How the Growth in Income Inequality Increased Economic Segregation

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Abstract

Households became more geographically segregated by income in the United States between 1970 and 1990. Economic inequality also increased between 1970 and 1990. Using 1970, 1980, and 1990 Census data, I find that an increase in income inequality at the state level is associated with an increased in economic segregation in the state. The increase in segregation was not mainly the result of a decline in within-neighborhood economic heterogeneity. Economic inequality between households in the same census tract hardly changed between 1970 and 1990. The increase in segregation was mainly due to an increase in the variance of mean neighborhood income. This has important implications for interpreting the consequences of increases in economic segregation and for understanding why economic inequality and economic segregation are related.

How the Growth in Income Inequality Increased Economic Segregation

Economic inequality increased in the United States between 1970 and 1990 (Danziger and Gottschalk 1995, Karoly 1993, Morris and Western 1999). Rich and poor households also became more geographically segregated in the United States during these years (Jargowsky 1996a, 1997). Some researchers have suggested that the increase in economic inequality caused the increase in economic segregation (Durlauf 1996, Wilson 1987). This paper tests that hypothesis and finds evidence that it is correct. Many observers have assumed that increased segregation made neighborhoods more economically homogeneous – uniformly poor or uniformly rich. But this need not follow. As I show below, if overall economic inequality increases, economic diversity within neighborhoods can either increase, decrease, or stay constant when economic segregation increases. The likely consequences of growing inequality will be very different if neighborhoods become more homogeneous than if they become less homogeneous. I present evidence that economic heterogeneity within neighborhoods changed very little between 1970 and 1980 when economic segregation increased.

Section I describes hypotheses about the social consequences of inequality between neighborhoods and within neighborhoods. Section II describes the relationship between economic inequality and economic segregation including the major hypotheses about why families segregate by income, and what each hypothesis implies about the likely effect of changes in overall economic inequality on economic segregation. Section III describes the data and methods that I use to estimate the effect of growing inequality on economic segregation. Section IV presents the results and Section V concludes.

I. Background

Imagine two societies in which economic inequality increases by the same amount. In the Society A families whose income rises seek out high-income communities, with low tax rates that yield high absolute revenues and ample public amenities, and where the social problems associated with poverty are largely unknown. Poor households remain trapped in low-income communities, where high tax rates are needed to generate even minimal public services, and lots of services are needed to deal with the problems associated with poverty. In Society A the increase in economic inequality results in an increase economic segregation because the rich move to more homogeneously affluent neighborhoods and the poor are trapped in more homogeneously poor neighborhoods.

In the Society B, nobody moves when economic inequality grows. Incomes rise more in rich neighborhoods than in poor neighborhoods, but these differences grow no faster than income differences within neighborhoods. Thus if four-fifths of the variation in household income was within neighborhoods at Time One, four fifths of the variation in household income will still be within neighborhoods at Time Two. In Society B, as in Society A, the mean income in rich neighborhoods increased more than the mean income in poor neighborhoods. But in Society B economic heterogeneity within neighborhoods did not decline at all.

The social and political implications of the growth in economic inequality may be quite different in these two societies. In Society B disparities in communities' tax bases grow far less than in the Society A. In Society B poorer communities' economic capacity to deal with the problems associated with poverty does not increase as fast as richer communities' capacity to deal with such problems, but under reasonable assumptions discussed below poorer communities underlying tax base does not decline. Members of poorer households have more face-to-face

contact with members of richer households in Society B than in Society A, so they have more affluent role models. But they may also experience more relative deprivation, both in their neighborhoods and at school.

The Effect of Economic Segregation. A growing theoretical literature in economics suggests that an increase in the disparity of mean neighborhood income hurts poor families (Benabou 1996, Durlauf 1996) when important goods and services are locally financed. For example, when schooling is locally financed, if some school districts get richer and others get poorer, the variation in school funding may also increase, which may increase the variance in educational outcomes (Benabou 1996, Fernandez and Rogerson 1996, de Bartolome 1990). If poor children lose more than rich children gain from such segregation, overall educational attainment could also decline. A similar mechanism could increase the variance in crime rates and other neighborhood problems.

Sociologists and psychologists have been more interested in the way role models, social networks, and neighborhood monitoring influence children's outcomes.[1] These explanations emphasize within-neighborhood economic heterogeneity. Recent research suggests that growing up with advantaged neighbors or classmates modestly improves children's educational attainment (Halpern-Felsher 1997, Connell and Halpern-Felcher 1997, Duncan 1994, Brooks-Gunn et al. 1993, Clark 1992, Crane 1991a, Mayer 1991, Rosenbaum 1991), cognitive test scores (Brooks-Gunn et al. 1993, Duncan et al. 1994, Chase-Lansdale et al. 1997), social behavior (Duncan et al. 1994, Case and Katz 1991, Peeples and Loeber 1994, Coulton and Pandey, 1992) and other outcomes.[2] Poor children's contact with affluent children will increase as neighborhoods become more economically heterogeneous. These studies therefore imply that economic heterogeneity within neighborhoods should improve poor children's outcomes. If this is correct, a decline in neighborhoods' economic heterogeneity might be a serious problem, at least for poorer children. But these studies do not imply that growing inequality between neighborhoods would be a problem.

