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ABSTRACT

More than 17 percent of households in American central cities live in poverty; in American suburbs, just 7.4 percent of households live in poverty. The income elasticity of demand for land is too low for urban poverty to be the result of wealthy individuals' wanting to live where land is cheap (the traditional urban economics explanation of urban poverty). Instead, the urbanization of poverty appears to be the result of better access to public transportation in central cities, and central city governments favoring the poor (relative to suburban governments).

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I. Introduction

In 1990, 17.5 percent of the population in the central cities of MSAs lived in poverty compared with just 6.9 percent of the population in suburbs. The gap between city and suburban poverty rates is just as large for people who have recently moved between MSAs as it is for long-time residents. Hence we argue that the concentration of poverty in central cities occurs mainly because such cities attract poor people, not because central cities make people poor.[1] While it is also true that substantial poverty exists in many rural areas, herein we focus on the well-documented fact that within U.S. metropolitan areas, the poor generally live in central cities and middle-income individuals generally live in suburbs (Margo 1992, Mieszkowski and Mills 1993, Mills and Lubuele 1997).[2]

This puzzle of why the poor live disproportionately in cities is one of the central questions in urban economics. A primary triumph of urban land use theory (Alonso 1964 and Muth 1968, or AMM) is its ability to explain the urban centralization of the poor. This monocentric urban model argues that richer consumers want to buy more land and therefore choose to live where land is cheap. The model can explain why the poor live in city centers as long as the income elasticity of demand for land is greater than the income elasticity of travel costs per mile (which is often thought to be one). The AMM model remains the textbook explanation of urban poverty (see Mills and Hamilton, 1995).

While elegant, the AMM model fails empirically. Its explanation hinges on a large income elasticity of demand for land area itself. While the income elasticity of total spending on housing may indeed by greater than one, we find using both aggregate and micro-data that the income elasticity of demand for land area is unlikely to be more than 0.4. This upper bound is extremely robust to alternative specifications. Our findings echo

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[1] Economic theorists have argued that there are poor people in cities because cities make people poor due to the social milieu in cities . The work of Case and Katz, (1991) and others suggest that the concentration of the poor into dense areas generates harmful local spillovers that exacerbate social problems.

[2] Here and below, "poverty" is based on the standard Census Bureau classification which establishes family income thresholds based on family size and number of dependent children under 18.

those of Wheaton (1977) who also provides empirical evidence that AMM cannot explain the sorting of the poor into cities.

More generally, housing market explanations cannot explain much of the urban centralization of the poor. The cost of housing for the rich, relative to the cost of housing for the poor, does not decline in suburbs. Rather, across metropolitan areas, the urban centralization of the poor is greatest in those areas where the poor have the greatest housing market incentive (relative to the rich) to suburbanize. Our evidence on housing prices also casts doubt on the importance of filtering and zoning explanations of urban poverty.[3] Nor is the urban centralization of the poor primarily the result of the poor choosing to live where the housing stock is older.

Authors who have accepted the empirical weakness of the AMM model have often looked at crime, schools and other urban social problems to explain the flight of the rich from cities (see Mieszkowski and Mills 1993, Mills and Lubuele, 1999). In many ways, such arguments are certainly right. After all, people who leave the cities often cite these urban social problems as a primary reason for their exodus (see Katz, Kling and Liebman, 1999). The rich appear willing to pay to avoid proximity to the poor, perhaps because of factors like low-quality public schools and crime.[4] However urban social problems are not really explanations of urban poverty. Such problems derive from the very concentration of poor people in cities rather than anything intrinsic to cities themselves.[5] Urban social problems therefore create a multiplier effect where an initial attraction of the poor to cities will then be greatly magnified to create significant rich-poor segregation. But to understand the urban centralization of poverty, we must understand the initial underlying forces attracting the poor to cities.

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[3] For recent research on the impact of zoning on the locational choice of different income groups see Gyourko and Voith (1997), who attribute a good deal of the sorting of the wealthy into the suburbs to mortgage interest deduction.

[4] More educated people are more likely to migrate out of a high crime center city than the less educated. For people with an education level greater than 12 years, an increase of one crime in the central city reduces their numbers in city by 1.54. Conversely, for people with less than 12 years of schooling, the out-migration response is .77 (Berry-Cullen and Levitt 1999).

[5] Glaeser and Sacerdote (1999) present evidence suggesting that one-half of urban crime appears related to the selection of the crime-prone individuals into cities.

We believe that the empirical evidence supports the importance of transportation modes in explaining why the poor live in cities. Public transport is inexpensive but slow. LeRoy and Sonstelie (1983) argue that low cash fixed costs but high fixed and marginal time costs make public transportation differentially attractive to the poor. Cars, in contrast, are expensive and fast. High fixed and marginal cash costs but low marginal time costs make cars differentially attractive to the rich. The group with the lower marginal cost of commuting should live further from the metropolitan work center.

Strong empirical evidence supports the importance of public transportation in explaining the location decisions of the poor. Within cities, proximity to public transportation has large explanatory power for the location of the poor. This holds for train stops in Atlanta, Boston, Chicago, Portland, and Washington and for bus stops in Los Angeles.

Of course, transit access is endogenous and public transportation may be structured to service the poor. To address this possible endogeneity, we first examine the effect of proximity to subways in the outer boroughs of New York City. No subway stops have been added since 1942 and so at least some claim might be made that subway-stop locations were predetermined prior to the evolution of many neighborhood characteristics. Again, the large explanatory power of public transit access for location of the poor accounts for most of the negative connection between proximity to the city center and urban poverty. To further address endogeneity, we look at rail expansions in Atlanta, Portland, and Washington D.C. in the 1980s. These three extensions were explicitly designed to connect central city areas to richer suburbs and not to improve access in poor areas. Here, the census tracts that gained access to public transportation became poorer.

Across metropolitan areas, there is a strong positive correlation between public transportation use in the central city (relative to the suburbs) and the concentration of poverty in the central city; this holds even when we look at the public transportation use of only the rich. Detailed examination of different metropolitan areas suggests a three-ring model of urban location: an interior walking ring where rich people live, a middle public transportation ring where poor people live, and an exterior car ring where rich people live. One implication of the transport mode model, which is empirically true, is that where only cars are used, the rich tend to live closer to the city center. We also find, again supporting the model, the when subway systems lead to a larger public transportation zone, income stays low in this enlarged transport zone.

A second underlying force attracting the poor to cities are more redistributive government policies. The poor are 9.7 percentage points more likely to live in a subsidized public housing unit and 23 percent more likely to receive significant government income transfers if they live in a central city rather than a suburb.[6] Across metropolitan areas, the urban concentration of the poor is greatest where the central city is most differentially generous to the poor. Within older metropolitan areas, we find that city geographic borders have large effects on the location of the poor (holding distance from the city center constant).

The ability of different transportation modes to explain the urban concentration of poverty was surprising to us. But perhaps it shouldn't have been such a surprise. After all, cities arise from the desire to eliminate transport costs for goods, people and ideas. From this point of view, it follows naturally that locational patterns within cities result from transport technologies.

II. Preliminary Facts and Discussion of Data Sources

In this section, we review basic facts on United States urban poverty based on 1990 Census data. Throughout the paper, we will refer the reader to Appendix II for a discussion of data sources and variable definitions.

Table 1—Basic Facts: In Table 1, we present the basic stylized facts that we are trying to explain. The data in this table are based on the Individual Public Use Micro-Sample (IPUMS) 1990 sample. In the first column, we give the poverty rate for members of the

population subgroup who are living in the central cities of metropolitan areas (based on the census designation of central cities and using the formal census definition of whether a household is in poverty). In the second column, we provide the poverty rate for comparable persons living in the metropolitan area outside of the central city (which we will refer to as suburbs). In the third column, we show the comparable poverty rate for those who live outside of metropolitan areas altogether.

The first row shows the poverty rate for all heads of households between ages 18 and 65. The poverty rate is much higher in the central city than in the suburbs. The poverty rate outside of metropolitan areas is also high, but that is not the focus of this paper, which aims to explain intra-metropolitan area sorting. The second and third rows look at sorting by race. It is clearly true that a significant amount of sorting occurs within each racial group, although a non-trivial amount of urban poverty is explained by the greater prevalence of African-Americans living in central cities. The greatest degree of urbanization of poverty occurs in the mid-west followed by the east. Relative poverty is much less in the south and lowest in the west. The final rows of Table 1 document that recent migrants to cities are as poor as long term urban residents. The most natural explanation of this fact is that cities are attracting the poor, not just making them.

Inside Cities—Figure 1 and 2 and Table 2: The poverty rates enumerated in Table 1 conceal the considerable heterogeneity that exists within some metropolitan areas. Using aggregate tract level data from the 1990 decennial census, Figures 1 and 2 illustrate the connection between income and distance from the city center.[7] The figures plot the fitted value of the logarithm of tract median household income against tract distance from the central business district based on a fourth-order polynomial regression. Central business district location is from the 1982 Census, which was based on polls of local leaders.

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[6] Elsewhere (Glaeser, Kahn and Rappaport, 1999), we have tested a set of theories about why big cities redistribute more per-capita than smaller cities.

[7] Census tracts are geographic units delineated by the Census Bureau to contain between 2,000 and 4,000 households. See Appendix II for further details.

Figure 1 shows the income-distance relationship for four older metropolitan areas (New York, Chicago, Philadelphia and Boston). In these cities (and in most other older cities) there is a clear u-shaped pattern. The census tracts closest to the city center are often among the richest in the metropolitan area. The poorest census tracts come next with the bottom of the curves generally lying between and three and five miles away from the central business district. After that point income rises again. In most cities, income begins to fall again in the outer suburbs.

Figure 2 shows the income-distance relationship for four newer cities (Los Angeles, Atlanta, Houston and Phoenix). In these cities a different pattern emerges. Rather than a u-shaped pattern, median income shows nearly a monotonic increasing relationship with distance from the central business district. As in the older cities, income sometimes falls in the outer suburbs.

Table 2 shows the results from regressing tract median household income and tract poverty rates on tract distance from the central business district using a spline with cut points at three (3) miles and ten (10) miles.[8] Columns 1 and 4 show that across all U.S. metropolitan areas, poverty drops most and income rises most within three miles of the central business district.

The remaining columns of Table 2 examine two subsets of metropolitan areas, which we refer to as "new cities" and "old cities". Each subset contains six metropolitan areas, and together the subsets represent the twelve largest primary metropolitan statistical areas in the United States. The six old cities (New York, Chicago, Philadelphia, Detroit, Boston and San Francisco) were among the ten most populous U.S. cities in 1900. In contrast, the six new cities (Los Angeles, Atlanta, Houston, Dallas, Miami and Nassau-Suffolk) had much smaller populations in 1900. For the old cities (Columns 2 and 5), moving away from the city center in the zero-to-three mile interval, poverty rises and income falls with distance from the CBD. Thereafter, poverty falls and income rises with distance though this effect becomes negligible after ten miles. For the new cities (Columns 3 and

6), moving away from the city center in both the zero-to-three and three-to-ten intervals, poverty falls and income rises with distance from the CBD. Beyond ten miles, there is a slight reversal with poverty increasing and income decreasing with distance from the CBD.

Thus we see that there are two very different patterns among American metropolitan areas. In older cities, with established downtowns and centralized employment, the rich often live closest to the city center. In newer cities, with decentralized employment and with a physical infrastructure built for vehicle use rather than walking, income rises monotonically with distance from the central business district.

A last stylized fact is that the sorting of households by income within metropolitan areas is not new. Figure 3 shows the income-distance relationship in 1910 for New York City.[9] The richest wards appear to be located between five and ten miles from the CBD. Thereafter income declines with distance from the CBD. While the relatively small number of wards make statistical significance weak, a polynomial fits the same inverted u-shaped relationship between income and distance that we see among the older cities in 1990. The fact that the poor lived close to the central city in 1910 suggests that explanations for urban poverty which rely on current housing market conditions can not fit the data well.[10]

III. Empirically Appraising the AMM Explanation

The Alonso-Muth-Mills (AMM) model is the masterpiece of urban theory. The heart of this model is a compensating differential: housing and land prices decline with distance from the central business district (CBD) to compensate individuals for longer commutes. If commuting costs rise by one dollar per day with each unit of distance, then individual

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[8] These points were chosen fairly arbitrarily. Results are not sensitive to using alternative, similar, spline cutoffs.

[9] Because we do not have income data for 1910, we instead construct a predicted median income based on 1910 occupational data and 1950 mean incomes across occupations. We have done this for Chicago and Boston as well and we find similar results.

willingness to pay for total land consumed must decline with distance by one dollar per day.[11] Thus the change in willingness to pay per unit of land falls with distance by one dollar divided by units of land consumed.

