How Economic Segregation Affects Children's Educational Attainment*

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Abstract

Economic segregation increased in the U.S. between 1970 and 1990. Three hypotheses suggest that economic segregation affects low-income children's educational attainment, but they provide different predictions about the direction of the effect. I combine census data with data from the Panel Study of Income Dynamics to show that an increase in economic segregation between census tracts in the same state hardly changes overall educational attainment but it exacerbates inequality between high-income and low-income children. With overall inequality held constant changes in economic inequality within census tracts have little effect on low-income children's educational attainment. But changes in inequality between census tracts reduce the educational attainment of low-income children. Substituting segregation between school districts for segregation between census tracts yields the same conclusions.

Studies show that that households became more geographically segregated by income in the U.S. between 1970 and 1990 (Jargowsky 1996, 1997), but no study has estimated the effect of this increase on children's educational attainment. Many studies document that advantaged neighbors are associated with better educational outcomes for poor children. However, if advantaged neighbors are also associated with better educational outcomes for affluent children, economic segregation could raise, lower, or leave unchanged overall levels of educational attainment. If increased economic segregation leads to more inequality in children's educational attainment, increases in economic segregation among parents would presumably result in more economic inequality in the next generation.

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Two hypotheses suggest that economic segregation would reduce the educational attainment of low-income children. The first emphasizes the political economy of school financing. It suggests that economic segregation between school districts reduces low-income children's educational attainment because when poor neighborhoods get poorer they spend less on schooling. The second hypothesis emphasizes the advantages of affluent neighbors for low-income children. These advantages can be the result of better role models, more monitoring, and better institutions. But a third hypothesis suggests that economic segregation could increase the educational attainment of low-income children. It holds that competition with affluent neighbors disadvantages low-income children and can cause them to feel relatively deprived. The political economy hypothesis suggests that differences in mean income across neighborhoods affects children's educational attainment. The other two hypotheses emphasize within-neighborhood social processes and suggest that economic inequality within neighborhoods affects educational attainment. None of the hypotheses predicts that economic segregation would reduce affluent children's educational attainment, and in fact the political economy hypothesis suggests that economic segregation could increase affluent children's schooling. If the benefits of economic segregation to high-income children offset the liabilities to low-income children, overall educational attainment would remain unchanged even though inequality in educational attainment increased.

This article estimates the effect of the growth in economic segregation on children's overall educational attainment and on the educational attainment of low-income and high-income children. I separately estimate the effect of an increase in between-neighborhood economic inequality and within-neighborhood economic inequality on educational attainment. I focus entirely on the effect of economic segregation. Racial and ethnic segregation are likely to be related to educational attainment. But the effect of racial and ethnic segregation is likely to differ from the effect of economic segregation because the correlation between racial segregation and economic segregation is relatively modest, only .240 in 1990 (Cutler & Glaeser 1997).[1] I focus on economic segregation because it increased dramatically between 1980 and 1990.

Previous Research

Two research traditions provide relevant theoretical and empirical background on the effect of economic segregation on educational attainment. The first emphasizes local school financing and the second emphasizes neighborhood social composition.

School Finance

When schooling is locally financed, mean school district income can affect school spending and school quality, which in turn can affect educational outcomes

(Benabou 1996; de Bartolome 1990; Fernandez & Rogerson 1996).[2] All else equal, as economic segregation between school districts increases, some school districts get richer and others get poorer, increasing disparities in school funding. As low-income children become concentrated in neighborhoods in which few resources are spent on schooling, their educational attainment might decline. Of course, this sorting would also concentrate high-income children in high-income neighborhoods that can spend a lot on schooling, which could increase the children's educational attainment. If school quality is a linear function of school spending and educational attainment depends on school quality, increased economic segregation would reduce educational attainment of the poor by about the same amount as it increased educational attainment for the rich. This would leave mean educational attainment unchanged but increase inequality of educational attainment between high- and low-income children.

Some evidence suggests that when states have reformed school funding to reduced reliance on local taxes for schools, funding for schools became somewhat more equal (Downes & Figlio 1997; Evans, Murray & Schwab 1997; Hoxby 2001), as did test scores (Card & Payne 1998; Downes & Figlio 1997). This suggests that disparities in local school tax policy affects school spending, which might also affect children's schooling.

Neighborhood Effects

Sociologists who study neighborhood effects have been less interested in school finance and more interested in the benefits that affluent residents might generate for their neighbors (Jencks & Mayer 1990; Wilson 1987).[3] These benefits could derive from better role models, more useful social networks, or more effective neighborhood monitoring (Jencks & Mayer 1990; Sampson & Laub 1994; Wilson 1987). Such mechanisms imply that both rich and poor children benefit from affluent neighbors. All else equal, as economic segregation between neighborhoods increases, some neighborhoods get richer and others get poorer, which can increase inequality in educational attainment.