Alesina and LaFerrara (2000) argue that because people prefer to interact with others like themselves, rising community inequality diminishes social capital among community residents by reducing social participation. This logic implies that smaller homogeneous groups within the community encourage social participation. This argument predicts that economic inequality reduces social capital. But given a level of inequality, economically homogeneous neighborhoods increase social capital. Both Alesina and LaFerrara (2000) and Costa and Kahn (2001) find that economic inequality in MSAs is associated with lower levels of participation in social groups. But neither study compares membership levels in MSAs with more or less economic segregation.

Thus theoretical and empirical evidence suggest that both the distribution of income and its spatial organization are important. But some hypotheses about the harmful effects of economic segregation emphasize the degree of economic heterogeneity between neighborhoods while others emphasize the degree of economic heterogeneity within neighborhoods.

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[1] See Jencks and Mayer (1990), Ellen and Turner (1997), and Gephart (1997) for reviews of this research.

[2] An exception is Evans et al. (1992) who find that the effect of school social composition on schooling outcomes is largely spurious.

II. The Relationship between Overall Inequality and Economic Segregation

Economic segregation and economic segregation are closely related. Suppose we divide a geographic area such as a state (or metropolitan area or country) into mutually exclusive geographic areas such as neighborhoods. We can then decompose the total variance of household income in the state (σ_{ts}^2) into two additive components: a between-neighborhood component (σ_{bn}^2) and a within-neighborhood component (σ_{wn}^2). This yields the identity:

$$\sigma_{ts}^2 = \sigma_{bn}^2 + \sigma_{wn}^2 \qquad (1)$$

The ratio of the between-neighborhood variance to the total variance ($\sigma_{bn}^2/\sigma_{ts}^2$) is a measure of economic segregation (Farley 1977, Jargowsky 1996a). In the absence of economic segregation, all neighborhoods will have the same mean income and $\sigma_{bn}^2/\sigma_{ts}^2 = 0$. With complete economic segregation, there is no income variation within neighborhoods and $\sigma_{bn}^2/\sigma_{ts}^2 = 1$.

If the mean and the total variance do not change, there is always a tradeoff between reducing economic inequality within neighborhoods and between neighborhoods. If overall inequality increases and both the within and the between neighborhood variances increase at the same rate, segregation will remain constant. But when overall inequality increases it is also possible for economic segregation to increase at the same time that economic heterogeneity within neighborhoods increases, as long as the between-neighborhood variance increases by a larger percentge than the within-neighborhood variance. Because overall economic inequality has increased, the increase in segregation observed in other research has no clear implication for the trend in within-neighborhood economic heterogeneity, which could be increasing, decreasing or constant.

Sociologists have developed many other possible measures of economic segregation besides the ratio of the between-neighborhood variance to the total variance.[3] Most of these other measures were developed to measure racial or ethnic segregation. The most commonly used measures are the "exposure index," which gives the probability that members of one group live in the same neighborhood as members of another group, and the "dissimilarity index," which gives the percent of residents with a particular characteristic who would have to move for the group to be equally represented in all neighborhoods.[4]

Massey and Eggers (1990) classified families by four income classes and computed an average index of dissimilarity for these groups. They found that between 1970 and 1980 inter-class dissimilarity declined for whites, Asians, and Hispanics, but increased for blacks. This implies that overall social class (economic) segregation did not change much between 1970 and 1980. Jargowsky (1996a) criticized this measure on two main grounds. First, because income is continuous, categorizing it into discrete categories throws away potentially valuable information. Second, because the income cut-offs that Massey and Eggers use fall at different points in the income distribution in 1970 and 1980, their measure of segregation could change because the

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[3] See White (1987) and James (1986) for reviews of measures of segregation.

[4] The index of dissimilarity is calculated as follows:

$$.5 \sum_{i=1}^{N} \left| (x_n / \mathrm{X_a}) - (y_n / \mathrm{Y_a}) \right|$$

where x_n and n_n are the number of x or y members in neighborhood n and X_a and Y_a are the number in area a.

underlying income distribution changed, even if the spatial distribution of income did not change. Using equation 1, Jargowsky shows that income segregation increased for whites, African Americans, and Hispanics both during the 1970s and during the 1980s.

Why Families Segregate. In this section I describe five highly stylized explanations for why families segregate by income. They predict different levels of economic sorting and different responses to increases in inequality. These models are summarized in the first and second column of Table 1. The third column describes the spatial organization of income implied by each explanation. Note that I assume that families do not choose neighborhoods based on the variance of neighborhood income, but that the variance is a result of their choices.

The first hypothesis about economic segregation follows from Tiebout's (1956) hypothesis that families with the same income sort into different neighborhoods according to their distinctive preferences for local amenities. Good schools are very important to some people while access to public transportation is important to others. As a result, people with the same income choose different neighborhoods depending on their taste for neighborhood amenities. Although Tiebout focused on families with the same income but different tastes, his model can easily be extended to families with different incomes. Such families can afford different overall levels of amenities, which leads to sorting by both income and taste.