The model can also explain sorting within cities. The more a group is willing to pay (per acre of land) for locations close to the CBD, the closer to the CBD they will indeed live. Where two groups live side-by-side, the group which has a willingness to pay that rises more sharply with proximity (at the border point) will live closer to the city center. As the slope of the willingness to pay per acre of land equals commuting cost per unit distance divided by total acres consumed, the poor will live closer to the city if:

$$(1) \qquad \frac{\text{Commuting Cost of Poor}}{\text{Land Area of Poor}} > \frac{\text{Commuting Cost of Rich}}{\text{Land Area of Rich}}$$

This equation can be transformed into an elasticity-type condition:

$$(1') \quad \frac{\text{Poor's Land}}{\text{Poor's Income}} \frac{\Delta\text{Land Area}}{\Delta\text{Income}} > \frac{\text{Poor's Commuting Cost}}{\text{Poor's Income}} \frac{\Delta\text{Commuting Costs}}{\Delta\text{Income}},$$

where Δ*Land Area* equals the land area consumed by the rich minus the land area consumed by the poor. This equation is a discrete approximation of the more general condition in a model where incomes fall along a continuum. In that more general model, poor people will live closer to the center if the income elasticity of demand for land area is greater than the income elasticity of commuting costs. (see Wheaton 1977, or Mills and

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10 Gin and Sonstelie (1992) argue that streetcars were too expensive for ordinary people at the turn of the century. As such, the poorest citizens walked and were willing to pay most for housing closest to jobs.

11 In some versions of the AMM model (Muth, 1969, DeSalvo, 1977), housing and land are the same and this leads to a focus on the income elasticity of demand for housing rather than land. More generally the total cost of housing equals the cost of structure plus the cost of land. This total cost of housing must fall with distance. Therefore unless construction costs vary with distance from the CBD (which does not appear to be the case), the compensating differential must occur through the price of land. Even when structure density varies, as long as the density is chosen optimally for marginal changes, all effects work through land price. The Muth and DeSalvo models implicitly assume that the income elasticity of demand for land and for housing are identical, so they are also consistent with our exclusive focus on the income elasticity of demand for land.

Hamilton, 1995).[12] Thus, we focus on estimating the income elasticity of demand for land after first discussing the empirical estimates of the income elasticity of commuting costs.

Theory suggests that the income elasticity of commuting costs per mile should be close to one. The marginal cost of an extra mile spent commuting includes both time and cash costs, but generally cash costs per mile are small relative to time costs. For public transportation, the marginal financial cost per mile is often zero. For automobiles, these costs are also likely to be small. Valuing time at either the wage rate, or at some constant fraction of the wage rate (as most empirical work assumes, see Small, 1992), implies a unitary income elasticity of commuting costs.[13]

However, some urban research on commuting costs has reported empirical evidence of smaller commuting cost elasticities (see Small 1992 and Calfee and Whinston 1998). The latter paper uses a contingent valuation survey where respondents with different income levels were asked about their willingness to pay for a shorter commute. There may be reasons to be suspicious of subjects' accuracy in answering these abstract questions. Empirical work on household residence and commuting patterns, in contrast, finds income elasticities greater than one (Bajari and Kahn, 2000). Given such inconclusive empirical estimates, we use the theoretically predicted unitary elasticity of commuting costs with respect to income as our benchmark value.

Our objective now is to estimate the income elasticity of demand for land, and to compare this elasticity with the benchmark value of one. While there is a large empirical literature on the income elasticity of demand for housing as a whole, there has been little work on the income elasticity of demand for lot size. Our basic household level regression is:

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[12] In the case of two income groups, the rich will live further away if ratio of land consumed by the rich relative to the land consumed by the poor is greater than the ratio of commuting costs per mile for the rich relative to commuting costs for the poor.

[13] For example, if time costs 15 dollars per hour, cars drive at 30 miles per hour (the average rate in our empirical work on driving speeds discussed later) and cars cost 20 cents per mile, then the income elasticity of commuting costs is .71.

$$(2) \qquad Log(Lot\ Size) = \alpha + \beta * Log(Income) + Other\ Controls + \varepsilon,$$

Our primary data source for this exercise is the 1995 American Housing Survey (AHS), which provides us with information on the individual incomes, personal characteristics and lot size for single family homes.

The first two regressions of Table 3 show results from estimating equation (2) using as observations individuals who own single-family homes for which we have data on lot size. The OLS regression in Column 1 estimates a 0.108 income elasticity of demand for lot size: as income doubles, lot size increases by 10 percent. A common issue throughout the income elasticity literature is the possibility that individuals' current reported income may misrepresent the actual permanent income on which they may base their purchasing decisions. To address this, Column 2 instruments for income using years of schooling.[14] The resulting IV estimate of the income elasticity of demand for lot size is 0.299.

Estimating income elasticity using only single family homes is surely problematic, especially as much of the population in most large cities lives in multi-family dwellings. Unfortunately, we do not have data on lot size for multi-family dwellings. To overcome this problem, we have constructed a lot size variable for apartment residents. For these buildings, we have taken interior area and multiplied it by 1.5 to find total area consumed by each household. This multiple is relatively arbitrary and is meant to accommodate hallways, lobbies and external space. We then divide by the number of floors in the apartment building to calculate land area per household. Using this constructed measure of land consumption, Columns 3 and 4 report OLS and IV estimates of the income elasticity demand for land of 0.092 and 0.019, respectively. That instrumenting reduces the estimated elasticity occurs because better-educated individuals tend to live in taller buildings, which in turn use less land space per household. Stratifying the AHS data by metropolitan area, and running 34 regression estimates of equation (1), we find additional evidence that the income elasticity of demand for land is low. The ordinary least squares

[14] Schooling is an invalid instrument if it has a direct effect on the demand for land, which it may have. For our estimates to be biased downwards, however, schooling must have a direct negative effect on the demand for land, which is possible but seems unlikely to us.

estimates of the income elasticity of demand for land is less than 0.4 in all metropolitan areas, and the estimate is greater than 0.3 in only two areas.

Probably the strongest component of the income elasticity of demand for land is the preference by high-income households to live in single-family detached housing. Therefore, in regressions (5) and (6), we pool the single-family home lot size variable with the estimated per household lot size variable for apartment dwellers. Doing so yields an OLS estimated income elasticity of 0.44 and an IV estimated income elasticity of 0.36. That these are the largest of the various income elasticity estimates confirms the primary role of demand for single detached housing in contributing to high income households' demand for land. But even these higher estimates are below the unitary income elasticity required by AMM to explain income location patterns.

One alternative view is that richer individuals don't care about owning large quantities of land themselves. Instead, they want to live in lower density communities which may have fewer social problems and other public amenities. Estimating the income elasticity of demand for land based on individual lot size would therefore underestimate the true income elasticity of demand for land. To examine such a possibility, we look at the relationship between median family income and average household land use at the tract level. Of course, such an approach cannot account for the large amounts of tract land space that may be used for commercial and other non-residential, "non-open space" purposes. Another advantage of tract level analysis is that we can control for distance from the Central Business District in our regressions

In regression (7), we find an income elasticity of 0.23 at the tract level. This estimate changes little if we instrument using education, and since we are using median income at the tract level the transitory income problem is much less likely to be severe. Overall, our results show a quite consistent pattern where the elasticity of the demand for space with respect to income lies between 0.1 and 0.4. If these elasticities are correct, then the AMM theory can only explain sorting if the income elasticity of the cost of commuting time were lower than 0.3, which seems implausible.

A More General Approach to the Housing Market

The previous section focused on the elasticity of demand for land. When the very particular conditions needed for the Alonso-Muth-Mills hold, the income elasticity of demand for land is the key to understanding whether housing markets explain the poor living in cities. But there are other housing market phenomena including exclusionary zoning provisions (which mandate a minimum suburban house size above that desired by the poor) and filtering (the large urban stock of older, low-cost housing) which would lead to the poor living in cities. Housing market forces will cause the sorting of the poor into cities, if they lead the prices for the housing of the poor to be relatively more expensive in suburbs. To evaluate this possibility, we calculate the following quantity:

$$(3)\ \text{Housing Incentive} = \sum_j \left(\text{Price}_j^{City} - \text{Price}_j^{Suburb}\right) * Quantity_j^{Poor},$$

where "j" indexes housing attributes, $Price_j^{City} - Price_j^{Suburb}$ reflects the difference in prices between cities and suburbs and $Quantity_j^{Poor}$ reflects the quantity of attribute j consumed (on average in both locations) by the poor. When housing consumption levels are fixed, this quantity reflects the financial incentive created by the housing market for the poor to live in suburbs (so negative values measure the financial incentive for the poor to live in cities).[15]

To estimate the price differences, in Appendix Table 1, we use the 1995 American Housing Survey to perform a standard housing price hedonic regression:

$$(4)\ .075 * Housing\ Price = \alpha * CC + \sum_j \beta_j Characteristic_j + \sum_j \delta_j * CC * Characteristic_j + \varepsilon$$

where CC is a dummy variable that takes on a value of one if the house is in the central city. The dependent variable is the self-reported housing value times .075. Mutiplying by .075 is meant to convert the price of a house into an annual flow cost (assuming a 7.5

[15] In previous versions of this paper, we have addressed the situation where housing bundles adjust to locations. This significantly complicates the analysis but does not appear to change the basic conclusions.

percent interest cost). The interaction terms (δ_j) represent the extra price of characteristic j in the central city. The regression also includes a complete set of metropolitan area dummies. Appendix Table 1 reports our estimate of the basic prices (β_j) and the added central city premia (δ_j). At the bottom of Column 3, we report the total annual financial incentive created by housing prices for the poor to live in suburbs (i.e. the sum over the various housing market characteristics of the central city premium multiplied by poor households' mean quantity consumed). The -\$149 value implies poor households' mean housing consumption bundle is indeed less expensive in cities than in suburbs, though we consider and annual savings of \$149 to be quite small.

To see if this phenomenon is general, we ran run separate housing regressions using the 1990 Census for 86 metropolitan areas. For each metropolitan area, for each housing attribute, we calculate central city premia from rental price regressions. Again, we interact these premia with the housing consumption choices of the poor (on average) in the metropolitan area as a whole. In 57 cases, the poor face a premium for living in cities. In 29 cases, the poor face a premium for living in suburbs. Across MSAs, there is a 363 dollar annual extra cost associated with living in the cities for the poor. This result differs slightly from the AHS, and in this case we tend to favor the AHS results because they are based on a much better set of housing characteristics. However, the findings from the Census certainly suggest that these results are not particularly strong.

Of course, basic urban economics never suggested that urban housing should be cheap. The critical question is whether it is cheaper for the rich or for the poor. To answer this question, we estimate the housing incentive for the rich, i.e. $\sum_j \left(\text{Price}_j^{City} - \text{Price}_j^{Suburb}\right) * Quantity_j^{Rich}$ again using the 1990 census and the American Housing Survey. In Appendix Table 1, we show that this quantity is negative for the rich in the American Housing Survey. Indeed, the housing incentive for the rich in AHS is -590 dollars, which is much larger than the housing incentive for the poor. Since the housing incentives for the rich to live in cities are much stronger than the incentives for the poor, it is hard to believe that housing markets are leading the poor to live in cities.

Across metropolitan areas, we find that in 52 out of 86 metropolitan areas, the rich face a price premium for living in suburbs. Figure 4 shows the price premia of central city living for the rich and poor respectively. The values for the poor are generally positive. The values for the rich are generally negative. The extra cost of living in the city given the average housing bundle of the rich is almost uniformly lower (i.e. it lies below the 45 degree line) than the extra cost of living in the city given the average housing bundle of the poor. These results imply that housing markets don't explain the sorting of the poor into cities. Indeed, if taken literally these results imply that housing market factors on their own, would lead the rich to live in cities.

As a final piece of evidence, we look at whether different values of $\sum_j \left(Price_j^{City} - Price_j^{Suburb}\right) * \left(Quantity_j^{Rich} - Quantity_j^{Poor}\right)$ across cities can explain different levels of poverty. We regress the difference in the poverty rate between the central city and the suburbs in each MSA on $\sum_j \left(Price_j^{City} - Price_j^{Suburb}\right) * \left(Quantity_j^{Rich} - Quantity_j^{Poor}\right)$, which is estimated separately across MSAs. Figure 5 shows the relationship between the poverty rate gap (i.e. the difference in the poverty rate between the central city and the suburbs) and this variable, which we call the housing cost incentive gap. The relationship is negative and in places where housing markets predict that the rich should suburbanize more, they suburbanize less.[16] This is another blow for the importance of housing market explanations.

Appendix Table 2 presents a second piece of evidence on the idea that cities attract the poor because of the supply of older housing. In this table, we regress tract poverty rates and tract median family income on tract distance from the CBD along with 5 variables that measure the percentage of tract housing stock in each of five age categories. We find that housing stock age in fact is not a strong predictor of poverty or income. The basic

[16] A natural interpretation of this is that when the rich suburbanize more for exogenous reasons, the price of housing for the rich in suburbs rises.

income-distance relationships detailed above are not altered by controlling for housing stock age.

