areas (in 1980 they are called Standard Metropolitan Statistical Areas, or SMSAs), as defined by the Office of Management and Budget. Metropolitan areas consist of counties or combinations of counties that represent a population nucleus, such that the area contains communities that are economically and socially integrated.[3]

We define real household income as follows:

$$Y_i = f(w_i, r_i, x_i), \tag{1}$$

where Y indicates real income for household i, w denotes their total nominal wages, r is a measure of their rent or housing expenditures, and x is the sum of their federal, state, and FICA tax liabilities.[4] We examine wages and expenditures for households, rather than for individual workers, because the cost of maintaining a home is commonly borne by more than one member of a household, and there is no available data with which to identify individual contributions. Because there are not significant inter-metropolitan differences in the number of income-contributing members per household, we can safely compare household incomes.[5] We also consider that housing expenditures are a reasonable index of differences in living costs because there is scant variation in metropolitan nonhousing costs.[6]

As compared with measures that depend on ACCRA or other aggregate gauges of living costs, direct household-specific matches of income and housing expenditures will produce superior estimates of real income levels. To make these matches, we use data from the Decennial Census of Population and Housing for 1980 and 2000, made available by the Integrated Public Use Microdata Series, or IPUMS (Ruggles et al., 2010). For 1980 we examine data from the 1 percent Metro sample; for 2000, we use a 5 percent sample. The Decennial Census gathers information on households' income, home values, and expenses, and a host of demographic and housing characteristics, making it ideal for this sort of analysis.

We estimate household real income by subtracting a household's annual land rent from their after-tax wage and salary income. Census respondents report their annual wage and salary income, which we aggregate to the household level. For all households

[3]Over time, the U.S. Office of Management and Budget redefines metropolitan area boundaries, generally increasing their size to account for urban expansion. There is no infallible way to account for such changes in our research: maintaining a constant geography risks ignoring important parts of functionally integrated regional labor markets (or inappropriately including remote hinterlands), while adjusting boundaries over time might introduce bias to the extent that some cities are adding very different submetropolitan areas from others. We opt for the latter approach, since it is the one that best preserves the underlying notion of a metropolitan region.

[4]The Federal Insurance Contributions Act, or FICA, is a payroll tax whose proceeds fund Social Security and Medicare programs, which are federal programs that support retirees, the disabled and some children.

[5]According to 1980 IPUMS 5 percent census microdata, the average number of household members that contribute wage and salary income to overall household income is 1.68. Meanwhile, the standard deviation is only 4 percent of the mean. In other words, average household sizes do not significantly differ between cities.

[6]Beeson and Eberts (1989, pp. 451), for instance, report that living cost indices that do not include housing vary only by 4 percent of the national average in either direction. By contrast, Albouy (2009) suggests that living costs matter for hedonic quality of life estimates—though it is not clearly established what role they play specifically, since calculations in that paper rely on including many cost features, such as federal and state taxes, that themselves depend on nominal income. It is possible that living costs do vary importantly in select cities. For instance, the generally poor public school system in Los Angeles might impose a significantly higher cost burden on households with children, as many parents choose to send their children to private schools. At the same time, the LA metropolitan area offers abundant good suburban schools, and many wealthy "urban core" areas have good schools as well as public magnet schools. The issue here is whether such differences are significant enough to driver inter-metropolitan locational choices, or whether they mainly operate in neighborhood choice within a metro area.

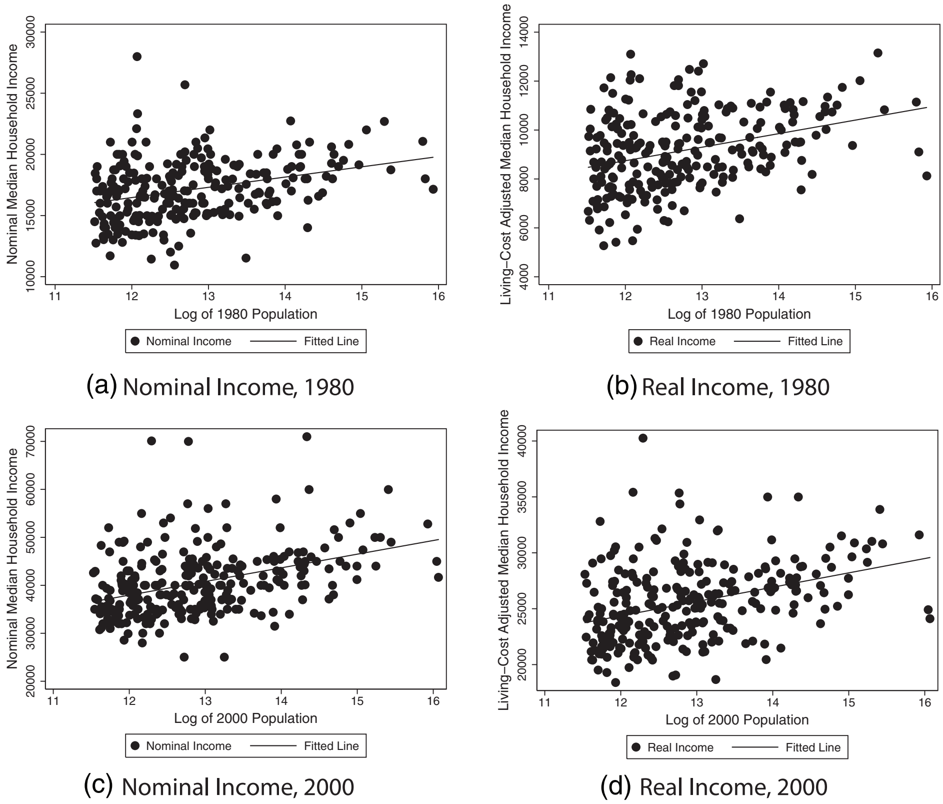
sampled, federal, state, and FICA tax liabilities are calculated, net of deductions, using the National Bureau of Economic Research TAXSIM program, version 9.0. Census households that rent their domicile also provide their monthly residential rent, which should track land values reasonably well, with the caveat that rents are subject to price restrictions in some locations. To estimate housing expenditures for renters, we annualize monthly gross rent, which includes their contract rent as well as utilities paid. For homeowners, we calculate an annual 'imputed rent' by taking the product of respondent-reported home values and the rent-to-home-value ratio, following Peiser and Smith (1985), Rauch (1993) and a host of others. We get rent-to-home-value ratios for 1980 and 2000 by averaging quarterly estimates produced by the Lincoln Institute for Land Policy, which are detailed in Davis, Lehnert, and Martin (2008). The annual discount rate in 1980 is 4.88 percent; in 2000 it is 4.62 percent.[7] Having calculated individual household real incomes, we estimate metropolitan median real income for a sample of noninstitutional households in over 200 metropolitan areas in each time period.[8]

In Figure 1, we show scatterplots of the relationship between population and nominal and real median household income in 1980 and 2000 for a consistent set of 244 metropolitan areas. In the left column we observe the expected upward sloping relationship between nominal income and population: "raw" wages are higher in large cities. In contrast to Glaeser and Maré's finding with 37 cities in 1990 however, we find that same is true for real incomes: in 1980 as in 2000, the median household in large cities earns more net of housing costs than the median household in smaller cities. The slope of each line diminishes when moving from nominal to real income levels, but in each case, the relationship remains significant and strongly positive.