The second model of economic segregation follows from the idea that affluent residents generate benefits for their neighbors (Wilson 1987, Durlauf 1996, Jencks and Mayer 1990). As a result, families will pay more to have affluent neighbors, independent of the level of publicly provided goods. The benefits of affluent neighbors could derive from a higher tax base, which provides any given level of public amenities at a lower tax rate, from better role models (Wilson 1987), or from more effective neighborhood monitoring (Sampson and Laub 1994). If everyone saw advantaged neighbors as an advantage and cared only about having advantaged neighbors, neighborhoods would be perfectly sorted by income, because the only way everyone can avoid having neighbors poorer than themselves is for everyone to have neighbors exactly like themselves. However, some families may see advantaged neighbors as a disadvantage. When disadvantaged children must compete with advantaged children for good grades, good jobs, or social status, they are more likely to lose out (Davis 1966, Jencks and Mayer 1990).[5] In addition, relative deprivation theory predicts that when the poor compare themselves to the rich, this can lead to unhappiness, stress, and alienation (Merton and Kitt 1950, Davis 1959, Runciman 1966, Williams 1975). Theories that focus on either relative deprivation or competition suggest that if all else is equal and neighbors are a relevant reference group or relevant competitors, families will avoid having richer neighbors. If everyone chose neighbors exclusively in this way, we would again observe perfect sorting by income, because the only way everyone can avoid having neighbors richer than themselves is for everyone to have neighbors exactly like themselves. This is the third model of economic segregation.

If relative deprivation were so important that the psychological benefits of having poorer neighbors exceeded the costs of having such neighbors, poorer neighbors would be a scarce resource and richer families would prefer them. The rich would then bid up the price of housing in poorer neighborhoods, driving out the poor. This process would continue until all

[5] For example, when a state university accepts all state residents whose grades place them in the top 10 percent of their graduating class, a student's chances of getting in are better if he or she goes to a disadvantaged rather than an advantaged high school (Attewell 1999).

neighborhoods had equal numbers of poor residents and were equally costly. Thus if poorer neighbors were desirable, all neighborhoods would tend to become economic microcosms of the larger society. This is the fourth model of economic segregation in Table 1.

We do not observe either the complete economic sorting implied in Models 2 or 3 or the complete economic integration implied by Model 4. As I show below, neighborhoods are quite economically heterogeneous, but they are not as heterogeneous as the states in which they are located. This might be because families with the same income have different tastes for neighborhood amenities as implied in Model 1, or because families make different tradeoffs between the quality of the housing unit and the cost of neighborhood amenities, including neighbors with different incomes. In addition, families value proximity to work, and employees in the same work site have highly variable earnings, so perfect neighborhood sorting by income is unlikely. The fifth model in Table 1 combines family preferences for location, amenities and neighbors' income.

This paper focuses completely on economic segregation. However, income sorting could also be a proxy for racial or ethnic sorting. Imagine that all families of race A are poor and all families of race B are rich. If families sort by race, we will observe complete economic segregation. However, to the extent that there is economic heterogeneity within race A and race B, families could sort by race while preserving considerable economic segregation. A relatively long line of research has addressed the issue of economic segregation within racial groups (Erbe 1975, Kantrowitz 1973, Farley 1977, Massey and Eggers 1990, Jargowsky 1996a, Cutler and Glaeser 1997). For example, Massey and Eggers found that in 1980 blacks in MSAs were relatively less economically segregated than Asians or Hispanics but somewhat more economically segregated than whites. Jargowsky found that blacks in MSAs were somewhat more economically segregated than whites in 1970, 1980 and 1990, and that economic segregation increased more for blacks than whites between 1970 and 1990.

In fact, while blacks are poorer than whites, both groups are almost as heterogeneous economically as the overall population. In 1998 the Gini coefficient for household income was .450 for whites and .466 for blacks and .456 for the overall population (U.S. Bureau of the Census 1989, Table B-3). Thus it is not surprising that most research finds that neighborhoods tend to be economically heterogeneous even when they are racially homogeneous (Jargowsky 1996a, Farley 1977). In fact when racial groups are economically heterogeneous, racial segregation can reduce economic segregation within groups because it can constrain minorities to live in close proximity to one another regardless of their income (Glazer and Moynihan 1963, Cutler and Glaeser 1997). Inequality increased more for whites than for blacks between 1970 and 1990. In 1967 the Gini coefficient for whites was .391 but it was .432 for blacks. If growth in economic inequality affects economic segregation, we would expect a greater increase in economic segregation among whites than blacks all else equal. This is the opposite of what Jargowsky (1996) finds and it is no doubt at least partly due to the fact that racial segregation declined somewhat over this period. Thus there is no necessary relationship between economic and racial segregation, and the effects of economic and racial segregation are also likely to differ.

The Relationship between Economic Inequality and Economic Segregation. All the hypotheses about why families sort into neighborhoods by income suggest that if economic inequality were fairly constant over a long period, a stable level of economic segregation would evolve based on the distribution of income and individual preferences. The housing stock in each neighborhood would then come to reflect the degree of neighborhood inequality consistent

with that level of segregation. An increase in economic inequality could increase economic segregation if housing quality does not change as quickly as the distribution of income. If the income of the richest neighborhood residents increases and they want a better house as a result, they can either improve their current residence or move to a better one. If it costs more than $200,000 to turn a $250,000 house into a $450,000 house, richer residents will often move to another neighborhood rather than improve their home. As aggregate demand for expensive housing grows, developers will create new neighborhoods composed of expensive units. As a result, the variance of household income within existing neighborhoods will not change much and the increase in the total variance of income will result in a proportionate increase in the variance of neighborhood mean income (Cadwaller 1992).

What happens to segregation when the overall level of economic inequality changes also depends on why families segregate. The fourth column in Table 1 shows what each explanation for economic segregation implies will happen when economic inequality increases. If families' preferences do not change when their income changes and families all prefer rich neighbors, an increase in economic inequality will still result in perfect sorting because all the increase in the variance of income will be between neighborhoods. The same logic applies if all families prefer neighbors like themselves or neighbors poorer than themselves.