Advantaged neighbors can also be a disadvantage. When disadvantaged children compete with advantaged children for good grades, good jobs, or social status, they are more likely to lose out (Davis 1966; Jencks & Mayer 1990). In addition, relative deprivation theory predicts that when the poor compare themselves to the rich, the comparison can lead to unhappiness, stress, and alienation (Davis 1959; Merton & Kitt 1950; Runciman 1966; Williams 1975). All else equal, as segregation increases, neighborhoods become more economically homogeneous. Relative deprivation and competition models suggest that such homogeneity could increase children's educational attainment.

It is possible that advantaged neighbors are both an advantage and a disadvantage. If the benefits of advantaged neighbors offset the disadvantages, we would observe no net effect of a change in within-neighborhood inequality.

Several studies find that having advantaged neighbors is associated with higher educational attainment among children (Brooks-Gunn et al. 1993; Clark 1992; Connell & Halpern-Felsher 1997; Crane 1991; Halpern-Felsher et al. 1997; Mayer 1991).[4] Estimates of the effect of neighborhood economic conditions have many well-known estimation problems (Duncan, Connell & Klebanov 1997; Jencks & Mayer 1990; Tienda 1991). However, even an unbiased estimate of the effect of a neighborhood's economic conditions would tell us little about the effect of economic segregation on educational attainment. The effect of segregation depends on the difference between the effect of affluent neighbors on poor children and on affluent children.

If the relationship between neighborhood mean income and educational attainment is linear, so that an increase in mean income raises educational attainment by the same amount in low-income and high-income neighborhoods, an increase in economic segregation between neighborhoods will not affect overall educational attainment. Instead, the increase in educational attainment in affluent neighborhoods will exactly offset the decrease in low-income neighborhoods. Brooks-Gunn et al. (1993) and Duncan (1994) and found that affluent neighbors increased educational attainment for advantaged children more than for disadvantaged children. If true, economic segregation could actually increase overall educational attainment without increasing inequality in educational attainment.

A few studies estimate threshold effects for neighborhood characteristics. For example, Crane (1991) found that neighborhoods with very few professional and managerial workers were associated with a higher chance of dropping out of high school. But apart from very disadvantaged neighborhoods, he found little evidence that neighborhoods lacking professional or managerial workers mattered. If these results were correct, the rise in economic segregation would have little effect on high school graduation except to the extent that it increased the number of people living in very disadvantaged neighborhoods. However, Clark (1992) was unable to replicate Crane's results, leaving some uncertainty about the importance of thresholds.

To my knowledge, only one study directly estimates the effect of economic segregation on educational outcomes. In focusing mainly on racial segregation, Cutler and Glaeser (1997) find that economic segregation had little effect on white metropolitan statistical area (MSA) residents' chances of graduating from high school or college. They do not report the effect of economic segregation on black MSA residents' educational attainment. This study also finds that racial segregation has a large negative effect on black children's educational attainment and that controlling economic segregation and other factors does not eliminate this effect. These findings highlight the important difference between economic and racial segregation and the need for research on each issue.

Measuring Economic Segregation

Sociologists have developed many possible measures of economic segregation.[5] Because most of these were originally developed to assess racial or ethnic segregation, they were developed for categorical variables. 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 index of dissimilarity, which gives the percentage of residents with a particular characteristic who would have to move for the group to be equally represented in all neighborhoods.

Massey and Eggers (1990) were the first sociologists to analyze trends in economic segregation. They classified families into four income classes and computed an average index of dissimilarity for these groups.[6] They found that between 1970 and 1980 interclass dissimilarity declined for whites, Asians, and Hispanics but increased for blacks. This implies that overall economic segregation did not change much between 1970 and 1980.

Jargowsky (1996) criticized Massey and Eggers's measure of segregation on two grounds. First, because income is continuous, categorizing it into discrete categories omitted potentially valuable information. Second, because the income cutoffs that Massey and Eggers use fall at different points in the income distribution for 1970 and 1980, changes in the underlying income distribution could make it appear as though segregation changed, even when the spatial distribution of income did not change. Following Farley (1977), Jargowsky (1996) used the neighborhood sorting index to measure segregation. This measure decomposes the total variance of household income for an area such as a state or metropolitan area (σ_t^2) into two additive components, a between-neighborhood component (σ_{bn}^2) and a within-neighborhood component (σ_{wn}^2). This yields the identity

$$\sigma_t^2 = \sigma_{bn}^2 + \sigma_{wn}^2 \tag{1}$$

The ratio of the between-neighborhood variance to the total variance $(\sigma_{bn}^2 / \sigma_t^2)$ is the neighborhood sorting index. In the absence of economic segregation, all areas have the same mean income and $\sigma_{bn}^2 / \sigma_t^2 = 0$. With complete economic segregation, there is no income variation within geographic areas and $\sigma_{bn}^2 / \sigma_t^2 = 1$. Using the neighborhood sorting index, Jargowsky (1996) shows that income segregation increased for whites, African Americans, and Hispanics between 1970 and 1980 and between 1980 and 1990.