Overall, Figure 1 shows an aggregate nominal and real wage premium that favors workers in large cities. Firms are able to pay higher nominal wages in large cities, most likely due to higher productivity. But the workers who live in populous metropolitan areas appear to be better off in real pecuniary terms, even after we account for differences in the cost of living. Moreover, the evolution of the distribution does not favor a tendency toward some distant moment of equalization. The coefficient of variation for real median household income increases from 0.137 to 0.145 over our study period: the gap between richer and poorer cities has modestly grown, not diminished.

[7]These kinds of estimates depend on the accuracy of owners' ideas about the value of their property. Results will be biased to the extent that owners are misinformed about their property's true value. For robustness, we considered an alternative measure of owner-occupied housing values, based on households' actual annual housing costs. In this "expenditures" approach, a household's annual mortgage payments, taxes, insurance, utilities, and condominium fees are summed into one figure that is roughly analogous to the housing costs faced by renters. This expenditure figure is then subtracted from tax-adjusted wages to arrive at real income. Ultimately, we opted for the "imputed rent" approach for one main reason. While rental prices float fairly freely, mortgage payments reflect housing prices frozen at the moment of purchase. Homeowners in two adjacent and similar homes will have similarly valued homes, but they may face very different mortgage payments—and hence annual housing expenditures—if they bought their homes at different moments in time. This is particularly important in the current context because potential migrants considering a move from one city to another must consider *current* housing values; they do not have the opportunity to buy a home at a price at which it might have sold at some point in the past. For this reason, we felt that imputed rents based on owner-supplied estimates of home values were likely to produce more accurate estimates of the key relationships explored in this paper. The two housing expenditure indices are fairly strongly positively correlated (0.6). Interestingly, the results shown in each subsection of Section 4 are materially similar in overall shape and significance to the ones produced using the "expenditures" method.

[8]Because both housing costs and incomes exhibit strong positive skew, we construct median income levels, rather than means.



Notes: (a) Nominal Income, 1980. (b) Real Income, 1980, Nominal Household Income = 790 log(population) + 7067, $n = 244$, $R^2 = 0.09$; Real Household Income = 553 log(population) + 2098, $n = 244$, $R^2 = 0.11$. (c) Nominal Income, 2000. (d) Real Income, 2000. Nominal Household Income = 2858 log(population) + 5030, $n = 244$, $R^2 = 0.16$; Real Household Income = 1282 log(population) + 8972, $n = 244$, $R^2 = 0.14$. Coefficients on population variables are significant at 1 percent level in each case.

FIGURE 1: Median Income and Population Levels for Metro Areas, 1980 & 2000.

Do Quality of Life Factors Push toward Inter-Metropolitan Utility Equalization?

The findings in the previous section do not neatly accord with the predictions of the general spatial equilibrium hypothesis. Lower housing expenditures should compensate lower nominal wage locations. And in a dynamic sense, migration should push incomes toward equalization in response to a location-specific productivity shock.

Utility could still be equalized if we consider a wider set of quality of life factors. According to Glaeser and Gottlieb (2006, p.1277) "... high real wages ... imply consumer disamenities." This point is debatable, since the value of many amenities ought to be reasonably well capitalized into the housing market (Graves, 1983, Cheshire and Sheppard, 2004). This is evidently true for schools and other public goods, but also true for many other kinds of amenities. For instance, home values are high in Santa Barbara in part because it is a spectacularly beautiful place. Nonetheless, to be consistent with spatial equilibrium, we should expect any externality from such amenities to be negatively related to real wages (Glaeser and Maré, 2001). Cities with pleasant climates, vibrant nightlife, or other amenities should also be those cities with comparatively lower real income.

TABLE 2: Correlations between Amenities and Real Income and Population

Amenities	Real Income (1980)	Population (1980)
Mean January temperature	−0.41**	0.004
	(0.00)	(0.95)
Climate & terrain	−0.002	0.23**
	(0.98)	(0.00)
Transportation	0.16**	0.44**
	(0.01)	(0.00)
Health care & environment	0.34**	0.84**
	(0.00)	(0.00)
Crime	−0.03	−0.42**
	(0.63)	(0.00)
Recreation	0.02**	0.35**
	(0.01)	(0.00)
Arts	0.23**	0.89**
	(0.00)	(0.00)
Education	0.15**	0.38**
	(0.02)	(0.00)

Notes: Standard errors in parentheses. Asterisks denote significance levels.
*Significant at 5 percent. **Significant at 1 percent.
Amenity variables are described in the Data Appendix.

With this relationship in mind, some urban economists have seized upon average January temperatures as a major driver of the later-twentieth century growth of Sunbelt population and income (Borts and Stein, 1964; Graves, 1980; Partridge, 2010), while others argue that an expansion of the housing supply in Southern cities is the more compelling cause (Glaeser and Tobio, 2008). If either amenities or a construction boom are exogenous determinants of the rise of the Sunbelt, then workers have revealed their willingness to trade wages for warmer winters or cheap, spacious accommodation. The relationship between the weather in January and population growth is a very consistent finding among equilibrium-flavored empirical explorations of the determinants of population growth in the U.S. (though less so in the European Union). As we show in Table 2, January temperatures are significantly and negatively associated with real wages in 1980, just as general spatial equilibrium models predict.

But is average January temperature a broad enough indicator of the amenities likely to affect locational decisions? Ultimately this is a behavioral question, best settled with data on the motivations and preferences of migrants, which are likely to be heterogeneous. Some people crave seasons, while others certainly prefer uniformly warm climates. Lacking data that peer inside the heads of human actors, we still have some indications that winter temperature is insufficient as a gauge of overall urban quality of life. One could begin with the common sense observation that Houston's summers are about as bad as Detroit's winters. If workers truly cared about climate, then it becomes hard to explain why places like Las Vegas and Houston have experienced such high population growth rates. Indeed, it seems implausible that January temperatures singularly guide mobility. Publications such as the *Places Rated Almanac* (Boyer, 1985), and Cities Ranked and Rated (Sperling and Sander, 2004), though far from perfect, combine survey and secondary data on amenities with the goal of providing information to assist with migration decisions. Each suggests that, even examining climate factors alone, individuals consider a wider range of qualities of place. In addition to the correlations with January temperatures, Table 2 presents the relationship between the *Places Rated Almanac*'s "Climate and Terrain" variable with both real income in 1980, and population levels in 1980. The "Climate and Terrain" combines information on temperature extremes, the number of days where heating and cooling would be needed, as well as other weather considerations. Though negative, the correlation between real income and this variable is both weak and insignificant, suggesting that the relationship between climate, population and income does not survive to a wider consideration of climatic characteristics.