Some people have suggested that with zoning, a housing market approach is just inappropriate. These scholars argue that because of zoning rules there just isn't any housing for the poor in suburbs so it makes no sense to look at housing prices. While there are certainly some suburbs where zoning has eliminated most low cost housing, nevertheless in every American metropolitan area there is a substantial amount of low cost housing in the suburbs. For example, 12.7 percent of the owner occupied houses in the suburbs are valued at or below the median value for houses owned by families living in poverty ($47,000; source 1990 IPUMS; $1990). Similarly, 30.4 percent of suburban rental units are priced at or below the median rental payment by households living in poverty. Since there is a positive, quite significant quantity of low cost housing in suburbs, we think our approach (looking at prices) is appropriate.

IV. Modes of Transportation

This section attempts three tasks. First, we ask whether poor people live in areas where public transportation is available. Second, we examine a model with three transportation modes and argue that this model explains both transportation and residential patterns. Finally, we present limited evidence on the decentralization of employment and suggest that this may be important in understanding the population patterns of the newer cities of the South and West.

Tables 4 and 5, Access to Public Transportation: Public transit is a relatively inexpensive transport mode; and in general, central cities allow for easier access to public transport then do suburbs. Higher relative demand for public transport by the poor could therefore help explain why the poor choose to live in cities. Presumably, public transportation exists, particularly in inner cities, either because of historical infrastructure investment (in the case of subways, nearly all of which were built prior to World War II) or greater population densities (needed for bus routes). Because the location of public transportation may itself be driven by the location of poverty, ideally, we would like to see the effects of exogenously determined access to public transportation. In addition, most transportation experts believe that *new* access to public transport, especially rail transport, is not skewed toward poor areas.

Using three different sets of aggregate tract-level data, Table 4 shows the results from regressing median family income on distance from CBD along with the percentage of individuals using public transit:

(5) $Log(\text{Median Income}) = \alpha + \beta * \text{Public Transport Usage} + \varepsilon$,

Column 1 replicates the basic income-distance relationship shown earlier (in Table 2) for a subsample made up of tracts within the Chicago, Washington DC, Atlanta, Portland and Boston metropolitan areas. In Column 2, including public transportation usage greatly increases explanatory power and eliminates most of the negative relationship between distance and income. In Column 3, instrumenting for public transportation usage using distance to train stops admits nearly identical results to the OLS estimates in Column 2. Access to public transportation appears to explain the bulk of the connection between distance and income. Of course, the possibility remains that the train stop locations were chosen to serve poor areas.

Table 4, Columns 4 through 6 replicate these results using tract level data from Los Angeles with distance to the nearest public bus route as the instrument for public transportation usage. Again, controlling for public transportation usage completely eliminates any positive relationship between distance and income and so explains the connection between poverty and urban proximity. In this case, instrumenting causes the estimated coefficient on public transport to rise, not fall. We recognize that because they are easier to move, these bus routes may in part have been located to address the needs of poorer residents.

Table 4, Columns 7 through 9 measure transportation usage solely by subway usage using tract level data from the New York City boroughs of Queens, Brooklyn, and the

Bronx. (Staten Island has no subways and subway coverage is far too dense in Manhattan to provide any meaningful variation). For this sample, no subway stops have been added since 1942; thus any endogeneity on stop locations stems from poverty levels of at least 48 years earlier. As many neighborhoods have changed radically during this period, we believe that these locations can be thought of as having some degree of exogeneity. The results are quite compatible with the earlier samples. Public transportation usage appears to strongly predict poverty and to explain a substantial amount (two-thirds or so) of the connection between proximity and poverty.

For three cities (Atlanta, Portland and Washington, D.C.) public transit construction between 1980 and 1990 increased resident access to transit. As discussed in Baum-Snow and Kahn (2000), these transit expansions were not targeted to increase transit access for poorer tracts. In Table 5, we look at whether poverty rose in tracts where rail transportation became more accessible. Our view is that public transportation's appeal to the poor arises because it eliminates the need to own a car; hence in measuring increased transit access, we want to pick up areas where new construction made it possible to walk to a transit line. Using data for the Atlanta, Portland and Washington DC metro areas, Columns 1 through 3 report results from a regression of the change in a tract's poverty rate on a dummy variable that equals one if a census tract was further than one kilometer from a transit line in 1980 but was within one kilometer of a transit line in 1990:

$$\text{(6)} \quad \text{Poverty Rate}_{1990} - \text{Poverty Rate}_{1980} = \alpha + \beta * \text{Change in Proximity to Transit} + \varepsilon .$$

In all cases, increased public transit access is associated with an increase in the poverty rates, but only in Atlanta is the effect strongly significant. Regression (4) pools the three cities allowing for metropolitan-area fixed effects. In this regression, the positive effect of increased public transit access on poverty is statistically significant at the 0.01 level. Regression (5) uses the pooled sample and additionally controls for distance from the central business district and the poverty rate as of 1980; the effect of increased transit access on increasing poverty is slightly diminished but remains positive and significant. While the results in Table 5 are not as strong or robust as we would desire, they continue to suggest the positive impact of access to public transportation on the location of the poor.

Anecdotal information also suggests that changes in public transportation can lead to increased poverty. For example, Harlem's evolution into a ghetto begins with the extension of the subway into that area (see Osofsky, 1966). As public transportation came to Harlem, African-Americans moved from less-segregated, less attractive areas closer to the city center into this newly accessible place.

A second approach to study the role of public transportation is to look at whether the sorting of the poor into central cities is different in metropolitan areas where public transportation is more differentially used in central cities. For a set of more than eighty metropolitan areas, we can calculate differential use of public transportation in central cities versus suburbs.[17] To eliminate the possibility that greater poverty is causing this usage, we look only at public transportation usage for people who are earning more than $75,000 per year. We then regress this MSA-level measure of differential public transport usage on the difference in the poverty rate between central cities and suburbs. The correlation between the two variables is 29 percent. Figure 6 shows the close connection between relative public transportation usage and relative poverty. This further points to the importance of public transportation in driving the presence of urban poverty.

A final piece of evidence we have on this point is to show the impact of central city residence on car ownership. If we regress car ownership on central city status, poverty and their interaction, we find:

$$\text{(7) Own Car} = \underset{(.00)}{.96} - \underset{(.002)}{.07}\text{*Poverty} - \underset{(.001)}{.11}\text{*City} - \underset{(.003)}{.15}\text{*Poverty*City},\ r^2=.195$$

Poor people who live in the center city are 26 percentage points less likely to own a car than a poor person who lives in the suburbs and 22 percentage points less likely to own a car than a non-poor person who lives in the city. Graphically, this relationship is illustrated in Figure 7, which shows car ownership by income for three locations: central cities across the U.S., suburban locations across the U.S. and central cities in our old cities. In suburban areas, even the poorest people own cars. In central cities, richer people own cars, poorer people do not. The income elasticity of car ownership is particularly steep in the older cities. Since cars are a very large budget item, the ability to rely on public transit provides poor people with a substantial incentive to urbanize.

The Three Mode Model: The previous discussion treated access to public transport as exogenous. In this section, we present a model (based on Arnott and McKinnon, 1978, and LeRoy and Sonstelie, 1983) where public transportation and residence-by-income patterns emerge endogenously from technological aspects of different transport modes. The basic intuition is that public transportation is a mode of transportation with a high time cost per mile and high time fixed costs. These fixed costs induce the poor, who have a lower value of time, to disproportionately use public transportation. The high time costs per mile mean that the poor might be willing to pay more than the rich to live close to the city center to avoid extraordinarily long commutes using public transportation, even if public transportation could be used anywhere.

To formalize this argument, consider a model with a fixed population of rich and poor (N_{Rich} and N_{Poor}) living in a long, narrow city and commuting to the center. We assume that there are three modes of transportation. The rich and poor have opportunity costs of time equal to W_{Rich} and W_{Poor} respectively. Each mode of transportation (denoted with subscript j) has fixed time costs (F_j), fixed financial costs (C_j) and a time cost per mile (T_j). For simplicity assume that each person consumes 1 unit of land at a price p(d), where d is distance from the central business district, and each person has one unit of time to allocate to work and transportation. We consider three modes of transportation: walking (j=w), public transportation (j=p) and automobiles (j=c). For simplicity we

[17] While there are over 330 metropolitan areas, the Census micro IPUMS data only identifies separate central city and suburbs for roughly a quarter of these MSAs. The 1995 AHS data identifies separate city and suburbs for only 34 metropolitan areas.

assume that $F_W = F_C = 0$, $C_W = C_P = 0$ and $T_W > T_P > T_C$. The following proposition characterizes the equilibrium of the model:

Proposition: There are always high wage persons living closest to the Central Business District and walking. If some rich people drive and some poor people take public transportation, and $T_P / T_C > W_{Rich} / W_{Poor}$, then (generically) there must be poor people living between the rich people who are driving and the rich people who are walking. (Proof is Appendix I).

There are many equilibrium structures of the model (depending on parameter values), but in general there will be three zones to the city. Closest to the city center there will be walkers (and the closest walkers must be rich). In the next zone, people commute using public transportation. In the last zone, people commute using cars. Within any of these zones, rich people will live closer to the center than poor people because of their greater value of time. However, if $T_P / T_C > W_{Rich} / W_{Poor}$, then there will be poor people in the public transportation zone living closer to the city than rich people who live in the automobile zone. This condition is the public transportation model equivalent of the classic AMM condition that the income elasticity of demand for land needs to be greater than one. We will examine this theory by looking for these zones and trying to measure the fixed time costs and per mile time costs of different transportation modes

Figure 8 shows plots of public transportation usage, median income (relative to the maximum in the sample) and walking with distance from the central business district. We present results for Chicago, Los Angeles, New York and Philadelphia. The results support the idea of three zones (everywhere except for Los Angeles). In all cities, walking to work declines very sharply within two miles of the central business and then plateaus at some fairly low number (presumably the walkers five miles from the CBD are not likely to be walking to the city center). In Chicago, New York and Philadelphia, public transportation first rises and then declines. In New York and Chicago, public transportation use declines slowly and still remains in use fairly far from the city center.

In Los Angeles, public transportation declines monotonically with distance from the CBD.

Average income appears to track the different zones moderately well. In New York, Chicago and Philadelphia, income is high close to the center where people are walking to work. Income then declines in the region where public transportation is common. Then incomes begins rising as car usage eliminates public transit use. In Los Angeles, median income rises with distance and so mirrors the decline in public transit usage. The raw graphs appear to support the three mode model.

To further examine this model, we use the 1995 National Personal Transportation Survey to look at the time costs of different transportation modes. As discussed in the data appendix, this data source provides detailed information on commuting patterns by transport mode for various commuters. For each of the three modes, we regress,

$$\text{(8)}\ \ \text{Time to Work} = \alpha + \beta_1 * (\text{Distance to Work} < 5\text{ miles}) + \beta_2 * \text{Distance}\,(> 5\text{miles}) + \varepsilon\,.$$

We allow the slope of "distance to work" to vary by including a spline because traffic speeds appear to be much faster for longer distances (presumably because these commutes are being done in the lower density areas of the MSA).

Our first regression in Table 6 shows results for walking. Walking appears to take between 11 and 16 minutes per mile. Certainly this seems somewhat brisk, but it is not completely implausible. The second regression shows results for automobile users. Car travel takes about two minutes per mile for very short commutes and one minute per mile on the margin for the longest commutes. This implies car speeds ranging from 30 to 60 miles per hour, which seems quite reasonable. Given its large sample size, we are particularly confident about this automobile regression.

The third and fourth regressions show results for public transportation. The fixed time costs are much higher than in the case of cars. Compared with the 4 minute fixed time cost of car travel (warming the engine, finding a parking spot), travel by bus is associated with a 19 minute fixed time cost and travel by train, a 22 minute fixed time cost. The marginal time cost of driving ranges from 54 to 65 percent of the time costs of taking a bus for distances up to ten miles. For close commutes, taking a car is faster than taking a train. For longer commutes, though the marginal time cost of taking a train is actually lower than that of taking a car, for nearly all observed commuting distances the high fixed costs of taking a train implies that taking a car remains faster.

To see whether these numbers seem broadly compatible with observed residential patterns, consider the mode choices that would be made given these parameter estimates: use a time cost of 12.4 minutes per mile for walking (with a 3.6 minute fixed cost), 2.1 minutes per miles driving (with a 4.3 minute fixed cost) and 3.3 minutes per mile cost of taking a bus (with a 19.3 minute fixed cost). We assume no cash costs of walking or taking a bus. In this case, taking a bus dominates walking beyond 1.72 miles. This seems to match up reasonably well with what we see in Figure 8. To determine when automobile travel dominates buses, we need to determine the average cash cost of car travel per trip and the cash cost of time. For example, if we thought that car travel costs 5 dollars per trip, then the crossover point hinges completely on the cost of commuting time. For individuals whose cost of time is twelve dollars per hour, it only makes sense to drive for trips that are over 8 miles. Since this roughly corresponds to the transition points in Figure 8, we believe that this model seems to work reasonably well in explaining the observed transport mode patterns.

