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INEQUALITY AND THE MEASUREMENT OF RESIDENTIAL SEGREGATION BY INCOME IN AMERICAN NEIGHBORHOODS

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Inequality and the Measurement of Residential Segregation by Income In American Neighborhoods
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ABSTRACT

American metropolitan areas have experienced rising residential segregation by income since 1970. One potential explanation for this change is growing income inequality. However, measures of residential sorting are typically mechanically related to the income distribution, making it difficult to identify the impact of inequality on residential choice. This paper presents a measure of residential segregation by income, the Centile Gap Index (CGI) which is based on income percentiles. Using the CGI, I find that a one standard deviation increase in income inequality raises residential segregation by income by 0.4-0.9 standard deviations. Inequality at the top of the distribution is associated with more segregation of the rich, while inequality at the bottom and declines in labor demand for less-skilled men are associated with residential isolation of the poor. Inequality can fully explain the rise in income segregation between 1970 and 2000.

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I. Introduction

The rising economic segregation of neighborhoods has a number of potentially important consequences for distribution and overall social welfare. Previous research suggests that U.S. metropolitan areas witnessed a substantial increase in neighborhood-level sorting by income over recent decades (Jargowsky, 1996, and Massey and Fischer, 2003). One explanation for this change is the widening income distribution, which could make high- and low-income families less likely to choose the same neighborhoods. However, residential segregation by income is typically measured using indices that are mechanically related to the income distribution. These indices conflate changes in the distribution of income across neighborhoods with the direct influence of inequality on residential choice. This paper investigates the relationship between rising income inequality and residential choice using a new measure of residential segregation that is not mechanically related to the shape of the income distribution.

Why is economic segregation across neighborhoods important? Income sorting affects the distribution of role models, peers, and social networks. Sociologists such as Wilson (1987) hypothesize that the lack of neighborhood exposure to mainstream middle-class role models and social networks is a major contributor to urban joblessness and social problems. A number of empirical papers also suggest that the characteristics of one's neighbors and peers in school affect outcomes (Case and Katz (1991), Cutler and Glaeser (1997), Hoxby (2000)), though the issue is far from settled (e.g., Oreopoulos (2003), Kling, Liebman, and Katz (2005)). Residential decisions have implications for commuting behavior and the allocation of public goods. If residential choice is sensitive to the income distribution, economic policies that moderate or amplify income inequality may shape the cities in which we live.

The importance of income segregation in metropolitan areas is heightened by the rapid urbanization of the world's poor. As noted by Doug Massey in the 1996 presidential address to the Population Association of America, "[the] hallmark of the emerging spatial order of the twenty-first century will be a geographic concentration of affluence and poverty. Throughout the world, poverty will shift from a rural to an urban base; within urban areas poor people will be confined increasingly to poor neighborhoods, yielding a density of material deprivation that is historically unique and unprecedented" (p.399). The issue addressed in this paper is also important because of the high and rising levels of income inequality found in many countries. Machin (2008) reports that male wage inequality grew substantially between 1980 and 2000 in Australia, Germany, Italy, Japan, the Netherlands, New Zealand, Sweden, the U.K, and the U.S., for example.

The work presented here investigates how income inequality influences neighborhood choice across income groups in U.S. metropolitan areas. I introduce a new measure of income sorting, the Centile Gap Index (CGI), which is based on the residential distribution of families by income percentile.[1] Measures of residential segregation by income are calculated for a panel of 216 cities. The average level of income segregation across neighborhoods rose substantially in the 1980s, but did not change much in the 1970s or 1990s. It appears that, in the 1980s, metropolitan residents systematically changed the income rank groups with whom they shared a neighborhood. Perhaps not coincidentally, the decade was also one of sharply growing income inequality.

I use the Centile Gap Index to examine the effect of income inequality on residential segregation by income. Because the Centile Gap Index is not mechanically related to the shape of the income distribution, it captures the effect of the income distribution on residential choice. The main

[1] I use the CGI in a companion piece to this one, Watson (2006).

finding is a strong and robust relationship between income inequality and income segregation, after controlling for metropolitan area fixed effects, year effects, and a number of other factors. Inequality at the bottom of the distribution is related to the residential isolation of the poor, while inequality at the top is associated with segregation of the rich. The estimates suggest that one standard deviation higher income inequality is associated with 0.4-0.9 standard deviations higher income segregation. In a statistical sense, the rise in income inequality can fully explain the growth in income sorting over the period in American metropolitan areas.

II. Theoretical Background

Tiebout (1956) suggests that household location decisions can be viewed as choices over bundles of local public goods. In the Tiebout world, income sorting across political districts arises because income is correlated with willingness to pay for public goods. Similarly, households might sort by income across school districts or neighborhoods because income is correlated with willingness to pay for school quality or neighborhood quality. At the neighborhood level, sorting by income results from a divergence in willingness to pay for neighborhood attributes, including those attributes that vary within a political jurisdiction.[2] Residents need not care about the income of their neighbors explicitly, but typically sorting by income will be more pronounced if they do.[3] This paper studies Tiebout-style sorting by income across neighborhoods.

The simplest form of the Tiebout model implies that residential segregation by income should be complete. Epple and Platt (1998) extend the model to allow variation in both tastes for neighborhood quality and income. Because both income and tastes vary across households, the

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[2] In this paper willingness-to-pay refers to the maximum amount an individual would pay for a good, which reflects both preferences and ability to pay.

[3] This is the case if all families prefer rich neighbors (because rich families can outbid poor families to live in rich neighborhoods), or if all families prefer neighbors like themselves. If rich families prefer poor neighbors, income sorting would be reduced.

willingness to pay for neighborhood quality is imperfectly correlated with income. In equilibrium, neighborhoods are partially but incompletely sorted by income.

The degree of income sorting is influenced by the income distribution. As inequality increases, it becomes less likely that rich and poor households are willing to pay similar amounts for a given set of neighborhood amenities.[4] This is the direct effect of changes in relative income on income sorting. The direct effect suggests that, as income inequality rises, the rich will be more likely to outbid the poor for high-quality neighborhoods and the rich and the poor will be less likely to live in close proximity.

In addition, it is possible that income inequality changes the quality of neighborhoods differentially. For example, falling income at the bottom of the distribution could generate a large relative increase in crime in low-quality neighborhoods, which in turn would change the relative prices of low-crime and high-crime neighborhoods.

Similarly, richer families might produce more positive neighborhood externalities (by investing in landscaping or local public goods, for example). In this case, neighborhoods comprised of high-income families would become more desirable and the relative price of high-income neighborhoods would increase as the rich became richer. These indirect effects could result in an additional link between inequality and segregation, depending on the underlying household preferences.

This paper focuses on income segregation at the neighborhood level. However, there is a mechanical relationship between central city-suburb sorting and neighborhood sorting. If

[4] Willingness-to-pay may change differentially with rising inequality because poor families can no longer afford to live in certain neighborhoods, even home prices are unchanged.

inequality differentially affects the decision of high-income families to live in the suburbs, income sorting across neighborhoods would be affected. The theoretical predictions regarding inequality and relative suburbanization of the rich are ambiguous.

The classic Alanso-Muth-Mills model of a monocentric city postulates that housing closer to the city center is more desirable because of lower commuting costs.[5] Holding other factors equal, the rich should be willing to pay more for land in the central city because they have a higher value of commuting time. In an effort to explain the empirical observation that (in the U.S.) the rich are more likely to live in the suburbs, the literature traditionally assumes that the income elasticity of demand for land is high (Becker, 1965). In this context, inequality should heighten the differential suburbanization decisions of rich and poor, holding other factors equal.

An alternative explanation for why suburbanization rates vary by income comes from Glaeser, Kahn, and Rappaport (2008). The model suggests that the poor place a high value on public transportation, which is most available in dense urban areas. The framework also suggests that in older "subway" cities, some rich residents live very close to the central business district and rely on public transit. Here rising inequality has an ambiguous effect on the relative suburbanization of different income groups.

It is also important to keep in mind that overall suburbanization tends to be associated with *lower* measured segregation levels. Central cities generally have higher levels of neighborhood segregation than suburbs, presumably because a neighborhood represents a much smaller physical area in the dense central city than in the suburbs. A neighbor's income level presumably matters more to the residential location decision when that neighbor is a short distance away.

[5] The classic monocentric model is summarized by Glaeser (2007).