Equation 1 shows that if the distribution of household income in an area is fixed, factors that reduce the *between*-neighborhood variance (the variance of neighborhoods' mean income) will necessarily increase the *within*-neighborhood variance of household income. Thus, if we assume a given overall level of economic inequality, the claim that residential segregation by income hurts children's well-being must also be a claim that inequality within neighborhoods does less harm than inequality between neighborhoods. However, if inequality increases, as it did beginning in the 1970s (Karoly 1993; Lichter & Eggebeen 1993; Morris & Western 1999), an increase in inequality between neighborhoods could be accompanied by an increase, decrease, or no change in inequality within neighborhoods. The next section shows that the distinction between economic inequality between neighborhoods and within neighborhoods is important both theoretically and empirically.

Data and Methods

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 the outcome of interest. I estimate the effect of economic segregation in states on educational attainment. I use states for three main reasons. First, states are relevant political jurisdictions for educational outcomes. A typical American state provides about half the funding for its public schools. Local school districts provide most of the rest. Research on trends in economic segregation have generally estimated the trend for Metropolitan Statistical Areas (MSAs) (Jargowsky 1996; Massey & Eggers 1990). But MSAs are not political jurisdictions, and in fact they often cross important political boundaries. Second, I analyze the relationship between changes over time in the level of segregation and changes in educational attainment. MSA borders have changed over time, but state borders have not, which makes states both easier to use and more consistent. Third, everyone living in the U.S. lives in a state except residents of the District of Columbia. The proportion of the population living in MSAs increased from 68.6% in 1970 to 74.8% in 1980 and 79.6% in 1990.[7] Thus trends in economic segregation that rely on MSAs include varying proportions of the population.

Because most Americans live in MSAs, both the level and trend in economic segregation in states and MSAs is highly correlated. Geographical differences in segregation are the same for states and MSAs. For example, both Jargowsky (1996) 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 for segregation in states would also hold for segregation in MSAs.

Theory should also tell us what smaller geographic units to consider. If one were mainly interested in school financing, one might want to assess the effect of economic segregation between school districts within the same state. But if interpersonal comparisons involving relative deprivation, competition, or role models influence children's educational attainment, and if children are more likely to make such comparisons with people in their immediate neighborhoods, it makes more sense to compare either elementary school attendance areas or census tracts. Data on elementary school attendance areas are not available. I therefore focus on census tracts, which typically have about 500 children aged 5 to 13. I estimate the effect of both segregation between school districts in the same state and segregation between census tracts in the same state on children's educational attainment. Because there was little substantive difference in the estimates, I mainly report the estimates for census tracts, but also report the relevant results for school districts.

My measures of state characteristics come from the 1970 1% Public Use Micro Sample (PUMS) of census data and from the 1980 and 1990 5% PUMS. I use the PUMS data to estimate the dispersion of household income in each state in 1970, 1980, and 1990. I then estimate the level of economic segregation between census tracts in each state for these same years.

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 mean income for each census tract in the state using the STF4 and STF5 census files.[8] I weight each tract mean by the population of the tract. The variance of the weighted means is the variance of household income between census tracts. To get the within-tract variance for each state in 1970, 1980, and 1990 I subtract the between-tract variance from the total variance of household income in the state for each year. I use linear interpolation to get estimates for the years between censuses.[9]

States vary considerably in the degree to which they are segregated. In 1990 the most economically segregated state was Illinois, where 52% of the income variance was between census tracts. Illinois was followed by Texas and Virginia, where 42% 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% of the income variance was between tracts in 1990.[10]

The degree of economic heterogeneity within a typical census tract varies substantially by state. 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 the area mean income and σ_{ta} is the standard deviation of income. In 1990 in Arkansas, Louisiana, Mississippi, and West Virginia the mean CV for income within a census tract exceeded .80. In Connecticut, Illinois, Maryland, New Jersey, and Virginia the mean was less than .60. Most other states in the Upper Midwest and Northeast, including New York, Michigan, and Pennsylvania, had average within-tract CVs around .63 in 1990.