What happens to the spatial distribution of income when inequality increases in the more realistic first and last models depends on whether a change in family income is accompanied by a change in preferences. If their preferences do not change when their income increases, then as inequality increases rich families will want to move to more affluent neighborhoods and poor families will have to move to poorer neighborhoods. However, families will have no reason to move to more or less homogeneous neighborhoods. The increase in overall economic inequality will therefore produce an increase in the variance of mean neighborhood income, no change in the variance of income within neighborhoods, and hence an increase in segregation. If the weights families put on amenities, location, or neighbor's income changes as their income changes, it becomes difficult to predict what will happen when inequality increases.[6]

Thus most models of economic sorting suggest that as economic inequality increases economic segregation should also increase. Most models also suggest that an increase in inequality would mainly increase the variance of mean neighborhood income and not heterogeneity within neighborhoods.

III. Data and Measures.

In order to measure economic segregation, one must decide what geographic units to compare. Ideally one should select geographic units that are theoretically relevant to some outcome of interest, but theory provides little guidance about what geographic units are important to different outcomes. Most research on the effect of neighborhood economic characteristics uses census tracts as proxies for neighborhood. This choice is motivated less by the theoretical relevance of census tracts, which typically consist of 1,000 to 2,000 households, than by the availability of data. Nor does theory tell us what larger geographic units to consider.

[6] For example, if a one percent income increase raises the demand for neighborhood amenities by less than one percent (making the elasticity less than one), then when the rich get another $1,000 they will demand a bit more, but when the poor lose $1,000 they will demand a lot less. Thus when economic inequality increases within a neighborhood and all else is equal, overall demand for the amenity will fall. Assuming the supply of the amenity drops in response, the neighborhood will attract fewer affluent residents, which would reduce within-neighborhood economic heterogeneity.

Massey and Eggers (1990) and Jargowsky (1996a) estimate changes in economic segregation between census tracts in Metropolitan Statistical Areas (MSA). The choice of MSAs is motivated both by a tradition of research on cities and by the notion that MSAs approximate labor markets, but not by a strong theory suggesting that the geographical distribution of income in MSAs is more important than the geographical distribution of income in counties, in states, or in the nation as a whole.

I focus on the effect of overall economic inequality in a state on segregation between census tracts in the state. I use census tracts as proxies for neighborhoods for the same reasons as other researchers: census tracts are the smallest geographic unit for which we have national data. Hypothesis about role models, competition for scarce resources, and neighborhood monitoring imply that the effect of neighborhood social composition may operate at fairly small levels of aggregation.

I use states for three main reasons. First, I analyze the relationship between changes over time in the level of inequality and changes in the level of segregation. MSA borders have changed over time; state borders have not, which makes states both easier to use and more consistent. Second, everyone living in the United States lives in a state except residents of the District of Columbia. The proportion of the population living in MSAs increased from 68.6 percent in 1970 to 74.8 percent in 1980 and 79.6 percent in 1990.[7] Thus trends in economic segregation that rely on MSAs include varying proportions of the population. Third, states are important political jurisdictions; MSAs are not political jurisdictions, and in fact they often cross important political boundaries. If the mechanisms through which economic inequality affects economic segregation are partly political, states may be better units than MSAs.

Because most Americans do live in MSAs, the level of segregation in states and MSAs is highly correlated. All trends that I estimate in this paper also hold for MSAs that had constant borders between 1970 and 1980 and between 1980 and 1990. In addition, geographical differences in segregation are the same for states and MSAs. For example, both Jargowsky (1996a) and Massey and Denton (1993) show that economic segregation by census tracts within MSAs is greater in the north than in the south. As I show below economic segregation between census tracts in states is also greater in the north than in the south. Thus it is reasonable to expect that the results in this paper for segregation in states would also hold for segregation in MSAs.

I also estimated the effect of growth in inequality at the state level on segregation between school districts in the state because school districts are important political jurisdictions within states, especially for children's outcomes. The results of these analyses were very similar to the results for segregation between census tracts, so I present only the results using states and census tracts. However, I show selected results for school districts in the Appendix. Important issues for future research should be to assess the relationship between economic inequality and economic segregation at different levels of aggregation and to assess the relative importance of economic inequality and segregation at different levels of aggregation on relevant outcomes.

The measures of state characteristics come from the Public Use Micro Sample (PUMS) of census data. The 1970 PUMS is a one-percent sample of U.S. households. The 1980 and 1990 PUMS are five-percent samples. To estimate the components of variance in equation 1, I calculate the total variance of household income for each state from PUMS data and calculate

[7] Statistical Abstract of the United States 1997, Table 40.

mean income for each census tract in the state using the STF4 and STF5 Census files.[8] I weight each tract mean by its population. The variance of the weighted means is the "between tract" variance (σ_{bn}^2). To get the within tract variance I subtract the between tract variance from the total variance of household income in the state. State-level analyses weight states by their population. The appendix describes the data and variables. Vermont and Wyoming were omitted in 1970 because the Census did not report census tract income for these states for that year. This leaves a sample of 148 state-year data points. The means for these 148 state-year data points are shown in the Appendix.