There is no clear theoretical link between inequality and overall suburbanization rates. Nevertheless, suburbanization was an important feature of the period. Between 1980 and 2000, the fraction of all metropolitan families living in the central city fell by 2.5 percentage points to 0.44, with a four point decline in the 1980s and a partial rebound in the 1990s.[6] This pattern would be expected to reduce measured income sorting holding other factors constant.[7]

There are a number of factors other than income inequality that are likely to shape residential patterns. In the empirical work that follows I control for time-invariant metropolitan area factors with metropolitan area fixed effects. I also account for differences in industrial composition that could affect overall employment, the employment of less-skilled men, and suburbanization of employment, all of which could directly impact residential patterns. Controls for demographic characteristics of the metropolitan area are included as well. Importantly, income is correlated with race and ethnicity, and segregation by race and ethnicity is a striking feature of American metropolitan areas.[8] In the analyses that follow, I separately examine segregation by income among black families, and include controls for racial segregation in some specifications.

In sum, even if no family cares explicitly about the incomes of its neighbors, factors such as income inequality affect the willingness of different income groups to pay for various attributes of neighborhoods. Divergence in the valuation of neighborhood attributes across income groups leads to market pressure for income sorting, so the model predicts a positive relationship between

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[6] See the web appendix for the definitions of central city and suburb. The finding that suburbanization declined slightly in the 1990s differs from results reported in Frey (2001) and Fischer (2008), who find increasing suburbanization over the 1990s. Weighted averages for in my sample show slight increases in suburbanization between 1990 and 2000. Reported suburbanization may be more pronounced in other studies because my sample excludes metropolitan areas that did not exist in 1970. Suburbanization, within-central city and within-suburb segregation are not calculated for 1970 due to data limitations.

[7] Farrell (2008) examines city-suburb sorting by race and ethnicity.

[8] Iceland and Wilkes (2006) discuss the links between segregation by race/ethnicity and segregation by class.

inequality and segregation.[9] In particular, as the real incomes of income rank groups diverge, income rank groups are less likely to share neighborhoods. These changes could be amplified if the relative quality of high- and low-income neighborhoods is affected by rising inequality. A widening income distribution is likely to have both direct and indirect effects on residential segregation by income.[10]

III. Measuring Residential Segregation by Income

To identify the effect of inequality on residential sorting by income, one needs an index to measure sorting. Because the literature on income segregation faces the challenge of measuring segregation along a continuous dimension, it cannot easily borrow indices from the racial segregation literature. One approach is to define two groups of interest, such as poor and non-poor, and use the dissimilarity and isolation indices developed in the racial segregation literature.[11] For example, Massey and Fischer (2003) report an increase in dissimilarity between poor and affluent families between 1970 and 2000. Abramson, Tobin, and Vandergoot (1995) and Massey and Fischer (2003) both find evidence of rising isolation of the poor.

By restricting the analysis to two groups, the isolation and dissimilarity indices do not make full use of the available information. Multi-group measures of segregation such as the entropy index have been proposed and used to describe both sorting by race and ethnicity and sorting by income (Reardon and Firebaugh, 2002, and Fischer, 2003). While including several groups captures additional variation, the relevant groups are defined by the researcher. In the case of a continuous

[9] In practice, there are pecuniary and non-pecuniary relocation costs faced by families and costs of retrofitting or building new housing. The impact of adjustment costs in growing and declining cities is discussed in Watson (2006).
[10] This paper does not attempt to distinguish the direct effect of willingness (and ability) to pay from the indirect effect of changing neighborhood quality.
[11] The dissimilarity index reflects the fraction of residents that would have to move to achieve balance across neighborhoods. Isolation is the fraction of a typical group member's neighborhood that is comprised of members of the same group.

variable, the appropriate boundaries between groups are not necessarily obvious. For example, Fischer (2003) defines four income groups with cut-offs corresponding to the poverty line for a family of four, four times the poverty line, and roughly halfway in between.

An alternative approach is to decompose the total income variation into within- and between-neighborhood variation. One of the most commonly used measures is the Neighborhood Sorting Index (NSI) developed by Jargowsky (1995), a measure of overall income segregation across Census tracts. The NSI is square root of the ratio of the between-tract income variance to the total income variance. Analogously, Ioannides (2004) evaluates in a regression context to what extent the variance of log incomes can be explained by a vector of cluster dummies, where clusters are small neighborhoods of about 10 homes.

The variance decomposition measures are intuitively appealing and give more insight into overall income sorting than the two-group or multi-group indices. A limitation of the Neighborhood Sorting Index is that it requires estimating the total variance of income in a metropolitan area, a variable that is not readily available. The variance of income can be estimated for a subset of metropolitan areas using the Public Use Micro Samples, can be estimated for each state using the PUMS, or can be estimated for the full set of metropolitan areas by making assumptions about the income distribution. Mayer (2001) solves the problem by using individual level census data by state to estimate total state variance of income. Instead, Jargowsky (1995) assumes a particular income distribution and then fits the income bins to that distribution.[12]

[12] In particular, he assumes metropolitan area income is distributed with a linear distribution below the mean and a pareto distribution above the mean, a convention which I follow for computing metropolitan area inequality measures. No assumptions on the income distribution of a metropolitan area are necessary for computing the Centile Gap Index.

A shortcoming of all of these measures is that they change mechanically when there is a rank-preserving spread in the income distribution, even if no family moves. The direction of the change depends on the initial distribution of family income groups across neighborhoods.[13] If one is interested in the effect of inequality on residential choice, this is not a desirable feature of measured income segregation.

I introduce an index of segregation that is not directly related to the shape of income distribution in a metropolitan area. The Centile Gap Index (CGI) estimates how far the average family income within a tract deviates in percentile terms from the median tract family income, compared to how far it would deviate under perfect integration. Because the Centile Gap Index is based on estimated income percentiles, it is particularly well-suited to studying the relationship between income inequality and income segregation. The formula for the Centile Gap Index of metropolitan area *m* is

$$CGI_m = (0.25 \ - \ (1/J_m) \ \Sigma_j \ |P_j - P_{medtj}|) \ / \ 0.25,$$

where CGI_m is the Centile Gap Index in metropolitan area m, J_m is the number of families in metropolitan area m, P_j is the estimated percentile in the metropolitan area m income distribution of family j, and P_{medtj} is the estimated income percentile of median family in the tract of family j. That is, the term $|P_j - P_{medtj}|$ represents the estimated income percentile distance of a given family from the median family in their tract. If a metropolitan area were fully integrated by income, each census tract would contain the full income distribution (defined from 0 to 1), and the average centile difference between a family and the median family in the tract would be 0.25.

[13] As a simple example, suppose there are four households. One neighborhood has households with incomes of 10 and 30, another has households with incomes of 20 and 40. The NSI is 0.2 (overall variance is 125 and between-tract variance is 25). If the richest person gets five dollars and the poorest person loses five dollars, the NSI becomes 0.26. If instead the household earning 30 gets $5 the household earning 20 loses $5, the NSI becomes 0.04. In both cases, the NSI changes even if nobody moves, and the direction of the change depends on the initial distribution of income across neighborhoods and the particular form of the change in the income distribution. Similarly, two-group and multi-group indices typically change mechanically when the income distribution changes because the fraction of the population in each group changes differentially across neighborhoods even if no family moves.

Therefore, under perfect integration, the CGI equals 0. In contrast, a completely segregated city would consist of homogenous neighborhoods. The average percentile difference between a family and the median family in the tract would be 0, yielding a CGI of 1 under perfect segregation.[14]

The major advantage of the Centile Gap Index is that it depends on income percentiles and therefore requires no assumptions about the income distribution of a metropolitan area. As mentioned above, the key assumption I make is that the distribution of income percentiles within an income bin within a census tract is uniform. If this assumption is correct, a rank-preserving spread of the income distribution with no subsequent movement of households would leave the Centile Gap Index unchanged.[15]

Conceptually, it is worth distinguishing between different notions of neighborhood income segregation that might be of interest. Both the neighborhood distribution of income and the neighborhood distribution of socioeconomic backgrounds are plausibly important to outcomes. The isolation of the poor, a measure of segregation used in some studies, focuses on the income distribution of the neighborhood of a typical poor family. In contrast, the Centile Gap Index is a measure of the distribution of income rank groups across neighborhoods, not of the distribution of income across neighborhoods. Thus, if neighborhoods are segregated and fixed, a rise in income inequality could make the poor worse off because average neighborhood income might fall. This effect is not captured by the CGI. Rather, a rank-preserving spread of the income distribution induces a systematic change in the Centile Gap Index only if it induces a change in the residential

[14] With a small number of income bins, perfect segregation cannot be observed. See the web appendix for a discussion.

[15] In practice, the CGI could change slightly in either direction as a result of a change in the income distribution even if families do not move because income bins rather than exact incomes are used. As discussed in the web appendix, the boundaries of the income bins do not appear to be very important empirically with 15 or more bins.

location choices of different income groups. For the current study, which focuses on how residential choice responds to inequality, this is an advantage of the Centile Gap Index.