Because many adults no longer live in the state where they were raised, using economic segregation in a state to predict the educational attainment of the adults in the state could lead to serious errors. To avoid potential problems of reverse causality, I use data from the Panel Study of Income Dynamics (PSID) to estimate the effect of state economic segregation measured when children were 14 years old on children's eventual years of schooling. Children in the sample were 14 years old between 1970 and 1984. I measure years of schooling when respondents were twenty-three years old. My PSID sample includes 3,240 respondents who were in the data set both when they were 12 to 14 years old and when they were 23 years old. A full description of the data and the variables appears in the Appendix.

The most straightforward way to estimate the effect of economic segregation (S) in state s on child i's educational attainment (E) might be to estimate:

$$E_{is} = \alpha + \beta_s S_s + \epsilon_{is} \tag{2}$$

where ϵ is an error term.

But equation 2 has several problems. First, as I have noted, it is useful to separate the effect of inequality within neighborhoods from the effect of inequality between neighborhoods. To do this we need to separate the components of economic segregation and include a measure of state mean income ($\overline{X}_s$):

$$E_{is} = \alpha + \beta_w \sigma_{ws}^{\ 2} + \beta_b \sigma_{bs}^{\ 2} + \beta_x \overline{X}_s + \epsilon_{is} \tag{3}$$

With mean state income controlled, the total variance of income is a measure of inequality in the state. Thus β_b is the effect of the state's inequality between census tracts with its overall level of economic inequality held constant. Put another way, it is the effect of increasing the income variance between census tracts holding constant the variance within tracts.

Many of the factors that cause one state to be more segregated than another might also affect educational attainment. For example, a state's racial diversity might be correlated with both economic segregation and educational attainment. To address the problem of omitted state variables, I control dummy variables for the Northeast, South, and Midwest regions. (The West is omitted.) This controls characteristics of the region that remain unchanged over the period of observation.

I also control several characteristics of states that have changed over time and may affect levels of segregation. These include state mean income, the percentage of state residents who are African American, the percentage who are Hispanic, the state unemployment rate, and the state returns to schooling. These are all measured when the child was 14 years old. Among states with the same mean income, those with high levels of unemployment are likely to have more inequality because unemployment disproportionately reduces the income of less affluent state residents. Because economic inequality and economic segregation are related (Mayer 2001), factors that affect inequality can also affect segregation. Inequality increased between 1970 and 1990 partly because the returns to schooling increased (Juhn, Murphy & Pierce 1993; Murphy & Welch 1992).[11] Because higher returns increase the incentive for children to stay in school, we expect increases in inequality to have increased educational attainment. My measure of returns to schooling is the average percentage increase in wages due to an extra year of schooling in each state and year, estimated for workers aged 18 to 65.[12]

In some models I control the logarithm of average family income when a child was 12 to 14 years old, parental education, and the child's race. The logarithm of family income can be a mechanism through which inequality affects children's educational attainment. If the relationship between educational attainment and parental income is linear, then when the rich gain a dollar and the poor lose a dollar, the educational attainment of the rich will increase by exactly as much as the educational attainment of the poor decreases, leaving the mean unchanged. However, if a 1% increase in income generates the same absolute increment in educational attainment, regardless of whether income is initially high or low, the relationship between the log of parental income and children's schooling will be linear. Then, if all else is equal, a costless redistribution of income from richer to poorer households will increase children's mean educational attainment, because shifting a dollar from the rich to the poor increases the education of poor children by a larger percentage than it decreases the education of rich children. Because parental income is at least partly endogenous with respect to the state's total variance of income, and because parental education is strongly correlated with parental income, I estimate models with and without these family background controls.

I control year dummy variables to account for the secular national trend in educational attainment. With both region and year dummy variables controlled, variation in segregation derives from a combination of changes in segregation within states over time and differences in segregation among states in the same region.

I experimented with controlling state dummy variables. This strategy has the advantage of controlling all invariant characteristics of states, but it has three important disadvantages. First, it can magnify measurement error in independent variables, including the measure of segregation, 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 segregation. Third, including state dummy variables greatly reduces the degrees of freedom available to estimate the model, increasing the standard errors of the estimates. Nonetheless, below I report the sensitivity of my conclusions controlling state rather than region dummy variables. In models with state dummy variables, the estimates can be interpreted as the effect of a change in economic segregation on a change in children's educational attainment.

With fixed effects and control variables the model becomes

$$E_{ist} = \alpha + \beta_w \, \sigma_{wst\text{-}10}{}^2 + \beta_{bs} \, \sigma_{bst\text{-}10}{}^2 + \beta_x \overline{X}_{s\ t\text{-}10} + \beta_z Z'_{st\text{-}10} + \gamma_r + \gamma_t + \epsilon_{ist} \quad (4)$$

where γ_r is a set of four region dummy variables and γ_t is a set of year dummy variables. The subscript $t - 10$ indicates that the variable was measured ten years before educational attainment was measured (at age 23). In this model Z' represents a vector of exogenous state characteristics that may have changed over time, including racial composition, and other variables discussed above.