IV. Results

Trends in Economic Inequality and Economic Segregation. The first row in Table 2 shows that mean household income in the United States increased between 1970 and 1980 and again between 1980 and 1990. The total variance of household income in the United States also increased over this period. The next five rows show that about 97 percent of the income variance in the United States is within states, and 66 to 79 percent is within census tracts.[9] Row 5 shows that economic segregation between census tracts in the same state declined slightly between 1970 and 1980 but increased dramatically between 1980 and 1990.[10]

States vary quite a bit in both the level of economic segregation and in the change in economic segregation between 1970 and 1990. Figure 1 the shows level of segregation in each state in 1990. In that year the most economically segregated state was Illinois, where 52 percent of the income variance was between census tracts. It was followed by Texas and Virginia, where 42 percent of the variance was between census tracts. The least economically segregated states tend to be in the South. In both Arkansas and Mississippi less than 15 percent of the income variance was between tracts in 1990.

Figure 2 shows changes in economic segregation. The increase in economic segregation between 1980 and 1990 was not confined to any particular region. California, Illinois, and Texas all experienced large increases in segregation, while several southern and mid-western states had small increases.

A common measure of inequality is the coefficient of variation (CV), which is equal to $\sigma_{ta}/\overline{X}_a$, where $\overline{X}_a$ is an area's mean income and σ_{ta} is the standard deviation of income. Row 7 in Table 1 shows that the CV of household income in the United States barely increased between 1970 and 1980 but increased a lot between 1980 and 1990.[11] Rows 8 and 9 show that between

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[8] Not all the geographic area in states fall into census tracts. The Appendix describes how I handle areas that were untracted in a given year.

[9] Appendix table 2 shows the absolute variance for states and census tracts in each year.

[10] Jargowsky (1996a) finds that economic segregation between census tracts in Metropolitan Statistical Areas increased by about 10 percent for whites between 1970 and 1980 and by about the same amount between 1980 and 1990. For blacks and Hispanics the increase was greater between 1980 and 1990 than between 1970 and 1980. When I estimate segregation between census tracts in MSAs that had the same boundaries in 1970 and 1980, I find a decrease in segregation. Differences between the way Jargowsky and I calculate economic segregation may account for the difference in the trend in segregation. See the Appendix for a discussion of these differences.

[11] Other measures of inequality also show a large increase in inequality between 1980 and 1990. All measures of inequality that I have computed show less growth in inequality between 1970 and 1980 than between 1980 and 1990. However, some measures result in more growth in inequality between 1970 and 1980 than the CV. For example, the Gini coefficient of household income increased from .361 in 1970 to .368 in 1980, an increase of only

1970 and 1980 the CV increased both within and between tracts. Thus census tracts became slightly more economically heterogeneous during the 1970s. This trend was reversed in the 1980s, when the CV for income within census tracts declined. By 1990 tracts were almost as economically heterogeneous as they had been in 1970, even though economic segregation between tracts increased dramatically over this period.

The degree of economic heterogeneity within a typical census tract varies substantially by state. In 1990 southern states had the most economically heterogeneous census tracts. This was because, as we have seen, southern states tend to be less economically segregated than other states. In Arkansas, Louisiana, Mississippi, and West Virginia the CV for income within a census tract exceeded .80. In Connecticut, Illinois, Maryland, New Jersey and Virginia the mean was less than .60. Other states in the Upper Midwest and Northeast including New York, Michigan, and Pennsylvania had within-tract CVs for around .63.

This evidence shows that economic segregation between census tracts in the same state increased at the same time that economic inequality increased. However, the fact that the trends coincide does not necessarily mean that the growth in inequality caused the increase in segregation.

Changes in Inequality and Segregation. To test the hypothesis that the level of economic inequality (I) in state *s* affects economic segregation between census tracts within that state one could estimate:

$$\sigma_{bn}^2/\sigma_{ts}^2 = \alpha + \beta_i I_s + \varepsilon_s \qquad (2)$$

where $\sigma_{bn}^2/\sigma_{ts}^2$ measures segregation. This model has several drawbacks. First, it confounds the effect of inequality on the numerator and the denominator of the dependent variable. As discussed above, separating these effects is important. Second, because $\sigma_{ta}/\overline{X}_a$ is a measure of inequality, σ_{ts} appears on both sides of equation 2. This is a problem if σ_{ts} is measured with error. To avoid these problems, I use both the total variance of income and state mean income ($\overline{X}_s$) to predict the income variance between census tracts.[12] With mean income controlled, the total variance of income in a state is itself a measure of inequality. Since the racial composition of a state may also affect both economic inequality and economic segregation, I also control the percent of state residents who are African American and the percent who are Hispanic. I also include year dummies (γ_t) to account for the fact that there was a secular trend in both economic segregation and inequality. I therefore estimate:

$$\sigma_{bys}^2 = \beta_0 + \beta_t\sigma_{tys}^2 + \beta_x \overline{X}_{ys} + \beta_A A_{ys} + \beta_h H_{ys} + \gamma_t + \varepsilon_s \qquad (3)$$

.008. The Gini coefficient then increased to .381 in 1990. The standard deviation of log income increased from .789 in 1970 to .822 in 1980 to .856 in 1990.

[12] More precisely this model should include $1/\overline{X}_s^2$. Substituting σ_{ts}/X_s^2 for I_s in equation 2 yields $\sigma_{bn}^2/\sigma_{ts}^2 = \alpha + \beta_i\sigma_{ts}^2/X_s^2 + \varepsilon_s$. In this model β_i is the combined effect of the variance of income and mean income in the state. Thus I separate these effects and remove the total variance from the denominator of the right side to yield equation 3. However, β_i is nearly identical whether I control $1/\overline{X}_s^2$ or $\overline{X}_s$, and the coefficient on mean income is much easier to interpret.

where A is percent African American, H is percent Hispanic and y indicates the year in which the variable is measured.