To understand whether the multiple mode model can explain the sorting of the poor into central cities, we must compare the ratio of the time costs per mile of cars and buses implies with the ratio of opportunity costs of time for rich and poor. This means that the key question is whether the opportunity cost of time of the poor group is worth more or less than 0.6 times the time of the richer group. While certainly there are some poorer persons whose time is worth less than one-half of the average rich person's time, Figure 8 shows income differences that are much closer. The rise in income with distance is much less than 100 percent which is what you would need for the poor people who take public transportation to live further from the city center than the rich people who drive in cars.

Of course, this model would predict that in countries with wider income disparities (such as Brazil), the rich would live closer to the central city as indeed they do.

We now test two further implications of the model. One implication of the model is that in areas where only one mode of transportation is used, the rich will live closer to the city center. There are no areas of cities where public transportation use (or walking) is ubiquitous. But there are areas where only cars are used. We look at sorting only in those areas where public transportation appears not to be available (or at least where public transport is unattractive as indicated by low usage). We define these areas by grouping all census tracts within four mile rings of the CBD together (i.e. all tracts within zero and four miles together, all tracts within four and eight miles together, etc.). We then consider a four mile ring to have essentially no public transportation if in 90 percent or more of the tracts in that ring, more than 97 percent of the workers in each tract do not use public transportation. We have also eliminated all tracts within three miles of the CBD under the theory that here walking is always a viable option. Column (1) of Table 7 shows a significant negative relationship between distance from CBD and income in the car zones. In an area where only one mode of transportation is being used, richer people appear to live closer to city center. This suggests that the existence of multiple modes of transport is crucial for understanding why the poor live in cities.

As a second test of the theory, we look at the effects of subways across metropolitan areas. The theory predicts that the transition from poor to rich will occur when cars replace public transportation. If a different transportation technology changes the point at which cars substitute for public transportation, this will change the point where urban poverty is replaced by higher income areas. We examine the subset of metropolitan areas that have subways. The effect of these subways is to move the public transit zone much further out since the time cost per mile of subways is much lower than the time cost per mile of buses. As regression (2) in Table 7 shows, in non-subway cities public transportation usage drops off quickly within three miles of the CBD. In subway cities there is no connection between public transportation usage and distance from the CBD until one reaches beyond three miles. We interpret this difference as the result of the subway technology.

The key implication of the three mode model is that the model predicts that the transition from poor to rich will occur when the transition from public transportation to cars occurs. As such, in subway cities this transition will be in the region between 3 and 10 miles. In non-subway cities, the transition will be between zero and three miles. In regression (3), we find that income rises sharply between zero and three miles from the CBD in non-subway cities, just when cars are replacing public transportation. The interaction terms in the same regression show that in subway cities the transition from poverty to wealth occurs between three and ten miles just when cars are replacing public transportation in those cities.

Figures 9, Panels A and B, show the patterns of income and public transportation usage in subway cities and non-subway cities respectively. In both cases, income and public transportation usage track one another (note that we have inverted income values with respect to the vertical axis). In cities with subways, public transit use remains high even at distances relatively far from the city center. In the subway cities, near the city center median income falls with distance from the CBD as predicted by the three-mode model (assuming a zone in which both poor and non-poor individuals use public transit). The rise in income and fall in public transit usage beyond three miles from the CBD in subway cities presumably pick up the shift from public transit to car usage by high income individuals.

An additional benefit of the transportation mode model is that it can explain the different income-location patterns between old and new cities described in the stylized fact section above. In new cities, even within three miles of the city center, the rich drive cars and the poor take public transportation. The correlation between the logarithm of income and public transportation use at the census tract level in the new cities within three miles of the CBD is -.626. As the rich are driving, it is quite understandable that they live further from the city center.

However, in the old cities there is no negative connection between income and public transportation use. Indeed, the correlation between the logarithm of income and public transportation use is positive .0371 in old cities within three miles of the CBD. Furthermore in that region there is a particularly strong positive relationship between walking and income: .245. As the rich appear to be particularly drawn to the high time cost per mile technology in older cities, it should not surprise us to find them closer to the city center in the older cities. In the newer cities, the rich are particularly likely to drive cars and it should therefore not surprise us to find them living further from the city center. Thus, the transportation model can explain the differences between the old and the new cities.

Decentralized Employment: A final benefit of the transportation mode model is that it can predict income-locational patterns even for non-monocentric cities. A monocentric representation poorly captures the reality of many newer cities, which feature a more uniform distribution of employment across space (Mieszkowski and Smith 1991, Giuliano and Small 1991). When employment is decentralized, we need not be surprised that the rich live on the fringes of the city. After all, they do not increase their commutes by living on the edges (Gordon, Kumar and Richardson 1991). Figure 10 shows employment densities for New York and for Los Angeles. One third of the employment in the New York metropolitan area works within one mile of the CBD. The comparable number for Los Angeles is under five percent.

To examine the differences between old cities and new cities more closely, Table 8 regresses time to work on distance from the CBD. The first two regressions show results for the old and new cities. For both types of cities, within three miles each mile to the city center adds one minute to the commute. In the three-to-ten-mile zone, commute times continue to rise (by almost a minute a mile) in old cities. But in new cities, commute times actually fall with distance from the CBD in the three-to-ten-mile zone; the natural explanation is that these workers are not commuting into the city. With decentralized employment, distance from the CBD does not mean longer commutes. Regression (3) shows the relationship between miles to work and family income using the 1995 National Personal Transportation Survey. In the old cities, richer people live further from work. This effect is lessened in the new cities. Regression (4) shows the general connection between employment density and income in old cities and new cities. In the old cities, employment density is strongly negatively correlated with income. In the new cities, employment density is orthogonal to income.

These effects suggest that in newer cities employment is less fixed at the city center. If employment can be decentralized, then the rich can live in the suburbs and not have lengthy commutes. A full treatment of this topic requires an analysis of the joint location of firms and workers, which is beyond the scope of this paper (see White, 1998, for an analysis).

IV. The Role of Politics

A third theory that we believe is important in the choice by the poor to live in cities is the role of big city governments. Differential generosity to the poor by big city governments relative to suburban governments may create another reason why the poor congregate in cities (see, for instance, Borjas 1999 and Blank 1988 for evidence on welfare magnets). Again, though, a primary reason why big city governments are so generous is that the poor live in cities, so the exogeneity of this force is in question. For our empirical work, we will focus on whether political boundary effects exist.

To examine whether there are political boundary effects, we use the tract level data. The basic idea is quite simple. The previous models suggest that distance from the central business district will be the crucial determinant of location of rich and poor. Political models suggest that political boundaries will be important, over and above their relationship with distance. These political boundaries presumably matter because central cities pursue policies that are more redistributive than suburbs. These policies may include housing market policies (such as zoning and public housing) and may also affect transportation—the subsidy to public transportation may be greater in inner cities. Central city governments may also be more generous in public health provision and may also provide more friendly and accessible welfare administration. Finally, the focus of important public services such as policing and schools may be more pro-poor in big cities than in suburbs.

For our twelve large metropolitan areas, we have coded whether census tracts lie inside or outside the largest city. Our first approach is to simply see if holding distance from the central business district constant, there is a central-city effect. In Table 9, the second regression shows the effect of for the six old metropolitan areas. The poverty rate is higher by 8 percent in the central city. This is a very large effect similar in magnitude to the effects related to distance from the CBD. Separate regressions for each of these cities also yield comparable 8 percent central-city effects. Notice, though, that compared to the base equation shown in Column 1, controlling for central city status only slightly changes the coefficients on distance from the CBD. As such, politics cannot explain observed distance-income relationships.

In the third regression, we control for the ratio of public housing units in the tract to total housing units. We find a strong positive relationship between public housing and poverty. Of course, the direction of causality in this regression is unclear—public housing may be built in areas in which the poor are more likely to live. Surprisingly, though, controlling for public housing has only a modest effect on the distance coefficients and on the central city dummies. This occurs because public housing appears to be much more evenly allocated than we had guessed. However, we conjecture that suburban public housing is more likely to be used by the elderly whereas urban public housing is more likely to be used by the non-elderly poor.

Regressions (4)-(6) repeat these results for the new cities. In these cases, there is no political boundary effect. The distance effects are substantial, but in none of the cities (except for Washington, D.C.) is there a significant boundary effect (in some of the cities, the boundary effects go in the wrong direction). This fits with anecdotal information on the differences between newer city governments and the older city governments in the East and Midwest, which suggest that the city governments of the older cities are much more redistributive.

We now try to quantify the magnitude of these political incentives for location of the poor in central cities. In Table 10, we regress income from the government received by poor households on a dummy if the household lives in a central city. The data source is the 1990 census micro-sample. Our first regression shows that the take-up rate for households in poverty is 8.8 percent higher in central cities. The second result shows that households in poverty receive 756 dollars more annually if they live in the center city relative to what they would have received had they lived in the suburbs. All of this effect works through higher take-up rates.

The third regression shows that poor people have an added 9.7 percent chance to live in public housing if they live in a central city. Based on 1995 AHS data, we have estimated a home price hedonic and find that a quality adjusted apartment's monthly rent is $140 lower if it is public housing in the suburbs and $180 lower if it is public housing in the center relative to the market price of a comparable unit. This means that the expected monthly financial benefit to the poor from living in the city public housing relative to the expected monthly benefits from living in suburban public housing comes to $4 per month. Thus, between welfare and public housing, the total incentive for the poor to live in cities is $64 per month.

To examine whether these effects really relate to the degree of centralization of poverty, we have calculated take-up rates and public housing residence rates across metropolitan areas using the census and the American Housing Survey. We then correlate the centralization of poverty (poverty rate in the city minus poverty rate in the suburbs) on two political variables: the difference in take-up rates between the cities and the suburbs and the differences in the probability of living in public housing for the poor between the cities and the suburbs. The relationship between differential take-up rates and centralization of poverty is shown in Figure 11. This as well as the relationship between public housing and centralization of poverty are shown in Appendix Table 3. Both variables are strongly correlated with the degree of centralization of the poor (39 percent and 29 percent respectively).

V. Conclusion

Traditional housing market explanations cannot explain the sorting of the poor into central cities. The income elasticity of demand for land is just too low. Instead, we find that transportation-mode choice plays a key role in explaining income sorting. The role of public transportation appears to be augmented in older cities by government programs that disproportionately favor the poor. In the newer cities, the puzzle of centralization of the poor is also explained in part by the decentralization of employment: as jobs are decentralized, high wage households are also decentralized.

There is no question that rich-poor segregation is a general phenomenon, much of which is unrelated to the urban theories discussed herein. Instead, we have argued that factors like schools and crime should be seen as a result of the poor choosing to live in cities rather than being the reason for their doing so. However, this sort of secondary effect may in practice be much more important in people's decisions than transportation and it may act as a multiplier so that an initial incentive pulling the poor into cities will create massive sorting.

Public transportation theory offers the possibility to explain income-sorting patterns across nations. Many authors have noted that in many European cities the poor live in suburbs (see Brueckner, Thisse and Zenou, 1997). High gas taxes and generous subsidization of public transportation mean that the high car mileage associated with American-style suburbs are unattractive to most middle-income Europeans. Furthermore, European central city governments are often national and often subsidize the rich rather than the poor. Thus the combination of public transportation and government can explain the U.S. – Europe differences in the location of the poor.

There are two policy implications of this work. First, our findings on the importance of public transportation suggests that public transportation is an important policy instrument which can influence the location decisions of the poor (as argued by Meyer, Kain and Wohl, 1965). Second, the importance of political boundaries may mean that there are politically created distortions that artificially induce the poor to crowd into cities.

Appendix I: Proof of Proposition I

Lemma: Land prices are continuous in distance from the central business district.

Proof: The nature of land pricing in this model is such that all rich people achieve an identical level of utility, U_{rich}, and all poor people achieve an identical level of utility, U_{poor}. Consider a city segment with an identical income population using an identical transportation mode. So that individuals remain equally well-off, it must be that $p'(d) = -W_jT_j$. Next consider a border at d* which divides identical income populations using different transportation modes. It immediately follows that those using the transportation mode with a higher marginal cost to distance, $C_j+W_jT_j$, will live on the CBD side of d*. While the slope of p(d) will change discretely at d*, p(d) must be continuous at d*; if not, the individuals on the high-priced side of d* could increase their utility by using their current transportation mode on the other side of d*. A similar argument establishes the continuity of prices at a border between different income groups.

Proposition: There are always high wage persons living closest to the Central Business District and walking. If some rich people drive and some poor people take public transportation, and $T_P / T_C > W_{Rich} / W_{Poor}$, then (generically) there must be poor people living between the rich people who are driving and the rich people who are walking.