In equation 4, β_w is the effect of living in a state with more economically heterogeneous census tracts, controlling inequality between tracts. Similarly, β_b is the effect of living in a state with more inequality between census tracts controlling economic inequality within tracts. If economic segregation affects educational attainment, β_b will differ from β_w. If $\beta_b > \beta_w$, living in a state with high between-tract inequality is more important than living in one with high within-tract inequality. This would be the case if the hypothesis about the political economy of school finance is correct. If $\beta_b < \beta_w$, living in a state with high within-tract inequality is more important than living in one with high between-tract inequality. This would be the case if the hypotheses about neighborhood effects is true. If β_w is positive, it suggest that living in a state with a lot of economic inequality within tracts improves educational attainment. If only the overall level of inequality in a state matters, β_b will not differ significantly from β_w.

Results

Model 1 in Table 1 shows that the effect of the between-tract income variance on years of schooling is positive and statistically significant at the .05 level. The effect of the within-tract income variance is also positive and statistically significant. These effects are roughly equal and not significantly different from one another at the .10 level.[13] The sum of the within-tract variance and between-tract variance is equal to the total variance in a state. With mean income controlled, the total income variance is a measure of economic inequality. The combined effect of the within-tract variance and the between-tract variance is statistically significant at the .05 level. Thus a state's level of economic inequality but not its level of economic segregation between census tracts affects children's educational attainment. The full results for this and other models are shown in Appendix Table A2.

If the level of inequality in a state does not change, an increase in σ_b^2 must be accompanied by the same decrease in σ_w^2. Thus the difference between β_b and β_w is the net effect of a one-point increase in the variance of mean neighborhood income on educational attainment when overall inequality is constant. This difference is shown in the third column of Table 1. To put this difference in perspective, the standard deviation of the variance of mean tract income is .118. Thus, according to these results, a one standard deviation increase in the variance of mean tract income is associated with a .229 * .118 = .027 year increase in educational attainment.

In model 2 of Table 1, I control the state unemployment rate and returns to schooling. If these characteristics affect a state's level of economic inequality but not the geographical distribution of income, controlling them will reduce the effect of within-tract income variance and between-tract income variance by about the same amount. Model 2 in Table 1 shows that adding these variables reduces the effect of within-tract variance somewhat more than the effect of between tract variance. However, the difference between β_b and β_w remains small and statistically insignificant.

TABLE 1: Effect of Economic Segregation on Years of Schooling

	Between-Tract Variance	Within-Tract Variance	Difference ($\beta_b - \beta_w$)
Model 1			
Controlling mean income, percentage African American and percentage Hispanic	2.620 (2.632)	2.391 (2.384)	.229
Model 2			
Adding state returns to schooling and unemployment rate	1.769 (1.638)	1.846 (1.890)	–.077
Model 3			
Adding parent's education, family income, and child's race	1.422 (1.485)	.975 (1.066)	.447

Source: PSID sample described in Appendix.
Note: Estimates are from OLS regressions that control region and year dummy variables. T-statistics are in parentheses.

If parental characteristics that affect children's schooling also affect their choice of a state within a region, omitting controls for these characteristics could bias the estimated effect of economic segregation. In model 3 of Table 1, I control parental income and education and the child's race. Controlling family background factors reduces the effect of β_w somewhat more than β_b, suggesting that advantaged parents live in states with somewhat more economic inequality within tracts. In this model neither β_b nor β_w is statistically significant. Consequently, even though the difference between β_w and β_b increases (column 3), the difference remains statistically insignificant.

In Table 1 no model produces a statistically significant difference between β_b and β_w. In all models both β_b and β_w are positive and jointly significant at at least the .10 level. From this we can conclude that a state's level of inequality but not its level of economic segregation is associated with an increase children's educational attainment.

Poor Children

Table 1 describes the average effect of economic segregation for all children, rich and poor. The fact that the overall effect of economic segregation is small is consistent either with the hypothesis that neighbor's income does not matter or the hypothesis that the benefits to rich children from living near other rich children roughly offset the costs to poor children of living near other poor children. To distinguish between these possibilities, I estimate separate models for high and low-income children.

"High-income" children are those in the top half of the income distribution; "low-income" children are those in the bottom half. Dividing the sample at the midpoint allows all variables to interact with household income in a way that is easy to interpret and preserves enough high- and low-income cases for meaningful analysis. Other divisions of the sample, such as quartiles, provide qualitatively similar results but with larger standard errors. A model that interacts household income with all the relevant variables is difficult to interpret and also results in very large standard errors. Dividing the sample in half is instructive even though it may not capture all the nuances of the effect of economic segregation at different parts of the income distribution.