The first column in Table 3 shows that a one point increase in the total variance of a state's household income leads to a .662 point increase in the variance of mean tract income, leaving a .338 point increase in the within-tract variance. It also shows that states with a greater proportion of African Americans are only slightly more economically segregated.

Unfortunately, the level of economic inequality in a state is likely to be correlated with many other state characteristics that could affect segregation. In this paper I try to estimate what would happen to economic segregation as a result of an exogenous change in economic inequality. An exogenous increase in inequality might result from polarization of the job distribution due to industrial restructuring or from a technological innovation that changed the skill needs of employers and therefore changed the wage premium for some skills. In response to such changes, states might differ in how much inequality increased depending on the skill distribution in the state, the available mechanisms for increasing high-premium skills, the generosity of the state's social programs, the "culture" of the state, and many other factors. To reduce this kind of omitted variable bias, Model 2 includes state dummy variables (γ_s), which controls all characteristics of a state that remain unchanged over the period of observation:

$$\sigma_{bys}^2 = \beta_0 + \beta_t\sigma_{tys}^2 + \beta_x \overline{X}_{ys} + \beta_A A_{ys} + \beta_h H_{ys+} \gamma_t + \gamma_s + \varepsilon_s \qquad (4)$$

Equation 4 estimates the average effect of a change in state economic inequality on inequality between tracts in the same state. For example, rural states tend to have less economic segregation than urban states. But states that were the most rural in 1970 tend to still be the most rural in 1990. Thus having a large rural population cannot account for the effect of a change in inequality on a change in segregation. However, controlling state dummy variables has two important disadvantages. First, it can magnify measurement error in independent variables, including the measure of inequality, which would downwardly bias the estimated effects. Second, if the lag structure of the model is not correctly specified, this too can result in downwardly biased estimates of the effect of inequality. Thus I show the result of the model with and without state dummy variables. In equation 4, if β_t is greater than 1, the increase in σ_{bs}^2 is greater than the increase in σ_{ts}^2, indicating that the within-tract variance fell and that tracts became more economically homogeneous. If β_{ts} equals 1, inequality between tracts increased by the same amount as overall inequality, leaving within tract inequality unchanged. If β_t is less than one, the increase in σ_{bs}^2 is less than the increase in total variance, meaning that inequality within census tracts increased.

Model 2 of Table 3 shows that β_t is greater than in the model without fixed effects, suggesting that some invariant state characteristics correlated with inequality reduce the effect of inequality on segregation. In both models β_t is less than 1 suggesting that an increase in the total variance of income in a state makes census tracts in that state slightly more internally heterogeneous. The results in model 2 imply that if the total income variance increases by 10 percent, the between-tract variance will increase by (.878)(123)= 107.9. This means that the within neighborhood variance will increase by 123 – 107.9 = 15.1. Almost all of the overall

increase in inequality thus takes the form of greater inequality between census tracts, leaving little change in inequality within tracts.[13]

In the fixed effects model, the effects of racial and ethnic mix are both small and statistically insignificant. This is not surprising, because percent African American in 1980 correlates .98 with the percent African American in both 1970 and 1990. The inter-year correlations for Hispanics are equally high.

Lagged Effects of Inequality. Inequality can effect segregation either because income changes are not evenly distributed across neighborhoods with the same initial level of inequality or because people move in response to income changes. Because it takes time for people to move, the effect of a change in inequality may not be felt for some time. The models in Table 3 estimate the effect of a change in economic inequality on a change in economic segregation in the same decade. If the lag between inequality growth and growth in segregation is longer than a decade, Table 3 will understate the effect of an increase in inequality on segregation. Nationwide inequality began to increase in the late 1970s with little growth in the early 1970s.[14] If it takes several years for families to move once inequality has grown, it would not be surprising that most of the growth in inequality first takes place within tracts.

To test the hypothesis that the growth in inequality in the late 1970s did not effect segregation until 1990, I estimate the following:

$$\sigma_{bs90\text{-}80}^2 = \beta_0 + \beta_{t90\text{-}80}(\sigma_{ts90\text{-}80}^2) + \beta_{t80\text{-}70}(\sigma_{ts80\text{-}70}^2) + \beta_x \overline{X}_{s90\text{-}70} + \beta_r R_{90\text{-}70} + \beta_h H_{90\text{-}70} + \gamma_r + \varepsilon_{st} \quad (5)$$

where the subscript 90-80 indicates a change between 1980 and 1990 and the subscript 80-70 indicates a change between 1970 and 1980. $\beta_{t80\text{-}70}$ indicates the effect of a change in the variance in household income before 1980 on the variance in mean tract income in 1990. When I estimate this model $\beta_{t80\text{-}70}$ is small and statistically insignificant (.162 with a t-statistic of .599). From this we can conclude that most of the effect of changing inequality on segregation occurs within a decade.

V. Conclusions

The increase in economic inequality between 1970 and 1990 resulted in increased economic segregation between census tracts within the same state. The increase in economic segregation did not come about mainly because tracts became more economically homogeneous. Economic inequality within tracts was roughly the same in 1990 and in 1970. Only inequality between tracts grew substantially between 1980 and 1990. Most models of economic segregation predict that as inequality increases the variance of income between census tracts will increase, so this result is consistent with most models of economic segregation.