IV. Residential Segregation Across Metropolitan Areas

The empirical analysis presented here is based on census tract level family income data from the 1970, 1980, 1990, and 2000 U.S. censuses.[16] As is common in the literature, I use the census tract – an area of roughly 4,000 people defined by the Census Bureau – as the definition of a "neighborhood."[17] Information at the tract level is used to construct indicators of income segregation and income inequality at the metropolitan area level, and to calculate several metropolitan area variables in 1970. I supplement the tract level information with data collected by the Census at the county level, county data in the City and County Data Books, and national industrial employment trends in the Integrated Public Use Microsample (IPUMS). The metropolitan areas are based on the 2003 census county-based metropolitan area definitions, so they represent a constant geographic area over time to the extent that the counties were tracted. The sample includes 216 of the 217 metropolitan areas that had at least one tracted county in 1970.[18]

The data on family income at the census tract level is available using 15-25 income bins defined by the Census Bureau. The information can be aggregated to the metropolitan area level and, to the extent that income is accurately reported, one can determine the actual range of income

[16] The tract-level family income data is provided by the Census in 15, 17, 25, and 16 income bins for 1970, 1980, 1990, and 2000 respectively. The implications of this fact are discussed in the web appendix.

[17] The primary disadvantage to defining a neighborhood as a census tract is that a neighborhood is a much smaller geographic unit in a dense urban area than in a sprawling suburb. It is likely that much of the true segregation in suburban areas is due to within-tract sorting and is not picked up by a tract-based measure. Because both the physical proximity and "nearest neighbors" matter (for example, a neighbor living a quarter mile away has less relevance in a dense urban area than in a suburb), the ideal measure of neighborhood segregation is unclear.

[18] Gainesville, FL is excluded from the analysis due to missing data. The definition of metropolitan areas is discussed in the web appendix.

percentiles in a metropolitan area represented by each income bin. This strategy eliminates the need for any assumptions about the income distribution in a metropolitan area and thereby overcomes a potential source of bias. Family income groups within a census tract are known to be within a narrow range of income percentiles, but the exact income ranks are not known. To estimate the likelihood that a family is in a given percentile within the narrow range, I assume that families in a particular income bin in a particular tract are uniformly distributed among the percentiles represented by the bin. In the web appendix, I discuss the uniformity assumption and argue that the bias introduced by it is small.

The consensus of the previous empirical literature is that neighborhood income segregation rose between 1970 and 1990, and flattened or declined between 1990 and 2000. Jargowsky (1995, 1996) reports that economic segregation within racial groups increased both over the 1970s and over the 1980s. Mayer (2001) finds a slight decline in overall tract-level segregation over the 1970s and a substantial rise in the 1980s.[19] Using a measure of segregation (the entropy index) that summarizes sorting over four income groups, Fischer (2003) similarly finds a pattern of increasing income segregation in the 1970s and 1980s and a decline in segregation in 1990s in large metropolitan areas.

Other work has looked at the residential segregation of particular groups. The isolation of the poor, the average proportion of poor people in a typical poor person's census tract, rose from 19.5 percent to 21.3 percent between 1970 and 1990 in large metropolitan areas (Abramson, Tobin, and Vandergoot, 1995). Jargowsky (1997) similarly documents a rise in the concentration of the poor in high-poverty neighborhoods over the period. Massey and Fischer (2003) report an

[19] Both Mayer (2000) and Jargowsky (1995) use the Neighborhood Sorting Index (NSI), a measure of overall economic segregation developed by Jargowsky. The NSI is square root of the ratio of the between-tract income variance to the total income variance. The total income variance must be estimated, an issue discussed in Section III.

increase in the concentration of poverty between 1970 and 2000 in large metropolitan areas, with a large rise in the 1980s and a decline in the 1990s. Massey and Fischer also measure the concentration of affluence and find rising residential segregation of the rich between 1970 and 2000. Fischer et al. (2004) report growing isolation of the top and bottom quintiles between 1970 and 1990, followed by flattening in the 1990s.

Table 1 presents some basic facts about the sample used in the present analysis. The 216 metropolitan areas in the sample underwent important transitions over the period. Between 1970 and 2000, the population of an average metropolitan area in the data set grew from 165,000 families to 245,000, and the number of census tracts increased accordingly. The mean and median family income and the educational attainment of metropolitan areas also grew over the time period. The industrial composition of metropolitan areas shifted, resulting in decreased demand for less-skilled men and a declining fraction of jobs in the central city. At the same time racial segregation was declining. All of these changes could plausibly affect the degree of income sorting in metropolitan areas.

As shown in Table 2, overall economic segregation in metropolitan areas increased between 1970 and 2000.[20] The average Centile Gap Index increased from 0.110 to 0.120 over the period, decreasing slightly over the 1970s and the 1990s and rising substantially over the 1980s. The weighted mean of the Centile Gap Index rose from 0.129 to 0.158 between 1970 and 2000. The weighted mean of the CGI rose during the 1970s and 1980s and was flat over the 1990s, reflecting the fact that income segregation increased earlier and more substantially in larger cities.

[20] One might wonder how large these changes in economic segregation were. The answer is that they were substantial, but average segregation in 1990 was not at a level unheard of in 1970. The metropolitan area with the median Centile Gap Index in 1990 would have placed at the 64th percentile of segregation in 1970. The 1990 mean Centile Gap Index is 0.3 of a standard deviation higher than the 1970 mean Centile Gap measure (using the 1970 standard deviation). Data for individual metropolitan areas is available on-line with the data appendix on the NBER website.

About two-thirds of American metropolitan areas witnessed increasing segregation of the rich from the poor over the last three decades, and over 85 percent of the metropolitan population lives in an area that was more segregated by income in 2000 than in 1970. The rise in overall economic segregation is not an artifact of the segregation index I have introduced. The NSI and the Herfindahl Index show a similar pattern, although income segregation as measured by the NSI increased in all three decades.[21] The panel data set including measures of income sorting for each of the 216 metropolitan areas is available on-line in the web appendix.

It is also useful to examine segregation at different parts of the income distribution. I divide the families in each metropolitan area into five income quintiles. The exposure of quintile x to quintile y is the fraction of quintile y families in a typical quintile x family's census tract.[22] For example, the exposure of the bottom quintile to the top quintile represents the fraction of top quintile families in a typical bottom quintile family's census tract. The exposure of an income group to itself is referred to as its "isolation."

The top and bottom income groups were more isolated in 2000 than in 1970. Families in the bottom quintile of their metropolitan area family income distribution had neighborhoods that were 26.3 percent bottom quintile in 1970 and 27.6 percent bottom quintile in 2000. Top quintile families were also more likely to live with other top income quintile families. In 2000, the typical family in the bottom quintile lived in a neighborhood that was about 28 percent bottom quintile residents and 14 percent top quintile residents, while the proportions were roughly reversed for top quintile families.

[21] The difference between the NSI and the other measures may be explained by two factors. First, the NSI heavily weights segregation of the extreme income groups relative to the other measures. In the 1970s, the poor grew more isolated but other income groups were fairly integrated. Second, the CGI and the Herfindahl are measures based on income percentiles rather than the variance of income. The formulas for the Neighborhood Sorting Index and the Herfindahl Index are reported in the web appendix.

[22] The formula for the Exposure Index is reported in the web appendix.

Empirically, income sorting between the central city and the suburbs does not explain neighborhood income segregation. The growth in neighborhood income segregation is not due to differential suburbanization rates, but rather sorting within the suburbs and within the central city in the 1980s. More generally, neighborhoods *per se* seem to be important to residential decisions. Davidoff (2005), for example, finds that neighboring zip codes in different jurisdictions are only slightly more different in terms of average income than neighboring zip codes within the same jurisdiction. Neighborhood attributes, even within political districts and school districts, are important to residential choice.

In sum, the story of the 1970s is one in which the poorest families grew more isolated from other groups, but most of the population experienced little change in income segregation. The 1980s witnessed far more pervasive growth in income sorting. The growing isolation of the poor was mainly driven by increasing concentration and isolation within the central city. The richest families also separated from other groups in the 1980s. Isolation of the top income quintile rose within the suburbs as well as within the city. In the 1990s, income segregation fell slightly, as income groups mixed within cities and within suburbs. However, this decline was too small to offset the rise in segregation in the 1980s. The growth of neighborhood segregation in the 1980s is responsible for the overall increase in economic segregation over the thirty-year period.

V. Inequality and Neighborhood Segregation by Income

What explains the rise in residential sorting by income in the 1980s? Rising income inequality is a natural candidate. The relationship between income inequality and income segregation is foreshadowed by Figure 1, which plots the strong positive relationship between growth in income segregation and growth in income inequality between 1970 and 2000.