Some researchers consider that other kinds of quality of life factors may be important in shaping urban performance, including leisure attractions (Carlino and Saiz, 2008), coastal access, and a host of consumer amenities (Rappaport, 2008; Glaeser and Maré, 2001; Clark et al., 2002; Florida, 2001). This claim is consistent with the broader theoretical discussions in Roback (1982) and elsewhere. The remainder of Table 2 presents the relationship between real income in 1980 and other amenities as measured in the *Places Rated Almanac*. We select indicators of the arts, recreation, health care and environment, crime, education, and transportation. Surprisingly, all of the other amenity indices are positively associated with real income, except crime. All but crime are also positively correlated with metropolitan population in 1980, which accords with general quality of life patterns in Albouy (2008): no matter how unpleasant their winters, large cities offer better amenities. Of all the quality of life measures we consider, only mean January temperature displays the expected relationship to real income. Some of the correlations are insignificant, and so we might reasonably question the extent to which we can conclude that high-income cities are also best endowed with a wide range of amenities.

To fully understand the relationship between amenities and urban growth, we would need more detailed data on the prices of amenities, the supply of unpriced amenities, and the role of variety and quantity of amenity supply in the individual utility function. It is important to note that despite 30 years of publication on the topic, supporters of the amenity-driven growth hypothesis have not generated these detailed data. Are amenities more abundant, but more expensive in, say, New York as compared to Houston? As of this writing in the fall of 2011, the Metropolitan Opera and the Houston Grand Opera are presenting Rossini's opera, *The Barber of Seville.* The Met's prices range from $25 to $430; Houston's prices range from $38 to $400, as indicated by their websites. An income-constrained individual can pay one-third less to attend an opera in New York than is required in Houston. It is a fair guess that New York has a greater total supply of entertainment amenities than Houston, though we lack the data to calculate convincing estimates on a per-capita basis, nor whether there are varying effects of access and crowding. But the existing literature offers no proof that amenities are more expensive in high-income cities, nor that such cities have lower supplies of free amenities, except for warmth, than in rapidly growing cities. General spatial equilibrium theory demands that "high amenities should be associated with lower real incomes since high real incomes are needed to offset low amenities in unattractive places" (Glaeser, 2008, p. 59). When we unpack the evidence and examine it closely, urban amenities do not appear to compensate for low real wages, in contrast to the expectations found in the Glaeser-Roback-Graves tradition.

Signs of Spatial Indifference among Comparable Workers

One possible reason why we find real utility gaps in cities is that we have not accounted for individual heterogeneity. Real wage differences could reflect variation in the composition of each city's labor force. Higher-skill workers are more productive and are compensated correspondingly. If a city hosted a larger share of high-skill workers, its median nominal wages would certainly be higher as compared with lower-skill cities.

These inter-urban wage gaps could also be reflected in real wage differences if the relationship between nominal wage income and housing expenditures were less than perfectly elastic.

Therefore, we would like to know if real wages are different not just across cities in aggregate, but also for comparable urban workers living in various urban locations. This question can be answered by estimating a linear random intercepts mixed model that predicts an individual household's real income as a function of a mix of household (level-1) and metropolitan (level-2) characteristics. In order to properly account for the fact that households are clustered in cities, we estimate the following model:

$$\ln\left(Y_{ij}\right) = \gamma_{00} + \gamma_{10}X'_{ij} + \gamma_{01}M'_{2j} + \mu_{0j} + r_{ij}, \tag{2}$$

where Y measures real wages for household i in city j, $\boldsymbol{X}'$ is a vector of household (level 1) characteristics, $\boldsymbol{M}'$, is a vector of city-specific (level 2) characteristics, μ_{0j} measures city-specific error, and r_{ij} accounts for individual-level error and is assumed to be independent and normally distributed with constant variance.

We are primarily interested in the variance components of the error terms, with the variance of r_{ij} and u_{0j} denoted as σ^2 and τ_{00}, respectively. Together, these permit calculation of the intraclass correlation, ρ, with which we can describe the percentage of observed variation in household real wages that is a function of city-level characteristics. If workers are truly arbitraging across locations then we should be able to fully account for inter-urban real wage differences by including a set of level-1 demographic factors, such as work experience and educational attainment. In other words, this implies an intraclass correlation that approaches zero. To the extent that there is considerable city-specific variance, this means that real wage levels are not equalized at our two cross-sections. If that variance is durable across time, this suggests—though it does not definitively establish—that the system is not heading toward the predicted equilibrium. In addition to the variance components, we are interested in the relationship between household real wages and a few city-level indicators, population in particular.

The model is estimated for 1980 as well as for 2000, using the 1 percent metro IPUMS Decennial Census sample for 1980 and the 5 percent sample for 2000. The dependent variable is the real wage level of a given household in 1980 or 2000, with real household wages estimated as detailed above. Since our unit of observation is the household, we must make some assumptions about how to aggregate the demographic characteristics of individual workers within the household. We privilege the characteristics of workers identified as the head of the household. Household heads contribute the most to household wages, and other material contributors are broadly similar to the household head across a wide range of income-relevant demographics.[9] We consider a host of wage-determining covariates that are commonly used in labor economics, such as race, educational attainment, experience (quadratic), marital status, and disability.[10] We also include a set of dummy variables that capture the broad occupational category of the household head, such as manager, farming, or machine operator. To describe differences in housing quality that would be reflected in housing costs and real income, we include variables

[9]Income-contributing household members, who are mostly husbands and wives, exhibit strongly similar means across race, age, disability, and marital status. Sex differences are obviously more marked.

[10]In some models, we include interactions between sex and experience, marital status, race, and education. We do not show output from these results because they do not materially affect the main relationship, while generating unwieldy tables.

describing the number of bedrooms in the home, the age of the building, and property acreage.

Tables 3 and 4 present the results for 1980 and 2000, respectively. Individual-level parameter estimates are found in the top section of each table, with a solid rule below to differentiate them from level-2 predictors. The level-1 coefficients are not interpreted because they act as controls. They are, however, uniformly significant and relate to the dependent variable in a sensible manner.