Proof: Regardless of income, the person who is closest to the CBD must walk. That is, for any $F_p > 0$, $C_c > 0$ and $T_w > T_p > T_c$, there exists a d** such that for d < d**, $W_iT_wd < WiF_p + W_iT_pd$ and $W_iT_wd < C_c + W_iT_cd$. The higher opportunity cost of time to rich people implies that rich people who walk will live closer to the CBD than any poor people who walk (there may be none). Hence the person who is closest to the CBD must be rich and walk.

To prove the second sentence, assume to the contrary that all rich people live in a continuum stretching out from the city center. By assumption some rich people drive. As driving has the lowest marginal time cost of the three transportation modes, among rich people, those who drive must live the farthest from the CBD. Let the border between rich and poor people occur at d***. Assume the poor person living on the distant side of d*** uses public transport. By the above lemma, prices are continuous at d***. Therefore the slope at which prices decline on the distant side of d*** must be less steep than the slope on the CBD side of d***, i.e. $p'(d^{***}-) < p'(d^{***}+)$. If not, both poor and rich people could increase their utility by moving to the other side of d*** while continuing to use their same transportation mode. $p'(d^{***}-) = -T_c W_{rich}$; $p'(d^{***}+) = -T_p W_{poor}$. Substituting and rearranging, $Tp/Tc < W_{rich}/W_{poor}$. But this violates an initial assumption. If the poor person on the distant side of d*** walks, a similar argument establishes that $Tw/Tc < W_{rich}/W_{poor}$ which in turn implies $Tp/Tc < W_{rich}/W_{poor}$.

Appendix II: Data Sources

The source for the census tract data is the 1990 Census of Population and Housing STF3A files. The Central business district location is from the 1982 Census, which was based on polls of local leaders. Each tract's distance to this CBD is calculated based on the latitude and longitude of the tract's center.

1910 and 1990 Census of Population and Housing is from the integrated public use micro samples available at http://www.hist.umn.edu/ipums. Both data sets provide household level data with metropolitan area identifiers. The 1910 data provide ward identifiers and the 1990 data provide center city/suburb identifiers for a subset of the metropolitan areas.

To estimate city and suburban housing attribute prices, we use the 1995 American Housing Survey (AHS). The data can be downloaded at www.huduser.org. We use all observations of households that live in a standard metropolitan statistical area. For each housing unit, we observe whether it is located in a central city or not, and whether the unit is owner occupied or a rental. For renter occupied housing, the AHS data indicates whether the unit is public housing or rent controlled. For rental occupied housing, monthly rent is reported (which is top coded at $1,000). For owner occupied housing, home prices are top coded at $250,000. The data include numerous proxies for the unit's structure type which include: square footage, rooms, bathrooms, the unit's structure type, whether a garage is present and the lot size of land. The AHS data also includes demographic data on each family living in a housing unit. The family's poverty status is coded. This allows us to construct average housing attribute consumption for families above and below the poverty line in cities and in suburbs.

The source for the transit data presented in specifications 1-3 in Table Five is Baum-Snow and Kahn (2000). The transit coverages for 1980 and 1990 were constructed using separate transit histories taken from various places off of the Internet for each of the five transit systems studied. The transit access variables, built using GIS software, were merged into the 1990 data set (because this is the year for which the GIS-delineated census tract codes matched) and then converted back to 1980 tracts with the rest of the 1990 data using population weighted conversion factors. This procedure yields for each census tract its distance to the nearest transit line in 1980 and 1990.

Los Angeles Bus Access Data is from the Countywide Planning Department, Los Angeles County Metropolitan Transportation Authority (LACMTA), One Gateway Plaza, Mail Stop 99-23-7 Los Angeles, CA 90012. GIS software is used to merge digitalized transit routes with census tracts.

Nationwide Personal Transportation Survey (NPTS) 1995 wave (see www-cta.ornl.gov/npts/1995). This 1995 random survey of 22,000 households' travel patterns identifies city and suburban dwellers and includes a detailed set of questions considering transport usage. For each household, the 1995 NPTS indicates whether the household lives in a metropolitan area (SMSA) and provides information on each vehicle in the household's stock including miles driven in the last year. The data set also provides information on the head of household. The NPTS reports which SMSA a household lives in and whether they live in the central city or suburb of that SMSA. In addition, each household's block and census tract population density is reported and the household's distance from public transit and its distance from work.

ZIP Code Business Patterns 1995 - Basic data items are extracted from the Standard Statistical Establishment List, a file of all known single and multi- establishment companies maintained and updated by the Bureau of the Census. The annual Company Organization Survey provides individual establishment data for multi-establishment companies. Data for single establishment companies are obtained from various Census Bureau programs, such as the Annual Survey of Manufactures and Current Business Surveys, as well as from administrative records of the Internal Revenue Service and the Social Security Administration.

Tract level data on the number of housing units which are public housing comes from the US Department of Housing and Urban Development. "Subsidized Housing Projects' Geographic Codes, form HUD-951" July 1996. See www.huduser.org.

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TABLE 1: Poverty in Cities and Suburbs

	Live in central city	Live in suburbs	Live outside MSA
All	0.175	0.069	0.105
	(0.380)	(0.254)	(0.306)
Black	0.294	0.154	0.276
	(0.455)	(0.361)	(0.447)
Non-black	0.136	0.062	0.086
	(0.342)	(0.241)	(0.281)
Age between 18 and 40	0.205	0.086	0.132
	(0.403)	(0.281)	(0.339)
Age between 40 and 65	0.140	0.052	0.076
	(0.347)	(0.222)	(0.266)
Not in the labor force	0.486	0.255	0.332
	(0.499)	(0.436)	(0.470)
In the labor force	0.105	0.045	0.068
	(0.307)	(0.208)	(0.253)
Male	0.276	0.144	0.220
	(0.447)	(0.351)	(0.414)
Northeast	0.186	0.055	0.068
	(0.389)	(0.389)	(0.253)
Midwest	0.224	0.054	0.114
	(0.417)	(0.226)	(0.317)
South	0.175	0.081	0.129
	(0.380)	(0.273)	(0.335)
West	0.134	0.078	0.108
	(0.341)	(0.268)	(0.311)
Changed house in the last 5 years	0.202	0.084	0.132
	(0.401)	(0.278)	(0.339)
Changed house and MSA in the last 5 years	0.161	0.070	0.108
	(368)	(0.255)	(0.310)
Changed house within the same MSA in the last 5 years	0.213	0.089	0.141
	(0.409)	(0.284)	(0.348)
Stayed in same house for the last 5 years	0.143	0.052	0.074
	(0.350)	(0.222)	(0.262)

Notes: This table shows the percentage of residents who are in poverty. The numbers in parentheses are standard deviations. The data are from the 1990 IPUMS microdata.

TABLE 2: Distance from City Center, Poverty and Income

Dependent Variable:	Poverty rate			Log of median family income		
	All	Old cities	New cities	All	Old cities	New cities
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.3475	0.2406	0.4428	10.0049	10.6199	9.6875
	(0.0022)	(0.0077)	(0.0127)	(0.0076)	(0.0265)	(0.0511)
Distance from CBD, less than 3 miles	-0.0511	0.0093	-0.0522	0.1248	-0.1130	0.1579
	(0.0008)	(0.0024)	(0.0039)	(0.0026)	(0.0082)	(0.0157)
Distance from CBD, between 3 and 10 miles	-0.1081	-0.0341	-0.0207	0.0407	0.1157	0.0700
	(0.0004)	(0.0009)	(0.0012)	(0.0013)	(0.0031)	(0.0048)
Distance from CBD, more than 10 miles	0.0008	-0.0007	0.0006	-0.0044	0.0035	-0.0033
	(0.0001)	(0.0003)	(0.0002)	(0.0004)	(0.0011)	(0.0008)
Observations	33,645	6,477	2,736	33,536	6,444	2,731
Adjusted R-Squared	0.3355	0.3212	0.3139	0.3130	0.2963	0.2487

Notes: Numbers in parentheses are standard errors. The unit of observation are census tracts. Data source 1990 STF3A file. MSA fixed effects are included. The "old cities" include New York, Boston, Chicago and Philadelphia and the "new cities" include Los Angeles, Houston, Atlanta and Phoenix.

TABLE 3: The Income Elasticity of Demand for Space

	American Housing Survey: Individual Level Data						Tract Level Data
Dependent Variable:	Log of lot size		Log of land per household for apartment residents		Log of land consumption for apartments and homes		Log of land per household
Estimation:	OLS	IV	OLS	IV	OLS	IV	OLS
	(1)	(2)*	(3)	(4)*	(5)	(6)*	(7)
Intercept	8.1198 (0.1062)	5.8172 (0.4091)	5.0959 (0.1086)	5.2904 (0.5243)	3.7006 (0.1358)	4.7955 (0.5451)	-10.1664 (0.1621)
Log of family income	0.1084 (0.0100)	0.2992 (0.0324)	0.0915 (0.0108)	0.0192 (0.0339)	0.4419 (0.0130)	0.3635 (0.0411)	0.2334 (0.0161)
Distance from CBD, less than 3 miles							0.2980 (0.0079)
Distance from CBD, between 3 and 10 miles							0.1619 (0.0040)
Distance from CBD, more than 10 miles							0.0914 (0.0020)
Observations	8,843	8,843	4,148	4,148	13862	13862	29359
Adjusted R-Sq'd.	0.1045	0.0669	0.3059	0.2982	0.218	0.2159	0.5963

Notes: Numbers in parentheses are standard errors. In regression (7), we include MSA fixed effects.

**Education dummies are used as instrumental variables for income.*

TABLE 4: Transportation and Median Family Income

Dependent Variable:	Log of median family income								
	Atlanta, Boston, Chicago, Portland and Washington: Public Transit Use			Los Angeles: Bus Routes			New York City (non-Manhattan): Subways		
	(1)	(2)	(3)*	(4)	(5)	(6)*	(7)	(8)	(9)*
Intercept	10.4262 (0.0409)	10.7080 (0.0604)	10.8182 (0.1303)	9.7954 (0.0764)	11.3141 (0.0928)	13.6002 (0.3807)	10.8098 (0.1078)	11.3745 (0.1052)	11.9439 (0.1450)
Distance from CBD, less than 3 miles	-0.0530 (0.0144)	0.0666 (0.0186)	0.0618 (0.0193)	0.1215 (0.0229)	-0.1096 (0.0219)	-0.4575 (1.0735)	-0.1724 (0.0296)	-0.1088 (0.0276)	-0.0447 (0.0315)
Distance from CBD, between 3 and 10 miles	0.0953 (0.0046)	0.0387 (0.0054)	0.0300 (0.0106)	0.0816 (0.0070)	0.0090 (0.0068)	-0.1002 (0.0195)	0.1052 (0.0062)	0.0631 (0.0063)	0.0207 (0.0095)
Distance from CBD, more than 10 miles	0.0269 (0.0064)	0.0153 (0.0077)	0.0124 (0.0083)	0.0123 (0.0035)	0.0093 (0.0029)	0.0047 (0.0041)	0.0077 (0.0147)	-0.0113 (0.0136)	-0.0304 (0.0151)
Percent using public transportation		-1.7019 (0.0824)	-2.0325 (0.3556)		-4.4049 (0.1926)	-11.0355 (1.0735)		-1.2716 (0.0751)	-2.5536 (0.2180)
Observations	2704	1856	1856	1335	1335	1335	1718	1718	1718
Adjusted R-Squared	.3796	.5261	.5220	.2928	.4920	0.0394	0.1775	0.2949	0.1750

Notes: Numbers in parentheses are standard errors. Unit of observation is the census tract. See Data Appendix. The omitted MSA is Portland. Regressions 1-6 include suppressed city dummies.

In these regressions, proximity to public transportation is used as an instrument for car and public transportation usage.

TABLE 5: Increased Public Transit Access' Impact on Changes in Tract Poverty

Dependent Variable:	1980 to 1990 Change in poverty rate				
	Atlanta	Wash. D.C.	Portland	All three cities*	
	(1)	(2)	(3)	(4)	(5)
Intercept	0.0438 (0.0084)	-0.0055 (0.0028)	0.0310 (0.0081)	0.0301 (0.0062)	0.0132 (0.0070)
Tract within .5 miles of transit in 1990 but not within .5 miles of transit in 1980	0.0395 (0.0150)	0.0177 (0.0105)	0.0203 (0.0232)	0.0271 (0.0080)	0.0169 (0.0082)
Distance from CBD, less than 3 miles					-0.0090 (0.0157)
Distance from CBD, between 3 and 10 miles					0.0070 (0.0020)
Distance from CBD, more than 10 miles					-0.0002 (0.0003)
Poverty rate in 1980					0.1783 (0.0287)
Observations	231	728	207	1,166	1,099
Adjusted R-Squared	0.0252	0.0025	-0.0011	0.0823	0.3094

Notes: Numbers in parentheses are standard errors. Census tract is the unit of analysis. For data details see Appendix.