This section offers a detailed analysis of the relationship between income inequality and income sorting. I examine the impact of income inequality on neighborhood sorting and city-suburb sorting for all metropolitan families. I perform a separate investigation of income sorting among black families. The baseline analyses include a large number of controls aimed at isolating the causal impact of changes in the income distribution on residential choice. I also instrument for inequality using actual and predicted manufacturing employment shares.

A. Analysis of Neighborhood Income Segregation for All Families

A fixed effects specification using four Census years allows one to control for any unobserved attributes of metropolitan areas that do not change over time and that could be correlated with both inequality and segregation levels. I estimate the following reduced form model:

$$Segregation_{mt} = \beta_1 * Inequality_{mt} + \beta_2 * PredictedEmployment_{mt} +$$

$$\beta_3 * Predicted\ Employment\ For\ Less\ Skilled\ Men_{mt} +$$

$$\beta_4 * Predicted\ Central\ City\ Employment\ Share_{mt} +$$

$$other\ MSA\ characteristics_{mt} * \beta_5 + \alpha_m + \delta_t + \mu_{mt}.$$

In the base fixed effects specification presented in Table 3, segregation is measured by the Centile Gap Index and inequality is the log of the 80-20 family income ratio. Three industrial composition variables – predicted employment, predicted employment for less skilled men, and predicted central city employment share - are constructed using 1970 industrial shares in each metropolitan area interacted with national industry trends.[23] These variables are intended to capture the effects of industrial change on employment and job location which may be correlated with income inequality and directly influence residential choice. Metropolitan area fixed effects,

[23] The construction of these variables is described in the web appendix.

α_m, and year fixed effects, δ_t, are included, as are additional time-varying metropolitan area characteristics.

As predicted by theory, income inequality is highly correlated with income segregation. Controlling only for MSA fixed effects and year dummies, a log point change in the 80-20 family income ratio reduces the Centile Gap Index by 0.126, as shown in column II of Table 3. If one compares columns I and II of Table 3, rising inequality fully explains the increase in economic segregation between 1970 and 2000.

Column III shows that the estimated effect of inequality does not change much when a number of time-varying metropolitan area characteristics are included as controls. The results of the preferred specification are shown in column V of Table 3. After controlling for the predicted effects of industrial composition and a number of other factors, the coefficient on inequality is 0.108. This number implies that a one standard deviation increase in income inequality raises income segregation by 0.4 standard deviations.

Controlling for the industrial mix does not change the robust relationship between income inequality and residential choice. Nevertheless, the industrial mix (operating through its effects on employment, employment of less-skilled men, and job decentralization) is an important determinant of segregation. After controlling for fixed effects, metropolitan areas with higher predicted employment have lower rates of income segregation (columns IV and V of Table 3). This fact is entirely driven by a strong negative relationship between the predicted employment of less-skilled men and income segregation. As discussed below, declines in the employment of less-skilled men are associated with the flight of the rich from the central city.

Predicted job centralization is also associated with lower levels of income segregation. A centralized employment base induces residents of all income groups to live in the central city (see below). (As shown in Table 5, both the top and bottom quintile are significantly less isolated in areas with industries favoring central city employment.)

Other control variables also show interesting relationships with segregation. Cities with college-educated adult population and a disproportionate share of children under 18 have more income sorting holding other factors constant. Although the role of school districts is not explored here, the results suggest that schools may be an important factor in the income segregation story. Land area is negatively correlated with income segregation because less densely populated areas tend to have lower rates measured income segregation.[24]

The Centile Gap Index has the advantage that it is not mechanically related to residential segregation by income. If no household moves in response to an income shock, the CGI is approximately unchanged. However, because the measure of sorting and the measure of inequality are both derived from the same income distribution data, there is a potential endogeneity concern. To address this issue, I instrument for inequality using the actual or predicted manufacturing share of employment.

Manufacturing employment is associated with relatively high wages for less-skilled workers. Coultier (1997) documents a strong negative association between the fraction of employment in manufacturing in a metropolitan area and the family income inequality in the metropolitan area. This relationship guides the choice of instruments for this analysis. The first instrument is the fraction of employment in the metropolitan area-year in manufacturing. The second instrument is

[24] Metropolitan land area can change over time if counties are not tracted in 1970. The web appendix describes metropolitan area definitions.

an alternative measure which addresses the possibility of reverse causality (i.e. the manufacturing share could be affected by residential patterns). I *predict* the fraction of employment in manufacturing based solely on 1970 metropolitan area industrial mix and national changes in employment by industry.[25] Metropolitan areas with high initial shares of manufacturing employment experienced larger losses during the 1970-2000 period. The predicted share in manufacturing has a correlation of 0.96 with the actual share in manufacturing.

The first stage relationship (not shown) suggests a strong relationship between manufacturing employment and inequality. A higher actual or predicted manufacturing share is associated with a lower 80-20 family income ratio for families. This is the case after even controlling for the other industrial mix variables. The F-statistic is over 35 for the actual share manufacturing instrument and over 21 for the predicted manufacturing share instrument.

Columns VI and VII of Table 3 show the results of the instrumental variable analyses. In column VI, the log of the 80-20 family income ratio is instrumented with the actual share of employment in manufacturing. In column VII, the predicted share of employment in manufacturing is used as an instrument. In both cases, the relationship between inequality and segregation retains its strong statistical significance. Coefficients are roughly double their size in the comparable OLS regression (column V of Table 3). It is possible that the larger coefficients reflect a particular responsiveness of residential patterns to manufacturing-related inequality. Alternatively, measurement error or unobserved factors associated with inequality could be attenuating the baseline coefficients. Inequality induced my manufacturing declines has a large and significant impact on residential segregation by income.

[25] Details about the construction of this variable are in the web appendix.

B. Alternative Measures of Income Sorting

The construction of the Centile Gap Index ensures that the main finding – a robust positive relationship between inequality and segregation - is not an artifact of a mechanical relationship between measured inequality and measured income segregation. Table 4 reports results using standardized versions of the CGI and two alternative indices: the Neighborhood Sorting Index (NSI) and the Herfindahl Index (HI). All three dependent variables are converted to standard deviation units for comparability across indices.

As shown in Panel A of Table 4, the results for the baseline specification are similar in sign and significance if one uses the Neighborhood Sorting Index (NSI) or the Herfindahl Index (HI) as a measure of segregation. In each case, a log point increase in the 80-20 ratio translates into a 2.7-2.8 standard deviation increase in income sorting. The results are consistent with Mayer (2001) who finds a positive relationship between state-level inequality and the between census tract variance of income for the 1970-90 period using the Neighborhood Sorting Index.

The results change if one instruments for inequality using actual or predicted manufacturing share. Using actual manufacturing share as an instrument, the effect size increases for all three indices, as shown in Panel B of Table 4. For both the CGI and the HI, a log point increase in income inequality is associated with a 5.3 standard deviation increase in income sorting. For the NSI, an insignificant 3.3 standard deviation effect is estimated. The predicted manufacturing share instrument (Panel C of Table 4) yields estimates of 5.7-6.0 standard deviations for the CGI and HI. However the effect is much smaller (0.7 standard deviations) and statistically insignificant using the NSI.

The small effect of instrumented inequality on the Neighborhood Sorting Index is unexpected. Further investigation reveals that controlling for the other industrial mix variables – predicted employment demand, predicted demand for less-skilled men, and predicted central city employment share - absorbs much of the relationship between predicted manufacturing and the Neighborhood Sorting Index. The NSI is particularly negatively correlated with the employment of less-skilled men. A specification which omits the other industrial mix variables is shown in Panel D of Table 4. The effect size is estimated at 3.7 standard deviations for the Neighborhood Sorting Index and 8.4-9.0 standard deviations for the CGI and HI.

As noted above, increases in inequality can mechanically change the NSI in either direction depending on the initial distribution of income across neighborhoods and the form of changes in the income distribution. Given the differences in coefficients across specifications, it is difficult to isolate the NSI's mechanical relationship between inequality and income sorting in this particular setting. In the IV models, the smaller coefficient on inequality for the NSI compared with the other measures of segregation could reflect a differential response to manufacturing-related inequality or could suggest that changes in residential location decisions are partly masked by the mechanical relationship between inequality and the NSI.

Table 5 shows fixed effects analyses for two additional alternative measures of segregation, the isolation of the bottom income quintile and isolation of the top income quintile. Notably, inequality at the top is associated with segregation of the rich, while inequality at the bottom is associated with income segregation of the poor. This pattern is explored in detail in Table 6, in which each coefficient represents the effect of inequality on a particular index of exposure from a separate regression.[26] The 90-50 family income ratio strongly affects the isolation of the rich. A high 50-10 family income ratio, in contrast, makes it more likely that the bottom quintile lives

[26] Recall that the exposure of quintile *x* to quintile *y* is the fraction of quintile *y* residents in a typical member of quintile *x*'s neighborhood. Isolation is the exposure of a group to itself. Because both the 90-50 ratio and the 50-10 ratio are included in these models, an IV strategy using the one instrument is not feasible.

with its own income group and less likely it lives with the top three quintiles. Income segregation patterns across income quintiles mirror specific changes in the income distribution, suggesting a causal link between income inequality and income sorting.