Model 1 in Table 3 presents estimates for a model with no metropolitan-level variables. The intraclass correlation is 12 percent, indicating that 12 percent of the variation in household real wages is determined by the city in which that household happens to be located, as opposed to household-specific demographic and housing characteristics. We have little guidance about how big the city-specific variance ought to be, however 12 percent is certainly sufficiently large enough to merit the multilevel estimation approach. It is not at all surprising that household factors like educational attainment and work experience account for the bulk of the variation in real wages. But, it appears that a considerable portion remains unexplained after accounting for household-specific characteristics.

A measure of metropolitan area population in 100,000s is added in Model 2, to account for the wage premium found in large cities. The intraclass correlation diminishes somewhat, as we expect. Population is statistically significant and positively related to household wages. In real pecuniary terms, households of all kinds are better off in larger cities. We include population less for causal purposes, and more as confirmation of the urban wage premium that was documented at an aggregate level in Section 3.1.

One possible source of bias in these estimates is individual (household) unobserved heterogeneity. Workers may differ in ways that cannot be fully enumerated by measures of schooling years, experience, occupation, and so on, but which are correlated with their household income. An unmarried, Asian lawyer with 20 years of work experience who lives in San Francisco may still be meaningfully different than an observably similar worker living in Phoenix. Those hard-to-measure differences could help to explain why the Bay Area lawyer earns a higher real income. While there is no foolproof way to describe this latent variation, we attempt to control for it by including a variable that estimates the overall sophistication of the work activities undertaken in a city as implied by a city's occupational structure. In other words, we assume that we might distinguish the San Francisco lawyer's greater ability on the basis of the degree to which there are larger concentrations of workers performing nonroutine (read: sophisticated) tasks in the Bay Area as compared with Phoenix. To measure nonroutineness levels in cities, we combine data from the Dictionary of Occupational Titles with our IPUMS census extracts. We construct our index by calculating the shares of nonroutine analytic and nonroutine interactive tasks in a city's total tasks, in a manner analogous to Autor, Levy, and Murnane (2003).[11] Model 3 includes the Nonroutineness index, which is positive and significant, but which does not materially change the size of the intraclass correlation from the previous model.

In Model 4 we add selected metropolitan-specific amenity variables. As with population, these are intended less as causal determinants of wages than a way to observe the direction and significance of their relationship to real income. We include indices of recreation, arts, and climate from the Places Rates Almanac, as well as mean January temperature. Only January temperature is significantly related to household income. Over this period in the United States, cities with higher real incomes tend to have colder winters.

[11]See Data Appendix for more details on the construction of this variable.

TABLE 3: The Determinants of (Log) Household Real Wages, 1980

	(1)	(2)	(3)	(4)
Educational attainment	0.026***	0.026***	0.026***	0.026***
	(0.001)	(0.001)	(0.001)	(0.001)
Experience	0.037***	0.037***	0.036***	0.036***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience squared	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Disability (1 = healthy, 0 = disabled)	0.247***	0.251***	0.250***	0.250***
	(0.005)	(0.005)	(0.005)	(0.005)
Married (1 = married, 0 = single)	0.292***	0.291***	0.290***	0.290***
	(0.004)	(0.004)	(0.004)	(0.004)
Race (1 = white, 0 = nonwhite)	0.066***	0.066***	0.067***	0.065***
	(0.004)	(0.004)	(0.004)	(0.004)
Sex (1 = male, 0 = female)	0.249***	0.246***	0.246***	0.246***
	(0.004)	(0.004)	(0.004)	(0.004)
Manager	0.250***	0.255***	0.256***	0.256***
	(0.005)	(0.005)	(0.005)	(0.005)
Tech/Sales	0.163***	0.166***	0.166***	0.167***
	(0.004)	(0.005)	(0.005)	(0.005)
Farming	−0.108***	−0.107***	−0.107***	−0.105***
	(0.013)	(0.014)	(0.014)	(0.014)
Craft	0.211***	0.218***	0.218***	0.219***
	(0.005)	(0.005)	(0.005)	(0.005)
Operator	0.176***	0.181***	0.182***	0.182***
	(0.005)	(0.005)	(0.005)	(0.005)
Number of bedrooms	0.160***	0.161***	0.161***	0.161***
	(0.001)	(0.002)	(0.002)	(0.002)
Property acreage	−0.002	−0.003***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Year built	−0.018***	−0.018***	−0.018***	−0.018***
	(0.001)	(0.001)	(0.001)	(0.001)
Population (hundreds of thousands)		0.004***	0.003***	0.005***
		(0.001)	(0.001)	(0.001)
Nonroutineness index			0.313*	0.344**
			(0.179)	(0.173)
Recreation index				−0.000
				(0.000)
Arts index				−0.000
				(0.000)
Climate index				0.000
				(0.000)
January temperature				−0.042***
				(0.006)
Constant	7.221***	7.188***	7.101***	7.089***
	(0.012)	(0.013)	(0.055)	(0.055)
Observations	383,686	340,538	337,106	332,928
Cities	279	226	215	210
τ_{00}	0.105	0.096	0.096	0.082
σ^2	0.790	0.791	0.790	0.791
ρ	0.117	0.108	0.108	0.094

Standard errors in parentheses.
*Significant at 10 percent. **Significant at 5 percent. ***Significant at 1 percent.

TABLE 4: The Determinants of (Log) Household Real Wages, 2000

	(1)	(2)	(3)	(4)
Educational attainment	0.046***	0.047***	0.047***	0.047***
	(0.001)	(0.001)	(0.001)	(0.001)
Experience	0.035***	0.036***	0.035***	0.035***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience squared	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Disability (1 = healthy, 0 = disabled)	0.085***	0.086***	0.086***	0.085***
	(0.004)	(0.004)	(0.004)	(0.004)
Married (1 = married, 0 = single)	0.346***	0.345***	0.344***	0.344***
	(0.003)	(0.003)	(0.003)	(0.003)
Race (1 = white, 0 = nonwhite)	0.067***	0.067***	0.067***	0.067***
	(0.003)	(0.003)	(0.003)	(0.003)
Sex (1 = male, 0 = female)	0.159***	0.160***	0.160***	0.160***
	(0.003)	(0.003)	(0.003)	(0.003)
Manager	0.319***	0.320***	0.320***	0.319***
	(0.004)	(0.004)	(0.004)	(0.004)
Tech/Sales	0.198***	0.199***	0.199***	0.199***
	(0.004)	(0.004)	(0.004)	(0.004)
Farming	−0.056***	−0.057***	−0.054***	−0.054***
	(0.010)	(0.011)	(0.011)	(0.011)
Craft	0.185***	0.187***	0.188***	0.187***
	(0.005)	(0.005)	(0.005)	(0.005)
Operator	0.146***	0.148***	0.148***	0.148***
	(0.005)	(0.005)	(0.005)	(0.005)
Number of bedrooms	0.155***	0.155***	0.156***	0.156***
	(0.001)	(0.001)	(0.001)	(0.001)
Property acreage	0.017***	0.017***	0.017***	0.017***
	(0.001)	(0.001)	(0.001)	(0.001)
Year built	−0.015***	−0.015***	−0.016***	−0.016***
	(0.001)	(0.001)	(0.001)	(0.001)
Population (hundreds of thousands)		0.005***	0.004***	0.004***
		(0.001)	(0.001)	(0.001)
Nonroutineness index			0.783***	0.721***
			(0.180)	(0.194)
Recreation index				0.000
				(0.000)
Arts index				0.000
				(0.000)
Climate index				0.000
				(0.000)
January temperature				−0.018**
				(0.007)
Constant	8.162***	8.112***	7.891***	7.873***
	(0.011)	(0.012)	(0.054)	(0.060)
Observations	589,329	543,490	528,624	522,569
Cities	285	244	213	208
τ_{00}	0.123	0.098	0.094	0.092
σ^2	0.890	0.888	0.887	0.887
ρ	0.121	0.099	0.096	0.094