Most census tracts are quite economically heterogeneous and they did not become much less heterogeneous over time. These facts are not inconsistent with the finding that the number of "high poverty" census tracts in MSAs increased (Jargowsky 1997, Abramson et al. 1995,

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[13] An alternative to equation 4 is to estimate the elasticity of the variance in mean neighborhood income with respect to the total variance of income by logging both the total and between neighborhood variances. However, the effect of the logarithm of total income variance on the logarithm of the variance of mean tract income is not statistically significant and the fit of model is not as good as the fit of the linear model.

[14] Published estimates using the Current Population Survey show that the Gini coefficient of household income was .394 in 1970 and .397 in 1975. But it increased to .403 by 1980. Gini coefficients estimated from Census data or public use CPS data do not correspond to the published CPS estimates because of differences in the way income data is top-coded.

Kassarda 1993). Poverty concentration increased in MSAs between 1970 and 1990, but even high poverty neighborhoods have considerable economic heterogeneity (Jargowsky 1996b). Economic segregation increased because mean income in some neighborhoods increased while mean income in other neighborhoods decreased. If mean income in a neighborhood declines, the poverty rate of the neighborhood will increase even if the variance of neighborhood income stays the same. The results in this paper suggest that the trend in poverty concentration is not part of an overall trend towards more economically homogeneous neighborhoods.

These results also suggest that models that estimate the effect of within-neighborhood economic mix on children's outcomes without controlling the effect of between-neighborhood economic mix may be misleading. Researchers usually interpret the effect of within-neighborhood economic mix as resulting from within-neighborhood processes such as neighborhood monitoring, the availability of role models, or competition for scarce resources. Within-neighborhood economic mix is by definition strongly correlated with the variance of income between neighborhoods when mean income is controlled. Thus the finding that within-tract economic mix is important may really mean that the variance of income between neighborhoods is important when the latter is not explicitly controlled. Because both within and between neighborhood economic inequality is strongly correlated with overall economic inequality, these results could also mean that economic inequality and not economic segregation is important when economic inequality is not explicitly controlled.

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Appendix

Description of the Data and Variables

The variables used in this analysis come from the 1970, 1980, and 1990 Public Use Microdata Sample (PUMS) of the U.S. Census. In 1980 and 1990 I used the full 5 percent samples. In 1970 I use the 1 percent sample because that is what is available.

Mean Household Income was computed by summing the components of income for each person in a household. Using components of person's income rather than person's total income increases the detail available at the upper tail of the distribution by avoiding Census Bureau top-coding of person's total income. To limit the detrimental effect on comparability of changes in the Census Bureau's top-coding of income components, we created uniform income components and top-codes that we used in all years. Variables are top-coded by reassigning values above the lowest 99th percentile of positive values among the years to the median of all values across years that lie above that lowest 99th percentile. The same was done for negative values using the highest 1st percentile as the cutoff. All dollars are adjusted to1998 dollars using CPI-U-X1.

The resulting components are then summed to get household income. The state-level measures of income, including income inequality, were then calculated from the resulting household incomes, both at the household level and the person level. Persons in group quarters were excluded from all calculations.

Percent African American and Percent Hispanic. I estimate these variables using 1970, 1980, and 1990 PUMS data and then use linear interpolation to assign values for the state in the year when the child was fourteen years old.

Decomposition of Income between Census Tracts.

I begin with the variance of total household income in a state calculated from the PUMS data described above. Next I compute the mean household income of each census tract using data from the STF4 file in 1970 and the STF5 file in 1980 and 1990. In 1980 and 1990 I divide the aggregate household income of the tract by the number of households in the tract. I weight mean tract income by the number of households in the tract and calculate the variance of mean tract income. This is the *between tract variance of income.* The *within-tract variance of income* is the total variance of income less the between tract variance.

Jargowsky (1996) estimates the total variance of household income from the grouped neighborhood level data in the STF files. I estimate the total variance of income from the PUMS files that include individual-level data. Using these data I get a better measure of the total variance of income because I need not make assumptions about the distribution of income within income categories and I am able to estimate top codes for each component of income rather than having to depend on the top coded category. Jargowsky does not use the PUMS data because it is hard to get PUMS estimates for consistent MSAs.

Not all the geographic areas of states are grouped into census tracts. The proportion of the population in census tracts in a state increased over time as states both increased population and as population becomes more geographically concentrated. The number of census tracts changed over time both because new tracts were created and because the boundaries of old tracts changed. The number of tracts increased from 34,026 in 1970, to 41,925 in 1980 to 48,187 in 1990.

I use all the tract data available in a year, rather than using a consistent definition of tracts. I do this because the growth in census tracts largely reflects growth in and concentration of population. I estimate the mean income for the state population not living in census tracts and

treat that area like a “super census tract.” That is, for the purpose of computing the between tract variance of income I treat the weighted mean of the untracted area as a census tract. This allows the within and the between tract variance of income to exactly sum to the total variance of income for the state. Because I weight by state population, states with higher proportions of their residence living in census tracts get high weights and those living in less populous states get lower weights. There was no tract level data available for Vermont or Wyoming in 1970 and these states are omitted from all analyses that involve census tracts.

Comparison of Segregation between School Districts and between Census Tracts in States.

Appendix Table 3 shows the effect of the total variance of state income on the variance of mean school district income. The mean variance between school districts in states is 107.83 compared to 352.80 for census tracts. Because school districts are larger than census tracts, it is not surprising that there is more variance between census tracts than between school districts in states.