* City dummies are included in regression.

TABLE 6: Travel Times by Mode and Location

Dependent Variable:	Travel time to work			
Transport Mode:	Walking (1)	Car (2)	Bus (3)	Train/Subway (4)
Intercept	3.5552	4.2802	19.2964	22.1375
	(0.3274)	(0.2254)	(2.2951)	(6.4347)
Miles to work if less than 5 miles	12.4047	2.1130	3.3361	3.3150
	(0.4450)	(0.0562)	(0.6186)	(1.4507)
Miles to work if more than 5 miles		1.2085	1.8412	0.7601
		(0.0124)	(0.1648)	(0.1865)
Observations	568	15,374	695	220
Adjusted R-Squared	0.5780	0.5531	0.3004	0.1339

Notes: The unit of analysis is the household. Numbers in parentheses are standard errors. For specification (1), we estimate the regression for commuters who live within 3 miles from work. Source: 1995 National Personal Transportation Survey.

TABLE 7: Transportation Zones

Dependent Variable:	Log of Income All Car Zone (1)	Percent using public transit (2)	Log of income (3)
Intercept	10.6820 (0.0098)	0.1935 (0.0016)	10.0080 (0.0083)
Distance from CBD, less than 3 miles		-0.0208 (0.0006)	0.1745 (0.0033)
Distance from CBD, between 3 and 10 miles	-0.0073 (0.0022)	-0.0082 (0.0005)	0.0262 (0.0024)
Distance from CBD, more than 10 miles	-0.0111 (0.0008)		
Distance from CBD less than 3 miles*Subway City Dummy		0.0189 (0.0001)	-0.2213 (0.0078)
Distance from CBD between 3 and 10 miles *Subway City Dummy		-0.0228 (0.0009)	0.0654 (0.0046)
Observations	5941	20781	20781
Adjusted R-squared	0.3909	0.7895	0.3378

Note: Standard errors in parenthesis. All regressions include metropolitan area fixed effect.
The "All Car Zone" is defined in section IV of the text.

TABLE 8: Employment Density and Travel Time to Work

Dependent Variable:	Time to Work		Log (Median Family Income)	Employment Density
	Old Cities, Tract Data	New Cities, Tract Data	Individual Data from NPTS	Old and New Cities, Tract Data
	(1)	(2)	(3)	(4)
Intercept	-0.2399 (0.6886)	-0.3542 (1.2855)	13.3559 (0.3375)	9.6435 (0.2527)
Distance from CBD, less than 3 miles	1.1516 (0.1178)	1.0312 (0.1747)		
Distance from CBD, between 3 and 10 miles	0.9805 (0.0475)	-0.1926 (0.0615)		
Distance from CBD, more than 10 miles	-0.3454 (0.0334)	0.2021 (0.0328)		
Distance to work			1.4416 (0.0302)	
Distance to work times new City			-0.1315 (0.0617)	
New City Dummy			-5.2366 (0.7536)	
Log of income				-0.3220 (0.0265)
Log of income times new city				0.2301 (0.0610)
Observations	4908	1282	5,317	5,235
Adjusted R-Squared	0.6897	0.3669	0.3936	0.3569

Notes: Numbers in parentheses are standard errors. Regressions (1) and (2) also include controls for transportation mode usage. In regressions (1), (2) and (4) the unit of observation is a census tract. All regressions include MSA fixed effects.

TABLE 9: Poverty and Political Boundaries

Dependent Variable:	Poverty Rate				
	Old Cities			New Cities	
	(1)	(2)	(3)	(4)	(5)
Intercept	0.256 (0.008)	0.170 (0.010)	0.125 (0.010)	0.440 (0.015)	0.455 (0.017)
Distance from CBD, less than 3 miles	0.007 (0.002)	0.011 (0.002)	0.016 (0.002)	-0.055 (0.004)	-0.056 (0.004)
Distance from CBD, between 3 and 10 miles	-0.034 (0.001)	-0.030 (0.001)	-0.028 (0.001)	-0.015 (0.001)	-0.016 (0.001)
Distance from CBD, more than 10 miles	-0.0006 (0.0003)	0.0014 (0.0004)	0.0011 (0.0003)	0.0005 (0.0002)	0.0005 (0.0002)
Central city		0.081 (0.006)	0.081 (0.005)		-0.013 (0.017)
Public housing's share of total census tract housing stock			0.278 (0.010)		
Observations	5,144	5,144	5,144	1,452	1,452
Adjusted R-squared	0.2999	0.3209	0.4053	0.2937	0.2947

Notes: Unit of analysis is the census tract. All regressions contain MSA-specific effects. Standard errors in parentheses.

**These regressions include housing age, size and style characteristic controls.*

TABLE 10: Redistribution in Cities and Suburbs

	Probability of welfare take-up for households in poverty	Annual Public Assistance Receipts ($)	Probability of living in public housing
Intercept	0.233	43.29	0.0267
	(0.004)	(2.95)	(0.004)
Central City	0.088	38.41	0.018
	(0.005)	(5.13)	(0.006)
Poverty		528.87	0.062
		(7.28)	(.010)
Poverty*Central City		718.5	0.097
		(10.71)	(.012)
Adjusted R-squared	0.0609	0.101	0.077
Observations	33,602	327,756	11,902

Notes: All regressions contain MSA specific effects. Data source for welfare take up is the 1990 IPUMS. Data source for public housing is 1995 AHS.

APPENDIX TABLE 1: Housing Prices and the Incentive to Suburbanize

	Price of a dwelling	City differential	Mean variable values: poor	Mean variables: non-poor
	(1)	(2)	(3)	(4)
Intercept	-263.13 (252.24)			
City dummy		1,759.76 (269.40)	0.603	0.452
Owner occupied	6,798.99 (77.52)	-1108 (106.55)	0.360	0.619
Attached House	40.21 (137.53)	-62.17 (176.09)	0.096	0.062
Multi-Units Structure	622.31 (92.54)	-491.16 (125.82)	0.393	0.272
Square Footage	0.72 (0.03)	-0.12 (0.04)	826	1,263
Dwelling has a garage	623.19 (67.38)	-145.76 (92.06)	0.427	0.619
Number of rooms	437.37 (21.25)	-258.76 (30.23)	4.9	5.6
Number of bathrooms	832.41 (55.65)	94.96 (80.45)	1.2	1.5
built 1985-1990	-758.29 (119.34)	308.48 (206.05)	0.077	0.123
built 1980-1984	-1,293.80 (165.61)	229.88 (266.34)	0.050	0.042
built 1970-1979	-1,271.81 (135.78)	607.93 (231.31)	0.047	0.063
built 1960-1969	-1,410.49 (126.58)	490.89 (216.20)	0.092	0.094
built 1950-1959	-1,152.89 (117.60)	-19.52 (202.72)	0.163	0.165
built 1940-1949	-1,108.46 (121.93)	-225.87 (206.20)	0.149	0.163
built 1930-1939	-1,240.06 (144.56)	-105.13 (226.38)	0.109	0.089
built 1920-1929	-1,254.87 (170.68)	-257.87 (245.92)	0.089	0.065
built 1910-1919	-1,179.78 (177.96)	-263.13 (252.24)	0.083	0.060
built pre-1910	-1,807.82 (168.00)	103.80 (240.91)	0.111	0.074
Lot size	0.0010 (0.0006)	-0.0040 (0.0010)	4,319	8,838
Adjusted R-Squared		0.7105		
Observations		21,755		
Incentive to suburbanize			**-$143 per year**	**-$590 per year**

Notes: The city column reflects the coefficient of the interaction of the variable and a city dummy. Numbers in parentheses are standard deviations. MSA fixed effects included. Data Source: 1995 AHS. Price measured as an annual payment.

APPENDIX TABLE 2: Poverty, Income, and Housing Age

Dependent Variable:	Poverty rate			Log of median family income		
	all	old	new	all	old	new
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.2161	0.1017	0.3828	10.6196	11.2463	9.8719
	(0.0084)	(0.0228)	(0.0267)	(0.0289)	(0.0819)	(0.1071)
Distance from CBD, less than 3 miles	-0.0457	0.0117	-0.0511	0.1048	-0.1154	0.1582
	(0.0008)	(0.0023)	(0.0039)	(0.0027)	(0.0082)	(0.0158)
Distance from CBD, between 3 and 10 miles	-0.0093	-0.0347	-0.0177	0.0326	0.1176	0.0611
	(0.0004)	(0.0009)	(0.0014)	(0.0013)	(0.0033)	(0.0054)
Distance from CBD, more than 10 miles	0.0007	-0.0013	0.0007	-0.0045	0.0039	-0.0036
	(0.0001)	(0.0003)	(0.0002)	(0.0004)	(0.0012)	(0.0008)
Housing stock 6 to 10 years old	0.2062	0.5031	-0.0417	-0.7799	-1.3876	-0.0477
	(0.0161)	(0.0431)	(0.0456)	(0.0559)	(0.1565)	(0.1834)
Housing stock 11 to 20 years old	0.0931	0.1666	0.0461	-0.4516	-0.7965	-0.1174
	(0.0099)	(0.0274)	(0.0287)	(0.0342)	(0.0976)	(0.1159)
Housing stock 21 to 30 years old	0.1121	0.1650	0.0660	-0.4684	-0.7211	-0.0942
	(0.0095)	(0.0250)	(0.0283)	(0.0329)	(0.0897)	(0.1144)
Housing stock 31 to 40 years old	0.0341	0.0911	0.0226	-0.3970	-0.5530	-0.1824
	(0.0090)	(0.0239)	(0.0251)	(0.0311)	(0.0859)	(0.1008)
Housing stock older than 41 years	0.1584	0.1175	0.0830	-0.7143	-0.5896	-0.2597
	(0.0083)	(0.2278)	(0.0254)	(0.0287)	(0.0810)	(0.1021)
Observations	33,612	6,463	2,735	33,536	6,444	2,731
Adjusted R-Squared	0.3567	0.3519	0.3189	0.3335	0.3094	0.2521

Notes: Standard errors in parentheses. Unit of observation is the census tract. All regressions include MSA fixed effects.

APPENDIX TABLE 3: Cross-MSA Sample Correlation Table

	Public transport use differential	Public transport use differential (rich)	Walk to work differential	Welfare take-up rates differential	Project differential	Poverty differential
Public transport use differential	1.000					
Public transport use differential (rich)	0.894	1.000				
Welfare take up rates differential	-0.061	0.109	-0.083	1.000		
Housing differential	0.084	-0.018	0.119	-0.0562	1.000	
Poverty Rate Differential	0.389	0.290	0.3668	-0.3889	0.294	1.000

Note: differentials are the differences from values in central city to values in suburbs.