C. City and Suburb Sorting

The 1970-2000 period was marked by substantial suburbanization. Table 7 examines the determinants of within-city, within-suburb, and between city-suburb sorting in a fixed effects model. There is some evidence that in cities with high inequality, the top quintile remains disproportionately in the central city, a pattern which would tend to reduce segregation. In places with industries favoring employment for less-skilled men, the top quintile is less likely to flee the central city. Overall, however, inequality has no significant relationship with overall suburbanization, and relative suburbanization patterns do not explain the link between inequality and segregation. Inequality is associated with income sorting *within* the central city and *within* the suburbs, as shown in the last two columns of Table 7.[27]

D. Analysis of Neighborhood Income Segregation for Black Families

Between 1970 and 2000, racial segregation declined (Cutler, Glaeser, and Vigdor, 1999, and others). It is less clear how economic segregation changed within race groups. Although the data is subject to suppression and the analysis is limited to a subset of 122 metropolitan areas with substantial black populations, the analysis suggests that economic segregation increased between 1970 and 2000 among black families and among white families (see Table 8).[28] Top quintile black families became much more likely to live with other top quintile black families and bottom

[27] Instrumental variables estimates are very imprecise for all dependent variables and there are no statistically significant relationships to report.

[28] The web appendix includes of discussion of several challenges posed by the available data. In particular, suppression is a problem, there are only nine income bins, and in some years the data is presented for families while in other years it is presented for households. The results should be considered suggestive.

quintile black families also became more economically isolated. Black family income segregation increased to a greater degree than income segregation overall.

Black family income inequality is a strong predictor of income sorting among black families. The fixed effects regression presented in column IV of Table 9 is analogous to column V of Table 3, but uses black family inequality instead of overall family inequality as the key independent variable. The estimated coefficient on black family inequality in Table 9 is significant, but is smaller than the coefficient in Table 3. In part, this may be due to measurement error in the smaller sample of black families.

If the link between inequality and segregation reflected unobserved changes in metropolitan areas, one would expect overall family income inequality to be reflected in segregation patterns among black families. However, this is not the case; overall family income inequality has no statistically detectable effect on economic segregation among black families (see column V of Table 9). This finding supports the notion that income inequality has a causal impact on residential choice.

It would be instructive to examine the relationship between inequality and segregation among black families using an instrumental variables approach. However, the first stage estimates suggest that actual and predicted manufacturing are not strongly correlated with black family income inequality after controlling for other factors. The relevant F-statistics are less than 4 and less than 2, respectively. The IV approach used for all families cannot be used to examine the effect of inequality on income sorting for this population.

As high- and low-income black families became more segregated from each other, what happened to racial segregation? As shown in Table 8, every income quintile of black families grew more exposed to white families (including white Hispanic families) over the period, but the change was most dramatic at the top of the black income distribution. In the sub-sample of 122 metropolitan areas, the exposure of a typical top quintile black family to white families grew from 0.48 to 0.62. This represents a truly remarkable change in a 30-year time period. The racial integration of rich black families outstripped that of poor black families, but even bottom quintile black families experienced a gain in exposure to white families.[29]

Column III of Table 9 shows the fixed effects analysis of empirical relationship between racial segregation and black family income sorting. Within the South, there is no significant relationship between racial and income sorting. However, outside the South, there is a negative association between racial segregation and income sorting among black families. Similarly, non-Southern cities with lower racial segregation have higher income segregation among all families (analysis not shown). Some metropolitan areas may be moving more quickly than others to a new residential equilibrium – one in which families sort primarily by income rather than race.

The analysis of income sorting among black families is consistent with the results for all families. The rapid growth in income inequality among blacks is reflected in a greater degree residential sorting by income for this group. These results support the notion that inequality generates divergence in willingness-to-pay for neighborhood attributes across income groups, and this divergence is reflected in residential choices, leading to segregation by income.

[29] Two measures of racial segregation are used in this analysis. I discuss them in the web appendix.

E. Summary of Findings

In conclusion, the baseline model suggests that a one point increase in the log of the 80-20 ratio in a metropolitan area is associated with 0.11 points higher Centile Gap Index. Roughly, this implies that a one standard deviation increase in log income inequality raises income segregation by 0.4 standard deviations for all families. The estimated effect size is 0.2 standard deviations for black families.[30] The IV estimates are larger, suggesting that a one standard deviation increase in income inequality raises income segregation by 0.9 standard deviations for all families. The effect of inequality on residential patterns mirrors specific changes in the income distribution. Inequality drives sorting within the suburbs and within the central city. Using the baseline model (column V of Table 3) to predict 2000 segregation with 1970 inequality levels, I find that income sorting in American cities would have declined over the 1970-2000 period to 0.100 in the absence of rising inequality (analysis not shown).

It is important to note that the factors driving segregation may also affect educational and labor market opportunities and, in turn, affect the income distribution. I have accounted for the educational composition of the metropolitan area and a number of labor market indicators in the analysis. I assume that the reverse causality factors are slower-acting and smaller in magnitude than the direct effect of income inequality on residential choice. Furthermore, the large and statistically significant IV estimates lend credence to the notion that inequality drives residential segregation by income.

VI. Conclusion

Neighborhood segregation by income grew between 1970 and 2000 in American metropolitan areas. This paper documents the change using a new measure of income sorting which is based

[30] The standard deviation of log(80-20 family income ratio) is 0.145 in the sample and the standard deviation of log(80-20 black family income ratio) is 0.162. The standard deviations for the CGI are 0.040 and 0.045 for all families and black families, respectively.

on income percentiles and therefore not mechanically related to the income distribution. I present evidence of a strong positive relationship between income segregation and family income inequality. One standard deviation higher income inequality is associated with 0.4-0.9 standard deviations higher income segregation. The estimates suggest that income sorting would have declined over the period in the absence of rising inequality.

Although this paper has not explored the effect of income segregation on individual outcomes, a number of researchers believe that neighbors matter. A widening of the income distribution affects the prices of housing and neighborhood attributes, making it more costly for low-income families to live near high-income families. Through this price externality, housing markets amplify the effect of income inequality on the well-being of different socioeconomic groups. If neighbors particularly affect the outcomes of children, this mechanism may also strengthen the link between equality in the income distribution and intergenerational mobility.

The results presented here beg the question of what motivates households choose one neighborhood over another. Why do households sort within political districts and school districts? Is it because physical attributes differ across neighborhoods, because social characteristics of neighbors differ across neighborhoods, or for other reasons? Traditional analyses of residential location decisions emphasize the choice over distances from the city center and the choice over political jurisdictions. The importance of neighborhoods – and neighbors – to residential location decisions is a ripe area for further work.

VII. References

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Table 1. Sample Means of Metropolitan Area Characteristics, 1970-2000

	Means of 216 Metropolitan Areas Unweighted			
	1970	1980	1990	2000
Metropolitan Area Characteristics				
Number of Families	164,878	188,255	219,737	244,766
Number of Tracts	151	171	196	220
Population (000s)	661	754	851	967
Mean Family Income Last Year (2000 dollars)	50,604	54,330	57,750	63,940
Median Family Income Last Year (2000 dollars)	44,789	47,597	48,188	51,659
80-20 Family Income Ratio	2.83	3.10	3.34	3.39
90-50 Family Income Ratio	1.94	2.00	2.13	2.23
50-10 Family Income Ratio	2.99	3.10	3.32	3.21
80-20 Black Family Income Ratio	3.53	4.41	5.85	5.40
Predicted Employment Rel. to 1970	1.00	1.28	1.54	1.73
Predicted Employment of Less-Skilled Men Rel. to 1970 Total Employment	0.44	0.43	0.38	0.38
Predicted Central City Share of Employment	0.57	0.52	0.52	0.48
Predicted Share Manufacturing				
Actual Share Manufacturing				
Fraction Black	0.10	0.10	0.11	0.12
Fraction Hispanic	0.05	0.06	0.07	0.10
Fraction Foreign Born	0.03	0.04	0.05	0.07
Fraction of 25+ College Grads	0.11	0.16	0.20	0.24
Fraction of 25+ High School Grads	0.55	0.68	0.71	0.85
Fraction Under 18	0.35	0.29	0.26	0.25
Fraction Under 65	0.91	0.90	0.86	0.88
Racial Segregation Index	0.38	0.32	0.28	0.22
Land Area (square miles)	1,894	2,469	2,844	2,843

Source: Tract-level and county-level Census data, U.S. Census Bureau, Census CD, Urban Institute Underclass Database, IPUMS, and author's calculations.