Model 1 in Table 2 shows that the effect of between-tract income variance is large, positive, and statistically significant for high-income children. The effect is smaller, negative, and statistically insignificant for low-income children. The effect of within-tract income variance is positive and statistically significant for high-income children, but small, negative, and statistically insignificant for low-income children. The difference between β_b and β_w is positive for high-income children and negative for low-income children but statistically insignificant at the .10 level for both high- or low-income children.

Model 2 controls the state unemployment rate and the state returns to schooling. For high-income children, the effect of the between-tract variance is large positive, and statistically significant, and the effect of the within-tract income variance is smaller and statistically insignificant. For low-income children, the effect of the between-tract variance is large, negative, and statistically significant, and the effect of the within-tract variance is very small and statistically insignificant. The effect of the between-tract variance is significantly greater than the effect of the within-tract variance (at the .10 level) for both high- and low-income children. From this we can conclude that with overall inequality held constant, an increase in economic segregation between census tracts is associated with an increase in high-income children's educational attainment and a reduction in low-income children's educational attainment. Model 3 shows that adding a child's own family background characteristics strengthens this conclusion.

Model 3 in Table 2 suggests that if overall inequality in a state stays the same, a one-standard-deviation increase in the between-tract income variance (.118) would increase high-income children's schooling by 2.701 * .118 = .319 years. The same increase would reduce low-income children's schooling by –2.200 * .118 = –.260 years. These effects roughly cancel one another, which is why model 3 in Table 1 showed no overall affect of economic segregation on children's educational attainment. This result suggests that this increase in economic segregation would increase the gap in educational attainment between high- and low-income students

TABLE 2: Effect of Economic Segregation on Years of Schooling by Family Income

	Between-Tract Variance	Within-Tract Variance	Difference ($\beta_b - \beta_w$)
High-income children			
Model 1: Controlling mean income, percentage African American and percentage Hispanic	3.876 (3.072)	2.535 (1.949)	1.341
Model 2: Adding state returns to schooling and unemployment rate	3.561 (2.656)	2.037 (1.542)	1.748
Model 3: Adding parent's education, family income, and child's race	3.777 (2.964)	1.076 (.889)	2.701*
Low-income children			
Model 1: Controlling mean income, percentage African American and percentage Hispanic	−1.475 (−1.111)	−.013 (−.009)	−1.462
Model 2: Adding state returns to schooling and unemployment rate	−2.660 (−1.812)	.096 (.064)	−2.756*
Model 3: Adding parent's education, family income, and child's race	−2.697 (−1.888)	−.497 (-.326)	−2.200*
Very-low-income children			
Model 3	−3.317 (−1.299)	.592 (.230)	−3.909

Source: PSID sample described in Appendix.

Note: Estimates are from OLS regressions that control region and year dummy variables. T-statistics are in parentheses. Low-income children are in the poorest half of the income distribution. High-income children are in the richest half of the income distribution. Very low-income children are in the poorest 25% of the income distribution.

* $p \leq .05$

by .579 years. In this example, income inequality in the state does not change but economic segregation does. We can also simulate what would happen if income inequality changes.

Imagine that the total income variance in a state increases by one standard deviation (.205). If this increase were entirely distributed within tracts (so that within-tract but not between-tract inequality increased), high-income children's educational attainment would increase by 2.037 * .205 = .418 years, while low-income children's educational attainment would hardly change at all. Thus, overall educational attainment would increase and the gap between high- and low-income children would increase by about .418 years. If instead all the increase in inequality were distributed between tracts (so that the variance of mean tract income increased) the educational attainment of high-income children would increase by 3.561 * .205 = .730 years, while the educational attainment of low-income children would decline by –2.435 * .205 = –.499 years. Thus, overall educational attainment would increase by .730 – .499 = .231 years, but the gap between high- and low-income children's educational attainment would increase by 1.229 years.

From these results we can draw three conclusions. First, an increase in economic segregation has little affect on overall educational attainment. Second, an increase in economic segregation exacerbates differences in educational attainment between high- and low-income children. Third, an increase in economic inequality that is distributed between census tracts increases the gap in educational attainment between high- and low-income children more than an increase in inequality that is distributed within neighborhoods. These results are consistent with the political economy model of how segregation would affect educational attainment.

Sensitivity Test

Because dividing the sample at the median family income is arbitrary, I reestimated model 3 for the bottom fifth of the income distribution. This is shown in the last row of Table 2. The results suggest that economic segregation may hurt very-low income children more than other children, but the confidence intervals are large.