The effect of the total variance of income on the variance of mean school district income is smaller than its effect on the variance between census tracts. The results in this table indicate that a 10 percent increase the total variance is associated with an increase of .272(123) = 33.5 in the variance between school districts, leaving an increase of 89.5 within districts. However, school districts are usually larger than census tracts and therefore more economically heterogeneous. The average variance between school districts within states is 107.83 compared to 352.80 for census tracts. This means that a 10 percent increase in the total income variance is associated with a 31.1 percent increase in the between school district variance and an 8 percent increase within census tracts. Thus while the absolute increase in income variance within school districts was larger than the absolute increase between school districts, the percentage increase

between school districts was much greater than the percentage increase within school districts. This is qualitatively the same pattern as for census tracts.

Appendix Table 1, Correlations, Means, and Standard Deviations of Variables

	1	2	3	4	5	6
(1) Total variance/1,000	1.00					
(2) Between census tract variance/1,000	.919	1.00				
(3) Within Census tract Variance/1,000	.872	.610	1.00			
(4) State mean income/$1,000	.911	.789	.855	1.00		
(5) Percent Black	-.022	.051	-.113	-.187	1.00	
(6) Percent Hispanic	.480	.488	.359	.362	.165	1.00
Mean	1233.769	352.796	881.560	43.749	11.438	6.794
Standard Deviation	367.222	226.386	182.247	6.557	7.489	7.789

Appendix Table 2, Decomposition of Income Variance

Variable	1970	1980	1990
(1) Mean Household Income for the US in 1998 CPI-U-X1 dollars (1,000)	39.715	43.569	45.482
(2) Variance of Household Income for the US/1,000	1031.9	1287.7	1744.8
(3) Between State Variance of Household Income for the United States/1,000	33.33	32.2	62.1
(4) Within State Variance of Household Income for the United States/1,000	998.6	1,255.5	1,682.7
(5) Within State but between Census Tract Variance of Income/ 1,000	257.6	275.5	595.8
(6) Within Census Tract Variance of Household Income/1,000	741.0	980.0	1,086.9

Appendix Table 3, Effect of the Total Variance of Income on between School District Variance of Income in States, 1970 to 1990

Variable	Model 1	Model 2 with state dummy variables
Total Variance of Income/1,000	.173	.272
	(5.021)	(7.870)
State Mean Income/10,000	1.554	-8.735
	(.988)	(-4.431)
Percent Hispanic	-2.036	-2.005
	(-3.848)	(-1.806)
Percent African American	.182	4.313
	(.362)	(1.728)
Adjusted R^2	.705	.942

Table 1, Spatial Organization of Income and the Effect of Inequality

Model	Utility Function	Expected Spatial Arrangement	Effect of Increase in Inequality
(1) Everyone seeks a bundle of neighborhood amenities (A)	$U_i = f(A)$	Some sorting by taste and some by income	Increase in σ_{bn}^2, possible change in σ_{wn}^2
(2) Everyone wants affluent (*R*) neighbors	$U_i = f(P_R)$	Perfect sorting	Increase in σ_{bn}^2
(3) Everyone wants neighbors like themselves	$U_i = f(\overline{X}_n)$	Perfect sorting	Increase in σ_{bn}^2
(4) Everyone wants to be richer than their neighbors	$U_i = f(P_P)$	No sorting	Increase in σ_{wn}^2
(5) Families make trade-offs between neighbors' income ($\overline{X}_n$), location (L) and amenities (A)	$U_i = f(\overline{X}_n, L, A)$	Some sorting	Indeterminate

Notes: All utility functions assume a fixed budget constraint.

Table 2, Household Income Characteristics by Year

Variable	1970	1980	1990
(1) Mean Household Income for the US in 1998 CPI-U-X1 dollars/1,000	39.715	43.569	45.482
(2) Total Variance of Household Income for the US/1,000	1031.9	1287.7	1744.8
(3) Percent of US Variance of Household Income between States	3.2	2.5	3.6
(4) Percent of US Variance of Household Income within States	96.8	97.5	96.4
(5) Percent of State Variance between Census Tracts	24.8	21.0	33.6
(6) Percent of State Variance within Census Tracts	75.2	79.0	66.4
(7) Coefficient of Variation for Household Income	.783	.785	.825
(8) Coefficient of Variation for Within Census Tract Income	.678	.696	.668
(9) Coefficient of Variation for between Census Tract Income	.384	.385	.470

Source: 1970, 1980, and 1990 Census data weighted by state population. See the Appendix for details on the computation of these variables

Table 3, Effect of the Total Variance of Income on between Census Tract Variance of Income in States, 1970 to 1990

Variable	Model 1	Model 2 With state dummy variables	Mean (Standard Deviation)
Total Variance of Income/10,000	.662	.878	1,233.769
	(10.192)	(8.404)	(367.222)
State Mean Income/$1,000	-5.042	-25.749	43.749
	(-1.699)	(-3.131)	(6.556)
Percent Hispanic	1.583	-3.074	6.793
	(1.588)	(-.897)	(7.789)
Percent African American	2.066	2.303	11.438
	(2.184	(.428)	(7.489)
Adjusted R^2	.897	.938	

Source: 1970, 1980 and 1990 Census data for states weighted by population size as described in the Appendix. Number of cases is 148.
Notes. Both models control year and state dummy variables. T-statistics are in parentheses.