Notes: Median income and income ratios are estimated. Inflation adjustment based on CPI-U, 1982-4 base year. Predicted variables based on 1970 industry mix interacted with national trends. For some cities 1970 black and Hispanic populations are imputed. College graduates include those with 4 or more years of college in 1970 and 1980. High school graduates include GED in 1990 and 2000. Racial segregation refers to the isolation of blacks from whites, adjusting for group populations.

Table 2. Sample Means of Income Segregation Measures, 1970-2000

	Means of 216 Metropolitan Areas Unweighted			
	1970	1980	1990	2000
Overall Family Income Segregation Measures				
Centile Gap Index (CGI)	0.110	0.106	0.123	0.120
Neighborhood Sorting Index (NSI)	0.342	0.391	0.417	0.420
Herfindahl Index	0.238	0.237	0.244	0.242
Family Income Quintile Exposure Indices				
Exposure of Bottom Quintile to Itself	0.263	0.267	0.281	0.276
Exposure of Bottom Quintile to Third	0.193	0.193	0.192	0.193
Exposure of Bottom Quintile to Top	0.151	0.150	0.140	0.143
Exposure of Top Quintile to Bottom	0.151	0.150	0.140	0.143
Exposure of Top Quintile to Third	0.189	0.191	0.188	0.189
Exposure of Top Quintile to Itself	0.275	0.271	0.286	0.283
Family Suburbanization Measures (210 Metro Areas)				
Fraction of All Families in Central City	--	0.464	0.425	0.439
Fraction of Bottom Quintile in Central City	--	0.528	0.499	0.519
Fraction of Top Quintile in Central City	--	0.439	0.399	0.408
Fraction of Central City in Bottom Qunitile	--	0.239	0.249	0.253
Fraction of Central City in Top Qunitile	--	0.184	0.182	0.178
Within Central City/Suburb Segregation (210 Metro Areas)				
Centile Gap Index Within Central City	--	0.125	0.147	0.138
Exposure of Bottom Quintile to Itself in Central City	--	0.390	0.444	0.445
Exposure of Top Quintile to Itself in Central City	--	0.253	0.268	0.254
Centile Gap Index Within Suburbs	--	0.067	0.082	0.079
Exposure of Bottom Quintile to Itself in Suburbs	--	0.191	0.195	0.187
Exposure of Top Quintile to Itself in Suburbs	--	0.276	0.286	0.286

Source: Tract-level Census data, U.S. Census Bureau, Census CD, Urban Institute Underclass Database and author's calculations.

Notes: See text and appendix for description of segregation measures. Suburbanization variables not available for 1970. Within central city and suburb CGI computed using city or suburb income percentiles.

Figure 1. Change in Family CGI v. Change In Inequality

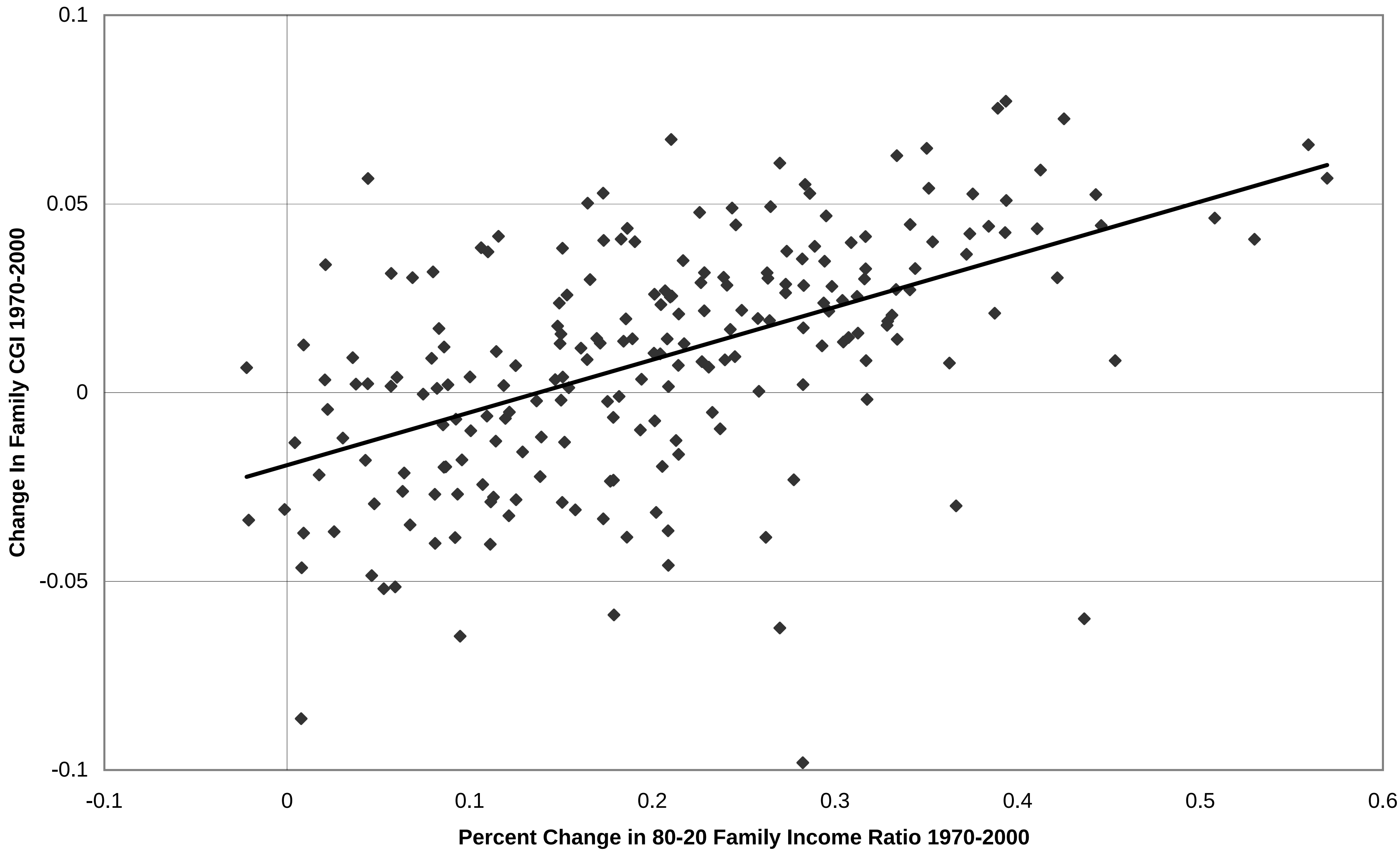

Table 3. Fixed Effects and IV Analyses of Neighborhood Segregation by Family Income

Dependent Variable: *Family Centile Gap Index*	I	II	III	IV	V	VI	VII
						80-20 Ratio Instrumented with Actual Share Manufacturing	80-20 Ratio Instrumented with Predicted Share Manufacturing
	OLS	OLS	OLS	OLS	OLS		
Log (80-20 Family Income Ratio)		**0.126****	**0.120****		**0.108****	**0.211****	**0.239****
		(0.016)	(0.021)		(0.020)	(0.060)	(0.072)
Pred. Employment				**0.192****	**0.197****	**0.203***	**0.204***
				(0.070)	(0.073)	(0.080)	(0.083)
Pred. Employment of Less-Skilled Men				**-0.911****	**-0.894****	**-0.877****	**-0.872****
				(0.285)	(0.281)	(0.294)	(0.300)
Pred. Central City Employment				**-1.211****	**-1.082****	**-0.959***	**-0.925***
				(0.331)	(0.364)	(0.413)	(0.430)
Log (Population)			**0.001**	**0.007**	**0.018***	**0.029***	**0.032***
			(0.010)	(0.010)	(0.010)	(0.012)	(0.013)
Fraction Black			**0.089**	**0.159****	**0.083**	**0.011**	**-0.009**
			(0.085)	(0.077)	(0.079)	(0.095)	(0.095)
Fraction Hispanic			**-0.008**	**0.098**	**0.013**	**-0.067**	**-0.089**
			(0.069)	(0.060)	(0.057)	(0.076)	(0.079)
Fraction Foreign Born			**-0.065**	**0.017**	**-0.051**	**-0.116**	**-0.134+**
			(0.062)	(0.047)	(0.053)	(0.071)	(0.080)
Log (Mean Family Income in 2000 dollars)			**-0.034****	**-0.091****	**-0.036****	**0.015**	**0.029**
			(0.016)	(0.015)	(0.016)	(0.033)	(0.039)
Fraction of 25+ High School Grads			**-0.031****	**-0.015**	**-0.033****	**-0.049****	**-0.054***
			(0.015)	(0.013)	(0.014)	(0.019)	(0.021)
Fraction 25+ College Grads			**0.296****	**0.319****	**0.194****	**0.075**	**0.043**
			(0.052)	(0.056)	(0.056)	(0.090)	(0.103)
Fraction Under 18			**0.180****	**0.197****	**0.194****	**0.192***	**0.191***
			(0.083)	(0.093)	(0.082)	(0.079)	(0.079)
Fraction Under 65			**0.267****	**0.113**	**0.199****	**0.281****	**0.303****
			(0.108)	(0.108)	(0.096)	(0.102)	(0.104)
Log (Square Miles)			**-0.011****	**-0.012****	**-0.015****	**-0.018****	**-0.019****
			(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Year is 1980	**-0.004****	**-0.016****	**-0.005**	**-0.116****	**-0.115****	**-0.114****	**-0.114***
	(0.002)	(0.002)	(0.007)	(0.036)	(0.039)	(0.043)	(0.045)
Year is 1990	**0.012****	**-0.009****	**0.010**	**-0.197****	**-0.199****	**-0.200***	**-0.201***
	(0.002)	(0.003)	(0.011)	(0.068)	(0.071)	(0.078)	(0.081)
Year is 2000	**0.009****	**-0.013****	**0.000**	**-0.291****	**-0.287****	**-0.283***	**-0.282***
	(0.002)	(0.003)	(0.013)	(0.094)	(0.099)	(0.110)	(0.113)
MSA Fixed Effects	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**
Observations	864	864	864	864	864	864	864
Number of Metropolitan Areas	216	216	216	216	216	216	216
R-squared	0.88	0.91	0.93	0.93	0.93		