Standard errors in parentheses.
*Significant at 10 percent. **Significant at 5 percent. ***Significant at 1 percent.

These same models are estimated for 2000 in Table 4. Tables 3 and 4 show very closely comparable results. Overall, 12 percent of the variance in real household wages is a function of metropolitan-level characteristics in both 1980 and 2000. Population remains positively and significantly related to real household wages, as does the nonroutineness of a city's occupational structure. Amenities are uncorrelated, all other things being equal, except for winter temperatures, which are weakly significant and negatively related to household real wages.

Overall, these results suggest that the real wage gaps detected earlier do not vanish after we account for differences in the composition of cities' workforces. Rather, households that are highly similar across a host of demographic and housing characteristics, earn different real income levels depending on where they live. Moreover, similar households do better in larger metropolitan areas where, as we have already seen, they also have access to better amenities.

Population Growth in High- and Low-Utility Cities

The preceding suggests that utility levels appear durably different among U.S. metropolitan areas. In a static sense, there appears to be little reason for workers to be indifferent about their location in 1980 and in 2000. As a result, we might detect some movement toward inter-urban utility equalization if cities with high levels of both real income and amenities in 1980 attract a disproportionate number of migrants. To capture these dynamics, we examine differences in population growth rates over our study period. We assume that workers consider values of real wages and amenities in 1980 to be a reasonable signal of future utility levels. This might be an imperfect assumption in an ever-changing world. Yet, when assessing inter-urban differences in utility, workers and prospective migrants have little else to go on.

Because we cannot neatly combine amenity values and real income into a single index, we arrange cities into four quadrants: those with above-average amenities and real income, those with below-average amenities and real income, those that have high income and low amenities, and those cities with low income and high amenities. To facilitate this grouping strategy, we standardize and then calculate a single mean amenity score for each metropolitan area, combining indices for climate, health, crime, transport, education, arts, and recreation.[12] This requires that we weight each kind of amenity equally—no doubt an imperfect assumption, although the different amenity measures are strongly positively correlated, except for crime. Figure 2 presents the relationship between the standardized amenity measure and real income in 1980. In it, we also distinguish between Sunbelt and non-Sunbelt cities.[13]

Top performers in the high-utility quadrant in 1980 include a host of large and dynamic cities, including Washington DC, Chicago, San Francisco, and Boston. Few of these high-utility cities are in the Sunbelt; Atlanta and Dallas are among the exceptions. Most Sunbelt cities lie in the low-utility quadrant, and to a lesser extent in the low real income and high-amenity quadrant. Non-Sunbelt cities are more evenly dispersed throughout the four quadrants. A number of high-utility cities in 1980 are on their way

[12]We also tried including mean January temperature in place of the broader climate measure. Results incorporating this variable were not meaningfully different from those reported below.

[13]We must choose an imperfect method of determining Sunbelt membership, since "Sunbelt" is a rhetorical device rather than a hard and fast dividing line. We define a city as being part of the Sunbelt if it is located in a state that belonged to the Confederacy during the American Civil War. Confederate states constitute typical definitions of the American South, and for much of the twentieth century their development stood in stark contrast to other parts of the country.

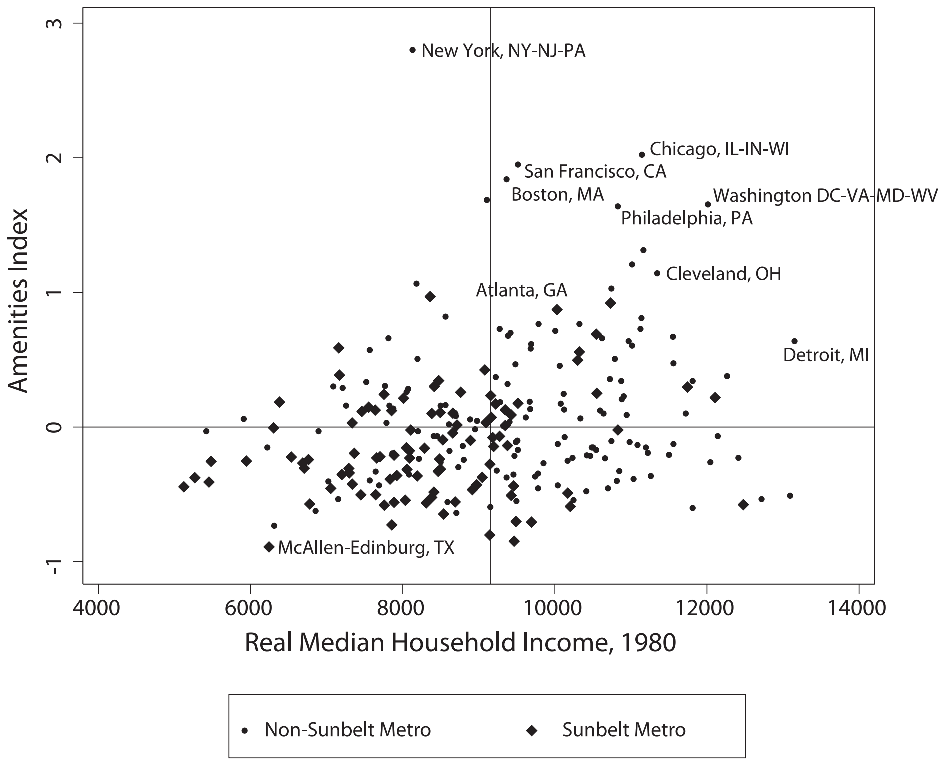


FIGURE 2: Amenities and Real Income in U.S. Metropolitan Areas

down, including Detroit, Cleveland, and Philadelphia. Unsurprisingly, they do not remain in this quadrant if we recalculate based on year-2000 values.