Table 1: Income and Distance from the City Center,
Four Old Cities

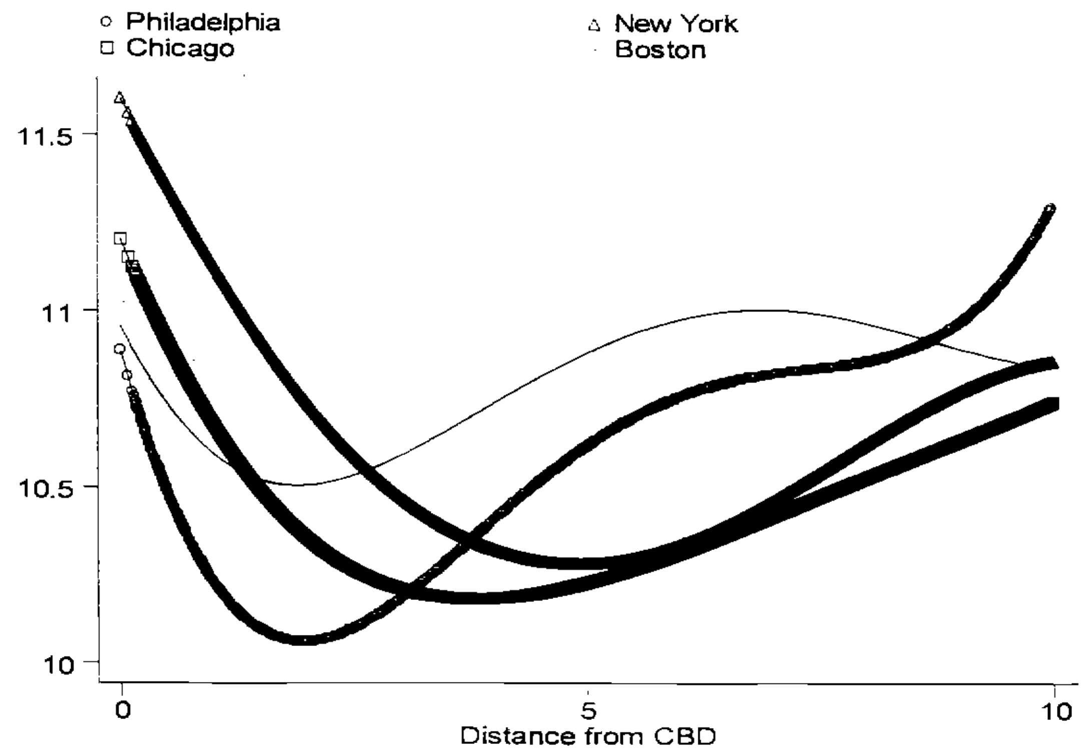


Figure 2: Income and Distance from CBD, Four New Cities

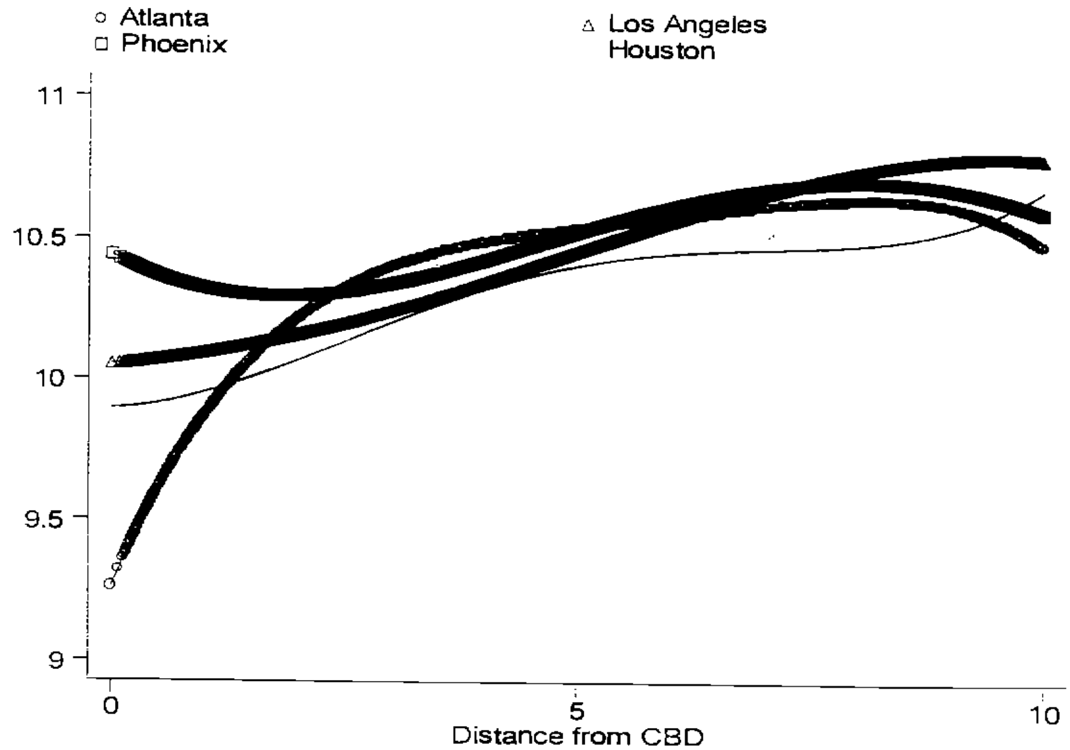


Figure 3: Occupational Status and Distance from CBD,
New York 1910 Ward Data

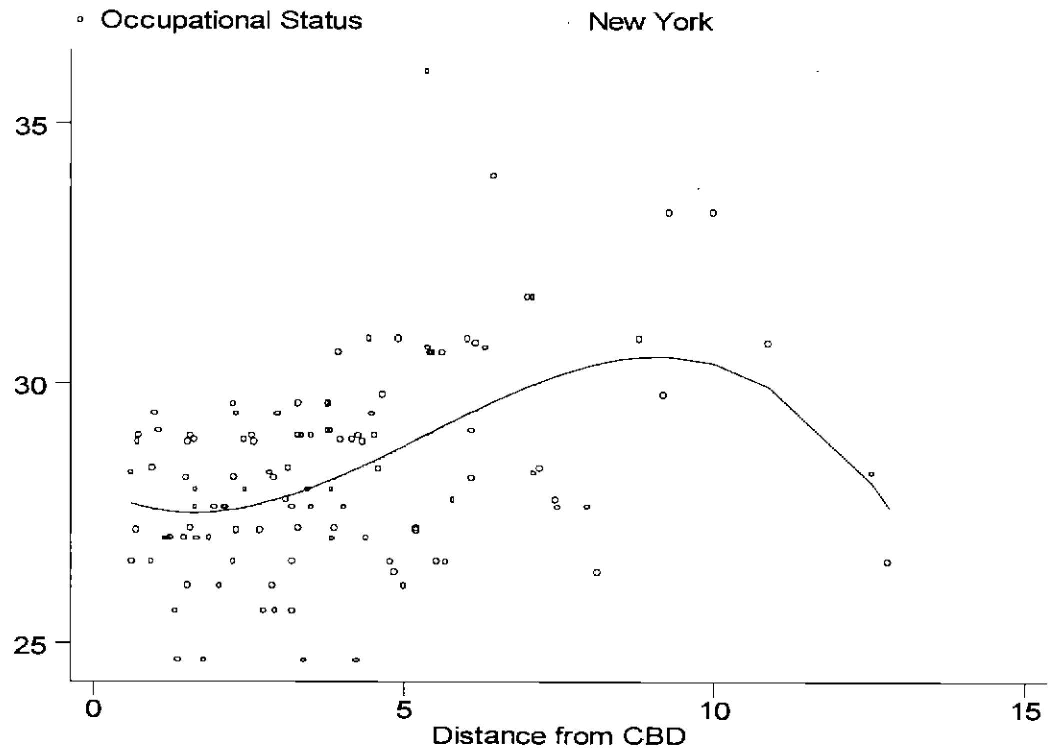


Figure 4: Housing Incentives to Live in the City: Rich vs. Poor

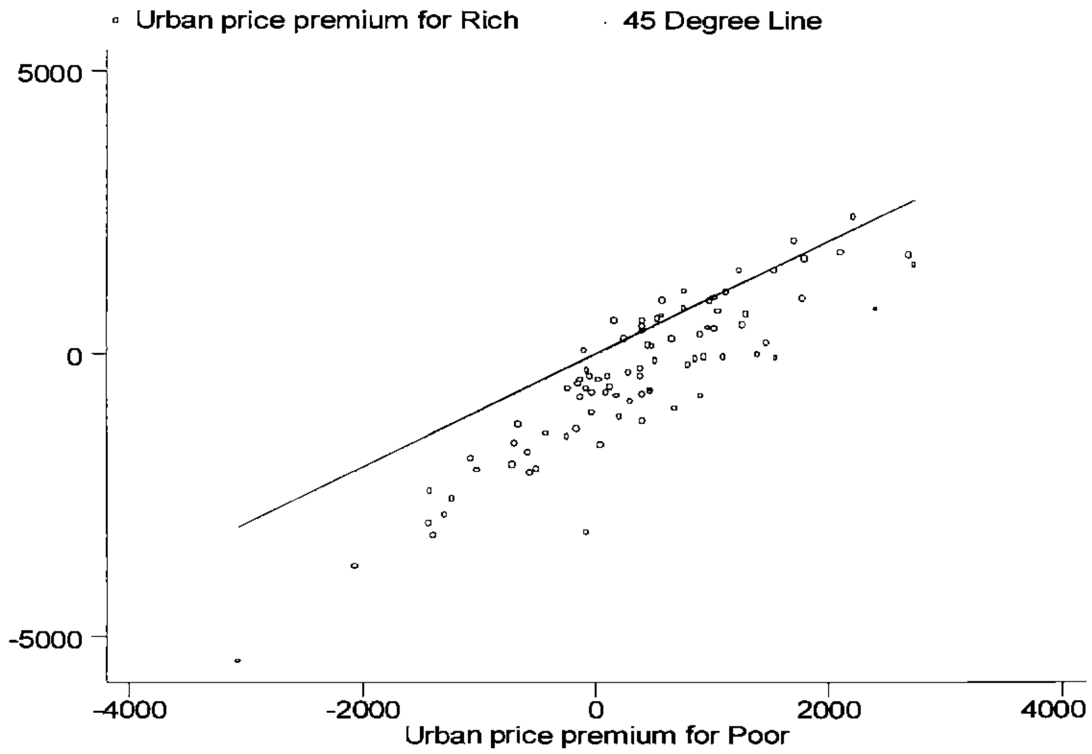


Figure 5: Urban Poverty and Housing Market Incentives

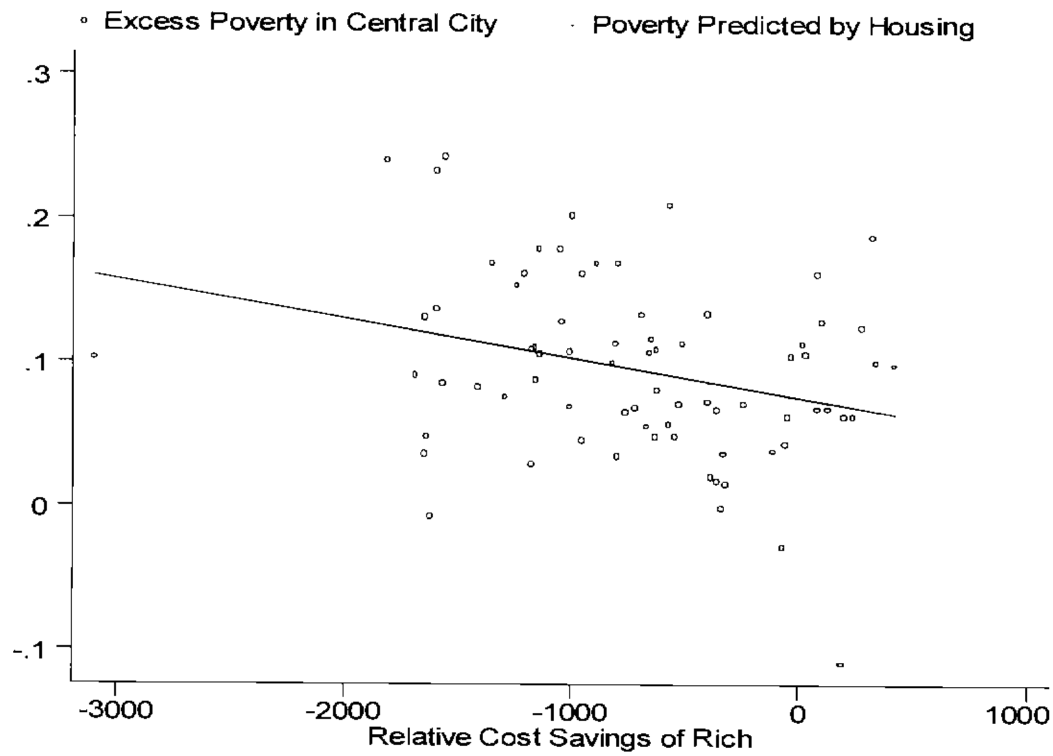


Figure 6: Urban Poverty and Public Transportation
Differences between Cities and Suburbs