Notes: Standard errors clustered on metropolitan area in parentheses. * and ** indicate statistical significance at the 10 and 5 percent level, respectively. The analysis is unweighted. See notes in Table 1 and text for variable descriptions.

Table 4. Analyses with Alternative Segregation Indices

Dependent Variable:	Standardized Family Centle Gap Index (CGI)	Standardized Neighborhood Sorting Index (NSI)	Standardized Herfindahl Index
Panel A. Baseline Model	**2.717****	**2.749****	**2.779****
Log (80-20 Family Income Ratio)	(0.492)	(0.585)	(0.457)
Panel B. Instrumented with Actual Share Manufacturing	**5.301****	**3.279**	**5.285****
Log (80-20 Family Income Ratio)	(1.502)	(2.085)	(1.434)
Panel C. Instrumented with Predicted Share Manufacturing	**6.007****	**0.710**	**5.729****
Log (80-20 Family Income Ratio)	(1.814)	(2.766)	(1.822)
Panel D. Instrumented with Predicted Share Manufacturing	**8.960****	**3.672***	**8.373****
Excluding Industrial Mix Variables	(1.771)	(1.764)	(1.670)
Log (80-20 Family Income Ratio)			

Notes: Each cell represents the coefficient from a separate regression. Baseline model is analogous to that in column V of Table 3. Instrumental variable models analogous to those in columns VI and VII of Table 3. Standard errors clustered on metropolitan area in parentheses. * and ** indicate statistical significance at the 10 and 5 percent level, respectively. The analysis is unweighted. Dependent variables are indices coverted to standard deviation units.

Table 5. Fixed Effects Analysis of Isolation of Top and Bottom Quintiles

Dependent Variable:	Isolation of Bottom Quintile		Isolation of Top Quintile	
	I	II	III	IV
Log (80-20 Family Income Ratio)	**0.060****		**0.084****	
	(0.015)		(0.015)	
Log (90-50 Family Income Ratio)		**0.010**		**0.163****
		(0.026)		(0.025)
Log (50-10 Family Income Ratio)		**0.055****		**0.007**
		(0.011)		(0.009)
Pred. Employment	**0.188****	**0.178****	**0.086**	**0.100***
	(0.062)	(0.062)	(0.055)	(0.053)
Pred. Employment of Less-Skilled Men	**-0.812****	**-0.801****	**-0.321**	**-0.378***
	(0.238)	(0.238)	(0.199)	(0.194)
Pred. Central City Employment	**-0.803****	**-0.847****	**-0.593****	**-0.593****
	(0.327)	(0.327)	(0.215)	(0.202)
Log (Population)	**0.007**	**0.006**	**0.008**	**0.007**
	(0.007)	(0.007)	(0.007)	(0.006)
Fraction Black	**0.133****	**0.117***	**0.047**	**0.083**
	(0.063)	(0.062)	(0.055)	(0.054)
Fraction Hispanic	**0.000**	**-0.002**	**0.041**	**0.061***
	(0.050)	(0.050)	(0.036)	(0.031)
Fraction Foreign Born	**-0.079***	**-0.069**	**0.038**	**-0.003**
	(0.047)	(0.049)	(0.037)	(0.032)
Log (Mean Family Income in 2000 dollars)	**-0.012**	**-0.014**	**-0.029***	**-0.043****
	(0.014)	(0.013)	(0.015)	(0.015)
Fraction of 25+ High School Grads	**-0.007**	**-0.010**	**-0.029****	**-0.026****
	(0.012)	(0.012)	(0.010)	(0.010)
Fraction 25+ College Grads	**0.071**	**0.086***	**0.214****	**0.219****
	(0.046)	(0.045)	(0.050)	(0.050)
Fraction Under 18	**0.193****	**0.180****	**0.012**	**-0.012**
	(0.077)	(0.079)	(0.066)	(0.065)
Fraction Under 65	**0.091**	**0.070**	**0.102**	**0.170****
	(0.079)	(0.080)	(0.071)	(0.073)
Log (Square Miles)	**-0.014****	**-0.013****	**-0.005***	**-0.005***
	(0.003)	(0.004)	(0.003)	(0.003)
Year is 1980	**-0.084****	**-0.082****	**-0.071****	**-0.073****
	(0.034)	(0.034)	(0.025)	(0.024)
Year is 1990	**-0.160****	**-0.155****	**-0.104****	**-0.115****
	(0.061)	(0.061)	(0.049)	(0.046)
Year is 2000	**-0.234****	**-0.226****	**-0.155****	**-0.175****
	(0.086)	(0.086)	(0.066)	(0.063)
MSA Fixed Effects	**yes**	**yes**	**yes**	**yes**
Observations	864	864	864	864
Number of Metropolitan Areas	216	216	216	216
R-squared	0.91	0.91	0.92	0.92

Notes: Standard errors clustered on metropolitan area in parentheses. * and ** indicate statistical significance at the 10 and 5 percent level, respectively. The analysis is unweighted. See notes in Table 1 and text for variable descriptions.

Table 6. The Effect of Income Inequality on Neighborhood Composition

Panel A. The Effect of Log 90-50 Family Income Ratio

Dependent Variable: *Exposure Index*	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Quintile 1	**0.010**	**0.030****	**0.026****	**-0.009**	**-0.057****
	(0.026)	(0.008)	(0.010)	(0.011)	(0.014)
Quintile 2		**0.022****	**0.016****	**-0.007**	**-0.061****
		(0.007)	(0.005)	(0.005)	(0.011)
Quintile 3			**0.009**	**-0.003**	**-0.048****
			(0.005)	(0.005)	(0.010)
Quintile 4				**0.016****	**0.003**
				(0.006)	(0.010)
Quintile 5					**0.163****
					(0.025)

Panel B. The Efffect of Log 50-10 Family Income Ratio

Dependent Variable: *Exposure Index*	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Quintile 1	**0.055****	**0.003**	**-0.019****	**-0.018****	**-0.021****
	(0.011)	(0.005)	(0.004)	(0.005)	(0.007)
Quintile 2		**0.001**	**-0.003***	**-0.002**	**0.002**
		(0.003)	(0.002)	(0.003)	(0.004)
Quintile 3			**0.006****	**0.007****	**0.009****
			(0.002)	(0.002)	(0.003)
Quintile 4				**0.008****	**0.004**
				(0.003)	(0.005)
Quintile 5					**0.007**
					(0.009)

Notes: Each cell represents coefficient from separate fixed effects regression including log 90-50 family income ratio, log 50-10 family income ratio and all control variables in Table 4. Standard errors clustered on metropolitan area in parentheses. * and ** indicate statistical significance at the 10 and 5 percent level, respectively. The analysis is unweighted.