To determine whether population growth rates differ significantly between quadrants, we regress population growth on a set of dummy variables indicating quadrant membership, with the high-amenity, high-wage quadrant as the reference group. Results are shown in Table 5. None of the quadrants have population growth rates that are significantly different from the group with both high real income and high amenities. Moreover, the p-value on the regression indicates that the overall specification is insignificant. In other words, the model with quadrants as covariates does no better at predicting urban population growth between 1980 and 2000 than a model with no predictors whatsoever. This runs counter to the prediction that the highest population growth rates ought to be found in locations with higher than average levels of real income and amenities. If there has been some shock that has led to higher utility in certain cities, whether cheaper housing, higher nominal wages or more pleasant amenities, workers should seize on this opportunity to increase their utility levels by moving from lower- to higher-utility cities. We find no evidence that this has been the dominant rationale for migration over this period.

4. CONCLUSION: REOPENING THE DEBATE ABOUT THE SOURCES OF INTER-METROPOLITAN POPULATION AND INCOME CHANGE

The general spatial equilibrium framework holds that individual workers' mobility decisions, hiring decisions of firms, and builders' choices to supply more housing are the

TABLE 5: Utility as a Determinant of Metropolitan Population Growth Rates, 1980–2000

Dependent Variable: Population Growth Rates	
Low amenities, low real income	0.150
	(0.205)
Low amenities, high real income	0.139
	(0.205)
High amenities, low real income	−0.017
	(0.249)
Constant	0.127
	(0.204)
Observations	239
R^2	0.008
p-value	0.613

Note: Reference group is high income, high amenity quadrant. Standard errors in parentheses.
*Significant at 10 percent. **Significant at 5 percent. ***Significant at 1 percent.

foundational motors of change in a national economy's system of cities. Applying this hypothesis to changes in the U.S. urban system during the latter part of the twentieth century, researchers have focused primarily on worker locational choices, in practice emphasizing amenities and the cost of housing as offsets to spatial differences in nominal wages. In a world where nominal wages can vary due to differences in skills, productivity, or market access, labor supply reaches equilibrium through migration, and real household utility is equalized across locations.

In this paper we have tried to investigate the principal empirical claims that support this framework, using data on metropolitan areas in 1980 and 2000. We find little support for spatial equilibrium defined as real utility equalization across metropolitan areas. Instead, our results suggest that the median household is durably better off in large metropolitan areas, taking into account their nominal wages, tax liabilities, and rents. This real wage premium persists once we account for differences in the composition of urban workforces. Controlling for a host of demographic and housing characteristics, in both 1980 and 2000 around 12 percent of the variation in household real wages is attributable to the city in which a household is located. Additionally, amenities increase, rather than diminish inter-urban utility gaps. According to the evidence presented in this paper, high real wages do not imply consumer disamenities, a finding which stands in contrast to the Glaeser (2008) general spatial equilibrium model, as well as recent empirical investigations such as Albouy (2008) and Gibbons, Overman, and Resende (2011).[14] Finally, inter-urban differences in utility do not appear to drive worker relocations over the study period. The populations of cities that had comparatively high utility levels in 1980 did not grow any faster than cities with low levels of amenities and real income. When individuals make mobility choices, they privilege factors other than nominal wages, housing expenditures, and amenities.

This is not the same as saying that workers disregard nominal incomes and priced and unpriced amenities when making locational choices. In our view, it is more probable that this kind of amenity-seeking behavior is a bigger driver of intra-regional, rather than inter-regional mobility decisions, and hence it has a much smaller influence on long-distance migration than job search and expected nominal income and security. Many

[14]Gibbons et al. (2011) obtain their results from Great Britain, which may indeed have inter-place utility equalization in a way that we cannot detect for the United States.

individuals choose residential location within a region based on housing qualities and costs, amenities and other Tiebout sorting factors.

These kinds of intra-regional movements are far from minor. In the course of articulating how spatial equilibrium plays out in the context of the U.S. urban system, urban economists routinely observe that American workers are highly mobile (see for example, Glaeser and Gottlieb, 2009, p. 988). This is correct, though the scale of such movement is worthy of attention: around 60 percent of annual mobility consistently occurs *within* counties, and a large share of the remainder goes on within metropolitan labor markets (Lansing and Mueller, 1967; Quigley and Weinberg, 1977; Schacter, 2001).[15] All of this intra-urban mobility is likely to be guided by issues of land prices and amenities; this paper has shown that it is simply less clear that these are the primary forces driving inter-urban mobility.

Our findings on inter-metropolitan utility gaps open up three groups of questions about the causes of change in urban systems: the role of amenities; price formation across space; and sequences of change in people and jobs. Let us take each in turn.

First, our results suggest that the field is afflicted with imprecise definitions of what does and does not count as an amenity. For over 30 years, the literature has asserted that the robust correlation between warm winters and post-war changes in the U.S. urban system signifies that amenities have shaped the evolution of that system. But, by any reasonable logic, a wide range of factors beyond January temperatures should count as amenities. When we consider other climatic factors, as well as humanly created amenities such as culture, shopping, or even modified natural landscapes (a good marina or golf course, for example), it becomes difficult to defend the general proposition that amenities compensate urban workers who live in cities where real incomes are comparatively low. Equally important, it is not at all straightforward to assume that the direction of causality moves from amenities to population or income. For any humanly created amenities, the reverse is just as plausibly true. Important endogeneity problems, due to omitted variables as well as reverse causation, could therefore plague existing theory and empirical findings. Contrary to the claims of Partridge (2010), researchers must accept that we are far from having proof that amenities have been an important force in reshaping the U.S. urban system over the last half century.

Second, with regard to price formation, there are quite a number of potential explanations for our findings on the relationships between urban wages, housing markets, and amenities. These explanations vary from ones that quibble only with some facts on the ground, to those that propose different foundational mechanisms driving price formation and the development of the broader urban system. On the former, consider that the real wage premium in large metropolitan areas could arise if cities where nominal wages are high also have an excess supply of housing. Of course, we are told that San Francisco and New York have very tight housing markets, and this result seems plausible, especially when we conflate the larger New York metropolitan area with the island of Manhattan. Nonetheless, sufficiently loose housing markets in large, high-wage metropolitan economies represents one possible partial explanation of our results that merits further exploration.

The real wage premium in large cities could also persist if dynamic, innovative industries that are strongly represented in those large metropolitan areas have insufficient access to the right kind of workers. Those labor shortages could be based on worker characteristics that are often unmeasured in standard surveys, but which may have large

[15]Indeed, even some proportion of interstate moves, which regularly make up as much as 20 percent of annual American mobility, likely represents movement within a urban region, as there are numerous large metropolitan areas, including New York, Boston, Chicago, and St. Louis that span multiple states.

material impacts on productivity. After all, not all 28-year-old white male college dropouts are Mark Zuckerbergs. The presence of workers with certain valued attributes would push nominal wages up; a limited national and global supply of these workers ensures that in-migration is not sufficient to fully bid wages down through the housing market. This real wage premium could be seen as a temporary friction to the general spatial equilibrium condition, but then it would remain for the modeler to show why it is temporary and for how long.