I also repeated the estimates shown in Tables 1 and 2 substituting state dummy variables for region dummy variables. In model 2 the effect of the between-tract income variance is 1.876 with state dummy variables, which is similar to the 1.768 found with region dummy variables. The effect of within-tract variance is 1.846 with region dummy variables but only –.479 with state dummy variables. This strengthens the conclusion that within-tract inequality has little effect on educational attainment. However, the standard errors are very large in the model with state fixed effects, and so the coefficients are not statistically significant at even the .10 level. The difference between β_b and β_w is not statistically significant in either model. Thus the conclusion that economic inequality but not economic segregation affects overall educational attainment holds in both models.

I repeated the models in Tables 1 and 2 substituting segregation between school districts for segregation between census tracts. Again the results are substantively the same. In all models the coefficient for between-district income variance is about the same as or greater than the coefficient for within-district variance, and the coefficients for between-district variance and within-district variance are positive for high-income children and negative for low-income children; β_w is significantly smaller than β_b in models for high-income but not low-income children. The effects are also roughly of the same magnitude regardless of whether I use census tracts or school districts. For example, in model 1 for the total sample, the coefficient for between-district income variance is 2.900 and the coefficient for within-district variance is 1.667, compared to 2.620 and 2.391 respectively in the same model using census tract data.

Conclusions

These results suggest that the increase in economic segregation between 1970 and 1990 had little effect on overall educational attainment. This is mainly because the increase in segregation was associated with an increase in educational attainment among high-income children and a similar decrease in educational attainment among low-income children. If correct, these results would mean that reducing economic segregation would reduce inequality in educational attainment between high- and low-income children, but not raise overall educational attainment.

Because the effect of living in a state with a lot of income variance between tracts is greater than the effect of living in a state with a lot of variance within tracts, these results seem to support the political economy hypothesis about the relationship between economic segregation and educational attainment. However, the relative unimportance of the distribution of income variance within neighborhoods could arise from the benefits and liabilities of advantaged neighbors roughly canceling each other out, leaving little effect of within-neighborhood economic inequality.

The results in this article do not necessarily imply that neighborhood economic inequality has no effect on children's educational attainment. Additional research that looks specifically at the effect of within-neighborhood income inequality is needed to test this hypothesis.

If economic segregation improves the well-being of affluent children, the rich are likely to segregate as they get richer. If they do and the increase in segregation exacerbates the gap in educational attainment between rich and poor children, economic segregation in one generation will contribute to economic inequality in the next generation.

Notes

1. This correlation is for 205 MSAs in the U.S. In this study economic segregation is measured as the degree to which the top 25% of the income distribution is separated from the rest of the population using the index of dissimilarity (see note 6). Segregation of blacks from whites is also measured with the index of dissimilarity.

2. The effect of school spending on educational outcomes is still hotly debated. Some reviews claim that neither school spending nor other school resources affect school achievement or other educational outcomes (Hanushek 1997). Other studies find that per pupil spending has a positive effect on educational outcomes (Ferguson & Ladd 1996; Hedges, Laine & Greenwald 1992) and future earnings (Card & Krueger 1996).

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

4. An exception is Evans, Oates, and Schwab (1992), who find that the effect of school social composition on schooling outcomes is largely spurious.

5. See James (1986) and White (1987) for reviews of measures of segregation.

6. The index of dissimilarity is calculated as follows:

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

where x_i and y_i are the number of x or y members in neighborhood n and X and Y are the number in area a.

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

8. Not all the geographic area of states fall into census tracts. See the Appendix for a description of how I handle areas that were untracted in a year.

9. National trends in inequality closely approximate a linear trend. To the extent that linear interpolation introduces error in the measurement of state economic segregation, it is likely to result in downwardly biased estimates of the effect of segregation.

10. The least economically segregated MSAs are also in the South. See Jargowsky (1996, Figure 1) and Massey and Denton (1993, Table 4.1).

11. Rising returns to schooling is not the main source of inequality growth. The within-education group variance of income rose almost as fast as the between-group variance of income (Juhn, Murphy & Pierce 1993; Karoly 1993), and educational attainment accounts for only 15-20% of the variance in income initially.

12. I use returns when a child was age 14 rather than returns at a later age for two reasons. First, the decision about how much schooling to get is intertwined with decisions about what to study: a student who does not expect to attend college often makes decisions about what to study in high school that make college attendance very difficult. Second, I assume that the rate of return to schooling often affects individual enrollment decisions

indirectly, by affecting the way "significant others" value education. These indirect influences are likely to mean that current attitudes reflect past as well as current returns.

13. I test the statistical significance of the difference between coefficients using a Wald test.

14. Model 2 is probably the right model to compare because it controls the most state-level characteristics but does not control parental income, which is not entirely exogenous.