Table 7. Fixed Effects Analysis of Suburbanization,
Within Central City Sorting, and Within Suburb Sorting (1980-2000)

Dependent Variable:	*Fraction All Families in CC*	*Fraction CC Families in Bottom Qunitile 1*	*Fraction CC Families in Middle Qunitiles 2-4*	*Fraction CC Families in Top Qunitile 5*	*Family CGI Within CC*	*Family CGI Within Suburbs*
Log (80-20 Family Income Ratio)	**0.028**	**-0.025**	**-0.018**	**0.043+**	**0.096****	**0.063****
	(0.096)	(0.034)	(0.026)	(0.025)	(0.038)	(0.027)
Pred. Employment	**0.038**	**0.077**	**0.033**	**-0.110**	**0.054**	**0.083**
	(0.304)	(0.095)	(0.065)	(0.079)	(0.113)	(0.081)
Pred. Employment of Less-Skilled Men	**-0.539**	**-0.544**	**-0.008**	**0.553***	**-0.318**	**-0.314**
	(1.277)	(0.420)	(0.264)	(0.327)	(0.430)	(0.329)
Pred. Central City Employment	**2.758***	**-0.348**	**-0.215**	**0.563**	**-0.628**	**-0.911****
	(1.418)	(0.474)	(0.303)	(0.391)	(0.428)	(0.403)
Log (Population)	**0.001**	**-0.031**	**0.009**	**0.023**	**0.020**	**0.023**
	(0.055)	(0.020)	(0.012)	(0.014)	(0.017)	(0.015)
Fraction Black	**0.063**	**-0.079**	**0.086**	**-0.007**	**-0.089**	**0.036**
	(0.522)	(0.153)	(0.095)	(0.116)	(0.135)	(0.114)
Fraction Hispanic	**0.206**	**0.101**	**0.100****	**-0.201****	**-0.009**	**0.079**
	(0.239)	(0.081)	(0.047)	(0.072)	(0.085)	(0.070)
Fraction Foreign Born	**-0.171**	**-0.123**	**-0.023**	**0.146***	**-0.043**	**-0.089**
	(0.290)	(0.108)	(0.066)	(0.077)	(0.088)	(0.075)
Log (Mean Family Income in 2000 dollars)	**0.066**	**0.025**	**0.018**	**-0.043***	**-0.025**	**-0.001**
	(0.099)	(0.030)	(0.027)	(0.023)	(0.033)	(0.024)
Fraction of 25+ High School Grads	**-0.017**	**0.033***	**0.003**	**-0.036****	**-0.015**	**-0.023**
	(0.058)	(0.018)	(0.015)	(0.016)	(0.021)	(0.019)
Fraction 25+ College Grads	**-0.311**	**-0.046**	**0.026**	**0.019**	**-0.002**	**0.093**
	(0.370)	(0.106)	(0.087)	(0.083)	(0.119)	(0.104)
Fraction Under 18	**-0.160**	**0.309****	**-0.115**	**-0.193**	**0.192**	**0.112**
	(0.454)	(0.155)	(0.111)	(0.122)	(0.160)	(0.139)
Fraction Under 65	**0.112**	**0.190**	**-0.352****	**0.162**	**0.218**	**0.082**
	(0.642)	(0.190)	(0.147)	(0.151)	(0.179)	(0.166)
Log (Square Miles)	**-0.024**	**-0.012***	**0.002**	**0.010**	**0.001**	**-0.008**
	(0.024)	(0.007)	(0.004)	(0.007)	(0.006)	(0.008)
Year is 1990	**-0.064**	**-0.019**	**-0.035**	**0.054**	**-0.005**	**-0.029**
	(0.149)	(0.047)	(0.031)	(0.037)	(0.053)	(0.037)
Year is 2000	**0.058**	**-0.045**	**-0.053**	**0.098**	**-0.050**	**-0.090**
	(0.236)	(0.077)	(0.053)	(0.063)	(0.088)	(0.065)
MSA Fixed Effects	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**
Observations	630	630	630	630	630	630
Number of Metropolitan Areas	210	210	210	210	210	210
R-squared	0.96	0.94	0.89	0.94	0.92	0.93

Notes: Standard errors clustered on metropolitan area in parentheses. * and ** indicate statistical significance at the 10 and 5 percent level, respectively. The analysis is unweighted. Within central city and within suburb analysis uses city and suburb income percentiles to construct CGI. See notes in Table 1 and text for variable descriptions.

Table 8. Sample Means of Racial Segregation and Within Race Income Segregation Measures, restricted sample 1970-2000

	Means of 122 Metropolitan Areas Unweighted			
	1970	1980	1990	2000
Fraction Black	0.14	0.15	0.16	0.17
Racial Segregation Index	0.49	0.44	0.39	0.28
80-20 Family Income Ratio				
All Families	2.92	3.21	3.46	3.53
White Families	2.66	2.90	3.08	3.29
Black Families	3.69	4.56	4.72	4.51
Centile Gap Index				
All Families	0.127	0.121	0.140	0.138
White Families	0.105	0.098	0.113	0.119
Black Families	0.097	0.122	0.162	0.162
Isolation of Bottom Quintile				
All Families	0.274	0.278	0.294	0.288
White Families	0.256	0.254	0.273	0.273
Black Families	0.255	0.273	0.296	0.297
Isolation of Top Quintile				
All Families	0.286	0.280	0.299	0.295
White Families	0.277	0.270	0.285	0.289
Black Families	0.273	0.291	0.323	0.322
Family Racial Exposure Indices				
Exposure of Bottom Quintile Blacks to Whites	0.435	0.436	0.488	0.505
Exposure of Second Quintile Blacks to Whites	0.444	0.456	0.512	0.529
Exposure of Third Quintile Blacks to Whites	0.456	0.482	0.548	0.556
Exposure of Fourth Quintile Blacks to Whites	0.467	0.506	0.574	0.581
Exposure of Fifth Quintile Blacks to Whites	0.480	0.534	0.606	0.622

Source: Tract-level Census data, U.S. Census Bureau, Census CD, Urban Institute Underclass Database and author's calculations.

Notes: See text and appendix for description of segregation measures. Indices created using within-race income percentiles. Data subject to supression and other limitations. Sample restricted to metropolitan areas with a minimum black population of 10,000 and 2 percent of the total population in 1970. 12 areas with missing data for 1970 excluded. For 1990 and 2000, family segregation measures are estimated based on adjustments to household data.

Table 9. Fixed Effects Analysis of Neighborhood Segregation Among Black Families

Dependent Variable: *Family Centile Gap Index*	I	II	III	IV	V
Log (80-20 Black Family Income Ratio)		**0.050****		**0.047****	**0.049****
		(0.018)		(0.021)	(0.024)
Log (80-20 Family Income Ratio)					**-0.004**
					(0.036)
Pred. Employment				**-0.029**	**0.018**
				(0.144)	(0.136)
Pred. Employment of Less-Skilled Men				**-0.060**	**-0.246**
				(0.512)	(0.497)
Pred. Central City Employment				**0.259**	**0.170**
				(0.592)	(0.584)
Log (Population)				**0.035****	**0.031***
				(0.015)	(0.016)
Fraction Black				**-0.187**	**-0.191**
				(0.117)	(0.127)
Fraction Hispanic				**0.188**	**0.210***
				(0.117)	(0.112)
Fraction Foreign Born				**-0.005**	**-0.032**
				(0.102)	(0.106)
Log (Mean Family Income in 2000 dollars)				**-0.033**	**-0.028**
				(0.029)	(0.035)
Fraction of 25+ High School Grads				**0.013**	**0.018**
				(0.030)	(0.030)
Fraction 25+ College Grads				**0.202**	**0.194**
				(0.138)	(0.154)
Fraction Under 18				**-0.020**	**0.005**
				(0.206)	(0.218)
Fraction Under 65				**0.223**	**0.161**
				(0.162)	(0.167)
Log (Square Miles)				**-0.002**	**-0.002**
				(0.008)	(0.008)
Racial Segregation if South			**-0.006**		**-0.017**
			(0.013)		(0.017)
Racial Segregation if Non-South			**-0.105****		**-0.044**
			(0.032)		(0.036)
Year is 1980	**0.026****	**0.015****	**0.023****	**0.022**	**0.003**
	(0.003)	(0.005)	(0.003)	(0.070)	(0.067)
Year is 1990	**0.065****	**0.053****	**0.061****	**0.061**	**0.018**
	(0.004)	(0.005)	(0.004)	(0.134)	(0.127)
Year is 2000	**0.066****	**0.056****	**0.058****	**0.061**	**0.005**
	(0.004)	(0.005)	(0.006)	(0.181)	(0.173)
MSA Fixed Effects	**yes**	**yes**	**yes**	**yes**	**yes**
Observations	488	488	488	488	488
Number of Metropolitan Areas	122	122	122	122	122
R-squared	0.87	0.87	0.88	0.90	0.90

Notes: Standard errors clustered on metropolitan area in parentheses. * and ** indicate statistical significance at the 10 and 5 percent level, respectively. The analysis is unweighted. See notes in Table 1 and text for variable descriptions. Sample is restricted as described in Table 8.