In our view, however, the Mark Zuckerbergs of the world have chosen the Bay Area over Phoenix not because the former offer a nicer climate or hipper cafes. Instead, these workers are there because certain industries uniquely suited to their talents are there. These workers moved to jobs and industries and not the other way around. More generally, product and labor markets in certain innovative industries may have rents attached to them that cannot be fully eroded through in-migration. This is because these sectors demand workers with particular (perhaps hard-to-observe) skills, and these workers are in reasonably tight supply. The real wage premium that is associated with such rents declines only when the production process itself evolves to reduce the skill content of work, rendering jobs in a given sector more easily contestable from many locations.

A more conventional version of this explanation would be simply: there is higher worker productivity in certain cities, and in historical perspective, those cities that had "resurgent" income performance from 1990 on are those with these higher productivity levels. But this is now a totally different kind of explanation from "jobs to people" story that dominates the work reviewed in this paper. If productivity suddenly turned higher in those cities because bigness once again became economically effective, it is because different industries located there from what had formerly dominated their economies. Put more simply, manufacturing left places like New York in the 1960s and 1970s, and somewhat later a set of new industries emerged to dominate the regional economy. Industries like finance in New York and high-technology in San Francisco pay high wages and are highly agglomerated.

This perspective is crystalized in the product cycle hypothesis, in which the dynamic between innovation and the routinization of production plays a crucial role in shaping overall patterns of urban economic welfare. Unlike spatial equilibrium, the product cycle makes firms and industries foundational in shaping differences in metropolitan economic performance. Industries or products move through phases of development, typically becoming progressively more capital intensive and less skill-based as they mature. In spatial terms, this logic implies that those regions specialized in the early phases of product cycles, or in industries that are permanently innovative, will require workers with high levels of skills and pay them accordingly. Some regions will have higher nominal wages than others because not all regions will be specialized in such nonroutine activities.[16] Labor supply scarcity in sectors that are early in the product cycle will ensure that these higher nominal wages are not fully bid down in real terms.

From this vantage, the real spatial wage and utility differences detected in this paper are not temporary conditions to be eliminated through migration. Instead they are durable outcomes that arise from the disruptive forces of ongoing development of the economy. This view, found in a long line of thought from Schumpeter (1934) to North (2005), rejects the representation of the economy as something that could ever actually realize an equilibrium distribution of resources, and in particular would be uncomfortable with the highly restrictive equilibrium condition of "real spatial utility equalization" as defined in general spatial equilibrium theory. This position is quite the opposite of that

[16]This is precisely our interpretation of the relationship between wages and the industrial nonroutineness index included in Model 3 in Tables 3 and 4.

defended by Rappaport (2007), who sees the spatial economy in terms of springing back to this equilibrium condition after shocks, as a matter of time. Ultimately, this is an epistemological difference, with some theorists choosing to see "shocks" as aberrations and subsequent adjustments as the heart of the economic process, and others, who see disruption and change as permanent and as ongoing as movements toward re-balancing demand and supply.

This epistemological debate about price formation is mostly ignored in regional science, where the equilibrium view dominates. As the present discussion suggests, we see this as a problem not least because each carries strong implications for methods. Assumptions as large as those that go into general spatial equilibrium thinking—of highly elastic tradeoffs between housing choice, wages, quality of life, and housing supply—ought to be subject to some evaluation, even if imperfect. As Leamer (2010) argues, we may be better off embracing observational, nonrandomized results, rather than requiring experimental evidence as an prerequisite for empirical work, especially where such evidence is basically inaccessible. And whatever econometric methods are used, they should be triangulated with external validation—on the ground historical-geographical knowledge—to see whether they are plausible or not. We return to this point in a moment.

Third, our results raise questions about causal sequencing: what set off the change in the U.S. urban system that spurred the development of Sunbelt, hurt the economies of much of the Northeast and Midwest, stimulated resurgence in New York and other selected older and colder cities, and allowed for continued population and income growth on the West Coast? General spatial equilibrium theory, and its more modest cousin, amenities theory, hold that such sequences of change can be set off when individuals and households are given access to environments that were previously inaccessible to them: thus the importance of air conditioning and better highways to unleashing massive population flows between regions. The initial cause is that people move; subsequently jobs follow. Translated into an image, these theories suggest that massive numbers of people woke up in the late 1950s and early 1960s and decided it was now time to move to the Sunbelt. From this, of course, all theorists would agree that there are then infinite incremental and circular relations that reshape the spatial economic system, between population/labor supply and firms/labor demand.

But regional science uses econometric methods that cannot actually illustrate what set off the sequence of developmental events that led to the metropolitan system we have today. Instead, it leaps from the observed correlations between nominal wages, housing cost, and amenities to a position that places amenities at the start of the story, presuming a particular sequencing that holds through many waves of migration; while at the same time claiming that firms are spatially indifferent "putty" production processes that can rather flexibly react to such changes in factor supplies.

If we cannot find evidence that there is spatial utility equalization today, nor a recent tendency toward it many decades after the development of the Sunbelt began, then how likely is it that wages and amenity conditions in the South were good enough in, say, 1947, to attract large numbers of northern workers away from their jobs? Let us now use Leamer's "external validation" condition to think about this question. In 1947, Congress passed the Taft-Hartley amendments to the National Labor Relations Act. Nearly all Southern states responded by becoming Right-to-Work states where unionization would be (and still is) much more difficult than in the Northeast or Midwest, thereby creating a distinct labor relations system in the South. Just 2 years later, Congress commissioned a report entitled "Why Industry Moves South" (NPA Committee of the South, 1949), whose goal was to try and understand why 88 plants had relocated to the nascent Sunbelt. Both the legislative change and this report predate the widespread adoption of air conditioning or the construction of the Interstate Highway System.