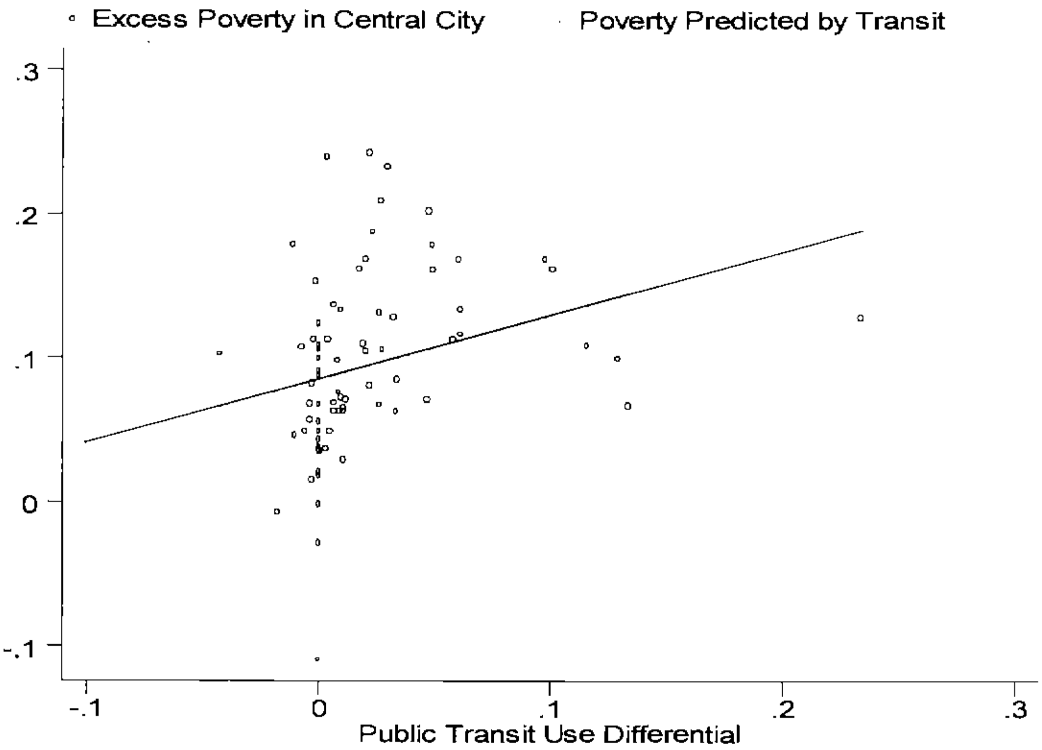


Figure 7: Vehicle Ownership Rates in Cities and Suburbs

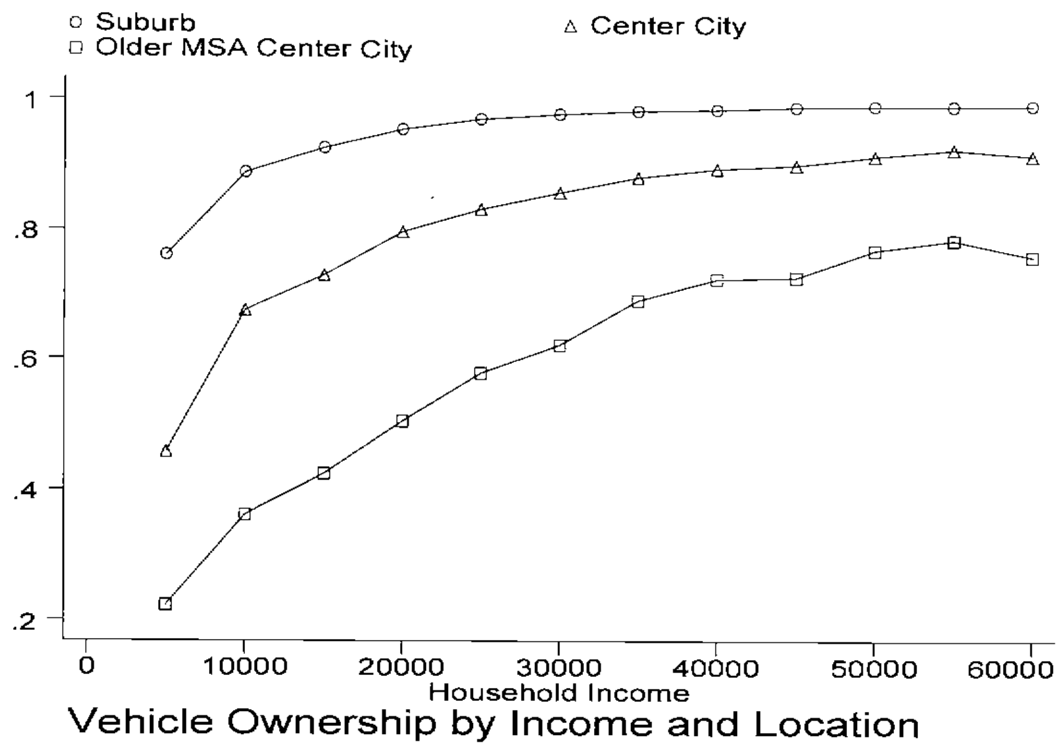


Figure 8: Zones of Transportation Modes Across Four Cities

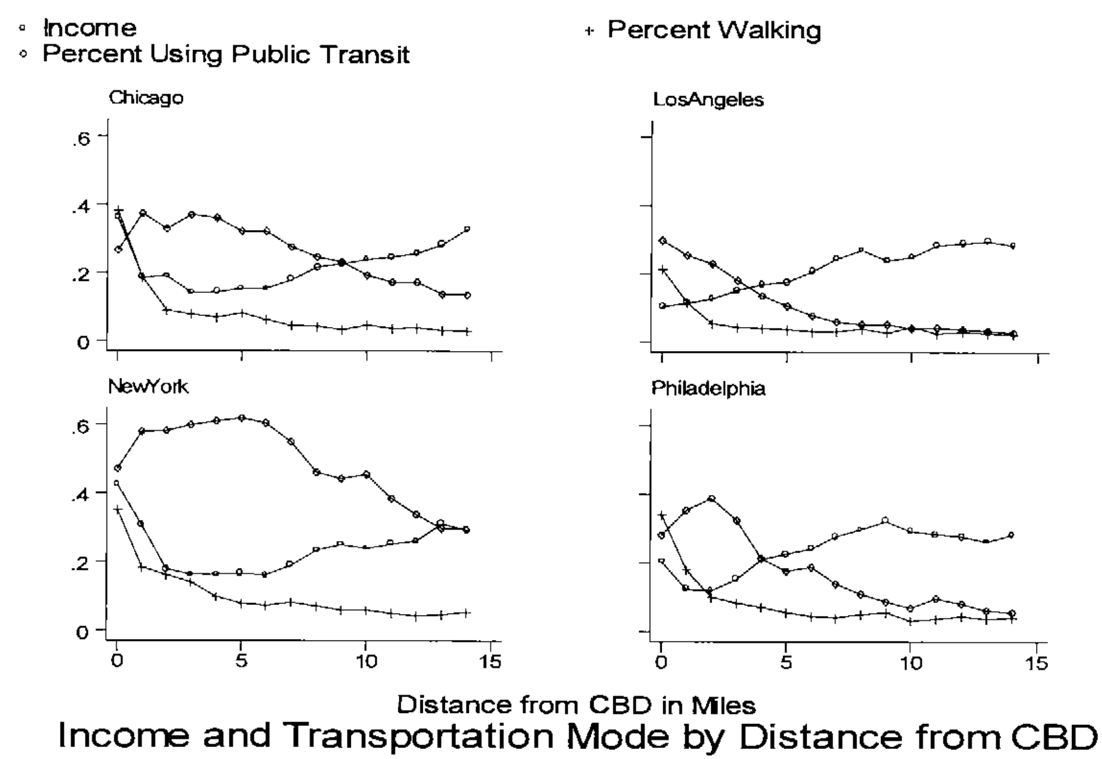
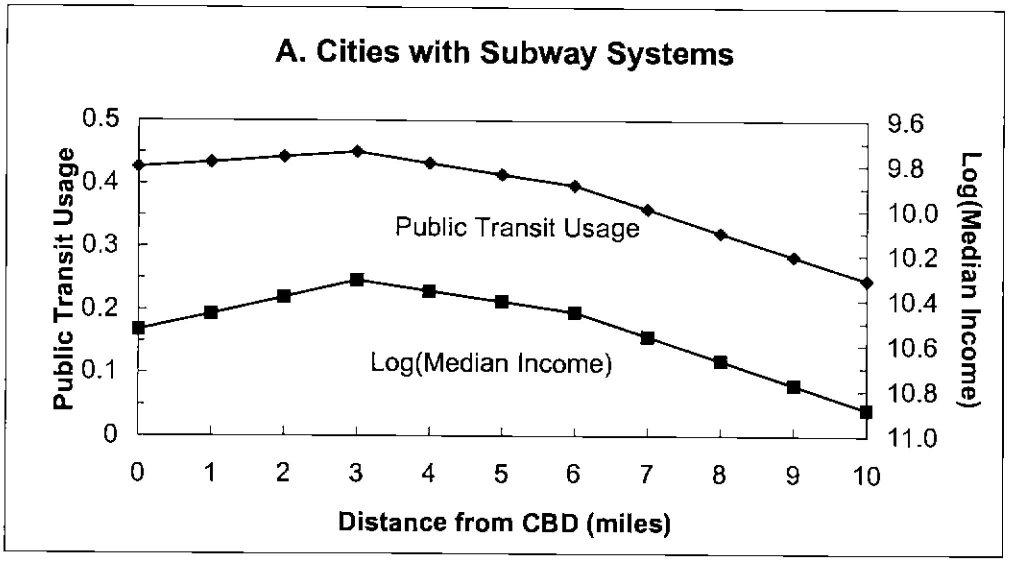


Figure 9: Public Transit Usage, Income, and Distance to CBD



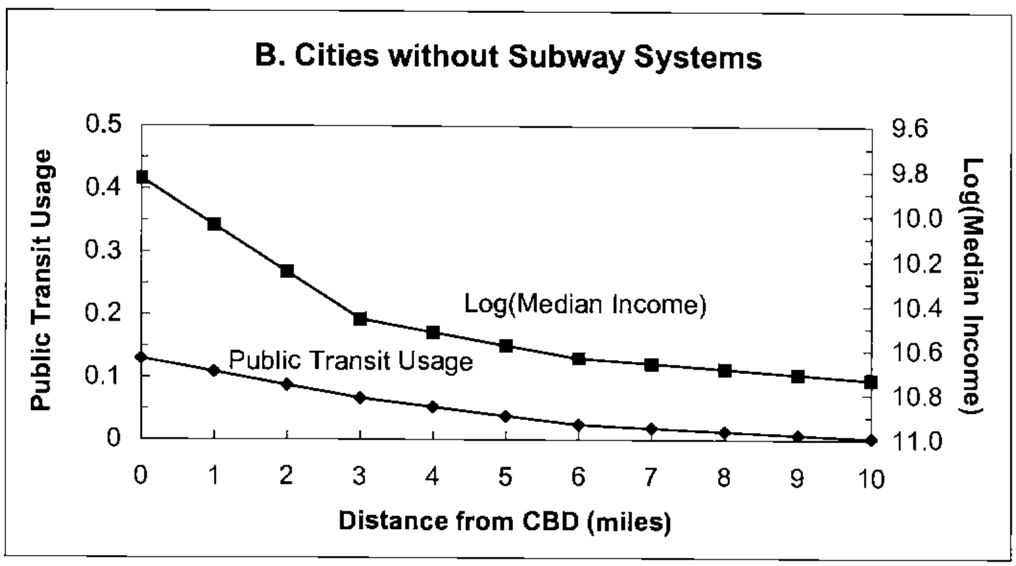


Figure 10: Cumulative Distribution of Employment
in New York and Los Angeles

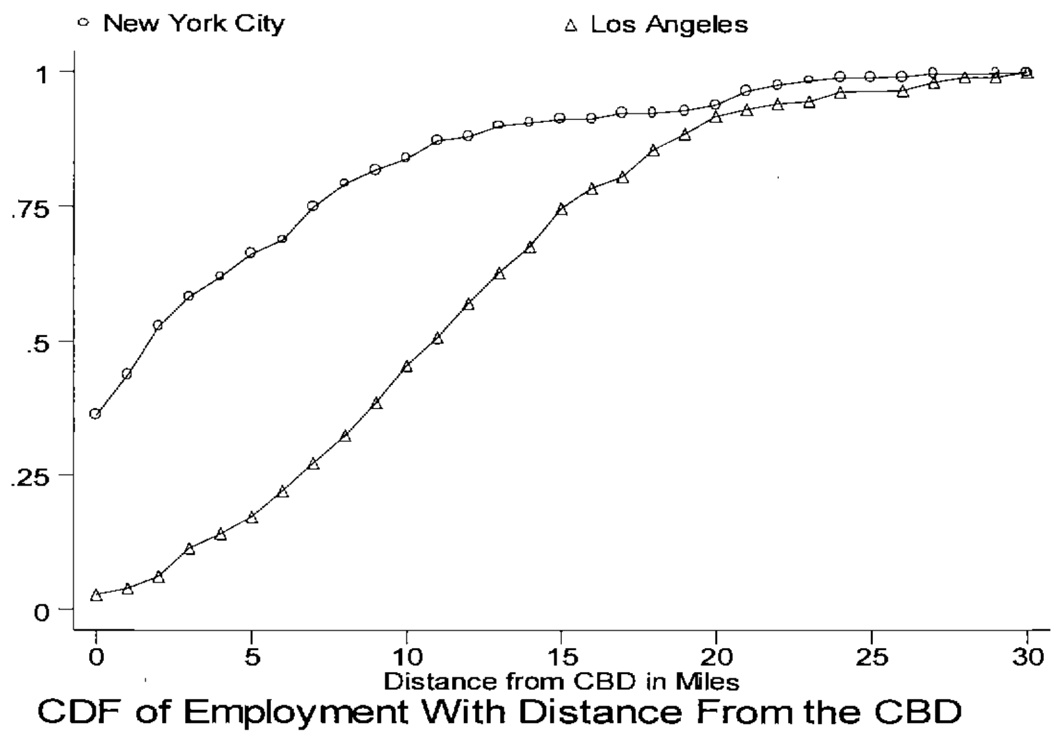


Figure 11:Urban Poverty and Higher Takeup Rates
for Government Assistance in Cities