This historical context points to an alternative set of drivers of recent change in the American urban system. Instead of being led by workers seeking warm sunny winters and sprawling suburbia, the story of the burgeoning Sunbelt and the declining Frostbelt starts with firms moving from the Northeast to the South and West in sectors like mill processing (textiles etc.) and other industries where work was being routinized. These were firms in sectors at the mature end of the product cycle; industries whose innovative days were mostly behind them. Many such firms, once locked into high-wage and highly unionized Northern cities, found their production processes increasingly easy to routinize and mechanize. Routinization reduced the skill level required in the labor force, which stimulated new locational freedom. Firms seized on this freedom, relocating to cities in the Sunbelt that offered cheap land and workers, and little regulation. These and other firms were and are not spatially indifferent, but rather they have semifixed factor coefficients at each stage in their life cycle, and their locational choices are driven by the uneven geographical distribution of factors as well as transport costs. This industry-specific set of constraints and opportunities, much more than workers' desires for warm winters, spurred the development of the Sunbelt and the decline of the Frostbelt. Subsequently, New York, Boston, San Francisco, and other cities boomed as demand grew for an emerging set of industries in early phases of the product cycle that intensively require complex and nonroutine activities, like software engineering and finance. Work in these sectors tends to be spatially concentrated in large metropolitan areas, because of high inter-firm transaction costs and the need for access to a large pool of labor due to their high turnover of skilled workers.

Once the initial plants located in the Sunbelt, subsequent waves of migration from North to South and West were likely driven first by the slowing down of job creation in many Northern industrial cities, and later by the growing structural unemployment there. This fits with a wealth of research indicating that unemployment strongly conditions mobility decisions for U.S. workers (for a review, see Greenwood, 1997). Structural unemployment in the Northeast and Midwest arose as the wide range of capital-intensive traditional manufacturing industries that dominated these regions entered mature phases of the product cycle. It just so happens that the places where wages have been low also have warmer winters than the places employment has been leaving for the last half-century or more in the U.S.; a coincidence, but not an initial cause. It is probably also coincidental that, in the words of the *Economist* magazine (2010), "the rush for both sun and sprawl has now reversed." Currently, states like Alaska and North Dakota have highest rates of employment growth, but not because of a shift in preferences toward long, harsh winters. Rather than household decisions, we suggest that the initial forces that set off the long transformation of the American urban system were choices made by firms, conditioned by industry-specific tension between innovation and routinization. Households initially made choices under the constraint of finding employment, not the search for weather and amenities. This alternative framework, grounded in theory from the economic geography of production and institutional economics is but one possible way to understand the deep causes of change in the U.S. urban system. It is unproven, but suggests additional avenues worthy of investigation.

More broadly, the evidence presented here suggests that regional science researchers seeking to understand the evolution of the American urban system need to become more expansive in the hypotheses they are willing to test. Amenities theory needs a great deal of definitional work and ways to look into directions of causality; we need to open up much more work on spatial price formation (housing, wages, amenities); and we need to reintegrate a sense of sequence into the evidence we gather. Only in this way will we be able to get at the roots of major changes in the shape of urban systems. It follows, as well, that the welfare properties of urban systems can only be understood in light of how they were caused, and policies for shaping urban systems in the future can only be assessed if we know what causal mechanisms they are trying to affect.

4. DATA APPENDIX

Places Rated Almanac Data

- Climate & Terrain: very hot and very cold months, seasonal temperature variation, heating- and cooling-degree days, freezing days, zero-degree days, ninety-degree days.
- Health Care & Environment: per capita physicians, teaching hospitals, medical schools, cardiac rehabilitation centers, comprehensive cancer treatment centers, hospices, insurance/hospitalization costs index, flouridation of drinking water, air pollution.
- Crime: violent crime rate, property crime rate.
- Transportation: daily commute, public transportation, Interstate highways, air service, passenger rail service.
- Education: pupil/teacher ratio in the public K-12 system, effort index in K-12, academic options in higher education.
- The Arts: museums, fine arts and public radio stations, public television stations, universities offering a degree or degrees in the arts, symphony orchestras, theatres, opera companies, dance companies, public libraries.
- Recreation: good restaurants, public golf courses, certified lanes for tenpin bowling, movie theatres, zoos, aquariums, family theme parks, sanctioned automobile race tracks, pari-mutuel betting attractions, major and minor league professional sports teams, NCAA Division I football and basketball teams, miles of ocean or Great Lakes coastline, inland water, national forests, national parks, or national wildlife refuges

Index of Industrial Nonroutineness

To construct our measure of industrial nonroutineness, we combine IPUMS Census microdata with data from the 1991 Revised Fourth Edition of the *Dictionary of Occupational Titles* (DOT). The DOT was created in 1939 as a means of evaluating and placing job seekers in the newly created U.S. Employment Service. We select several DOT job characteristics that reveal the intensity with which a specific job demands nonroutine interpersonal interactivity, nonroutine analytics (or problem solving), nonroutine manual activity, routine manual, or routine cognitive tasks. Our index of nonroutineness combines analytic and interpersonal components of nonroutineness. DCP, our chosen measure for nonroutine interactive tasks, refers to activities in which a "worker is in a position to negotiate, organize, direct, supervise, formulate practices, or make final decisions . . . negotiating with individuals and groups" (U.S. Department of Labor, 1991, 10–1). Air traffic controllers as well as litigators score highly on this metric. GED-MATH, describing nonroutine analytic tasks, measures general educational development in mathematics, and ranges from basic addition and subtraction to the application of advanced calculus. EHF, our measure for nonroutine manual tasks, indicates physical coordination. Professional athletes, firefighters, and airline pilots score highest on this indicator. STS measures routine cognitive tasks, and involves "complying with precise instruments and specifications for materials, methods, procedures, and techniques to attain specified standards" (U.S. Department of Labor, 1991, 10–4). Machinists, bookbinders, and mechanical engineering technicians all achieve high scores on this metric. Secretaries, dental assistants, and textile sewing machine operators score highly on FINGDEX, our indicator of routine manual work.

TABLE A1: Selected Task Variables from the Dictionary of Occupational Titles, Revised 4th Edition

Task Type	Name	Description
Nonroutine interactive	DCP	Direction, control, and planning of activities
Nonroutine analytic	GED-MATH	General educational development in mathematics
Nonroutine manual	EHF	Eye-hand-foot coordination
Routine cognitive	STS	Sets limits, tolerances, or standards
Routine manual	FINGDEX	Manual dexterity

These measures correspond to the task characteristics used by Autor et al. (2003) in their seminal study of the skill structure of U.S. employment. We link this DOT data to Census workers, in order to describe the distribution of task requirements in the economy. To do so, disaggregated occupational data is summed to the level of over 500 Census Occupation Codes, using a crosswalk published by the National Crosswalk Service Center. We assign task means to individual workers in the 1 percent metro IPUMS sample in 1980 and the 5 percent sample in 2000. We match tasks to all noninstitutional, full-time employed workers between the ages of 16 and 64. Each worker receives task means based on their occupation for each of the five task categories. These task means vary continuously on a scale of 0 to 10, with 10 indicating that a given occupation makes comparatively intensive use of a given task characteristic. Hence, an occupation scoring a 10 on the DCP metric would be intensive in nonroutine interpersonal tasks as compared with another occupation scoring a 3 on the same scale. Because we cannot directly observe individual Census workers, we assume that workers in the same occupation have the same distribution of task intensities.

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