15. The story is similar when I reestimate models for children in the top and bottom half of the income distribution. In model 1 for the top half of the income distribution the effect of between-tract income variance is 3.968 in the model with state dummy variables compared to 3.561 with region dummy variables. For the bottom half of the income distribution, the effect of the variance of mean neighborhood income is –2.435 in the model with state dummy variables compared to –2.660 in the model with region dummy variables. However, the standard errors of the estimates are large in models with state dummy variables. The only difference between the model with state dummy variables and region dummy variables is the effect of within-tract income variance for low-income children. In the model with region dummy variables this coefficient is .096 with a very small t-statistic compared to –8.192 in the model with state dummy variables. This coefficient is significant at the .10 level. The conclusion that economic segregation reduces low-income children's educational attainment holds for both models.

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APPENDIX

Description of the Data and Variables

PSID Data

I use data from the 1993 wave of the PSID. PSID variables were constructed by pooling across the 26 currently available waves of the PSID Family File (years 1968 through 1993).The sample includes all respondents who were ages 23 through 37 in 1993 and who are not missing data on independent variables. I weighted the observations to account for the PSID sample design. I assigned values to each individual based on that individual's age rather than a particular year. For example, I average family income when children were aged 12 to 14. Thus it was averaged over 1985 to 1987 for children born in 1973 and over 1990 to 1992 for children born in 1978. Following is the description of the variables created with PSID data. The means and standard deviations of all variables are in Table A1.

Years of schooling is the number of years of schooling that a respondent reported having completed when he or she was 23 years old.

Log family income is the natural logarithm of a household's cash income averaged over the three years when the child was age 12 through 14. All income values are in 1998 dollars using the CPI-U-X1 price adjustment.

Parental education is the highest year of schooling completed by the mother as reported when the child was age 14. If this was missing, I use the mother's education when the child was age 13 and so on until age 11. If all these values were missing, then I assigned the father's education when the child was age fourteen.

African American dummy variable set to 1 if the child was African American, 0 otherwise.

Census Data

Most of the state-level 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 5% samples. In 1970 I use the 1% sample because that is what is available. Because state-level data is attached to individual cases, the means and standard deviations of state-level variables reported in tables are approximately weighted by the state population. For all variables computed with census data, I use linear interpolation for the intercensus years and assign values for the year in which a child was 14 years old.

APPENDIX (Continued)

State Mean Household Income was computed by summing the components of income for each person in a household. Using components of a person's income rather than a person's total income increases the detail available at the upper tail of the income distribution by avoiding Census Bureau top-coding of total household 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 price-adjusted 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. The resulting components are then summed to get household income. Persons in group quarters were excluded from all calculations.

State Percentage African American and Percentage Hispanic

I estimate these variables using 1970, 1980, and 1990 PUMS data.
Returns to schooling for individual *i* in state *s* and year *y* is estimated for workers age 18 to 65 years using the following model:

$$lnW_{isy} = \alpha + b_s S_{is} + e_{is}$$

where *S* is the individual's schooling. In this model b_s is the percentage increase in wages due to an additional year of schooling. I experimented with twelve measures of returns to schooling, using different age groups, different functional forms, and separating returns for men and women. I use the measure that increased R^2 the most when added to the estimation model. This measure also corresponds best to economic theory about the functional form of returns to schooling and produces an estimated return to schooling that is consistent with previous research (Ceci 1991; Mayer & Knutson 1999; Winship & Korenman 1999).

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.

TABLE A1: Correlations among Variables

	1	2	3	4	5	6	7	8	9	10
1. Years of schooling	1.00									
2. Mean household income/$1,000	.106	1.00								
3. Percentage African American	–.080	–.320	1.00							
4. Percentage Hispanic	.055	.342	–.119	1.00						
5. Child's race is black	–.144	–.124	.342	–.013	1.00					
6. State between-tract variance/10,000	.109	.760	–.014	.615	–.023	1.00				
7. State within-tract variance/10,000	.092	.821	–.249	.342	–.104	.562	1.00			
8. Log household income	.358	.287	–.230	.120	–.387	.207	.231	1.00		
9. Parent's education	.364	.240	–.250	.104	–.247	.150	.241	.459	1.00	
10. State unemployment rate	–.071	–.032	.083	–.044	.029	–.023	.030	–.032	–.101	1.00
11. State returns to schooling	.046	–.003	.502	.325	.137	.350	.234	–.003	–.059	–.075
Mean	12.906	36.728	11.460	4.971	.155	.256	.837	10.759	11.431	8.788
Standard deviation	2.121	4.526	7.744	6.170	.362	.118	.113	.657	2.661	2.341

Source: See data description in the Appendix.

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 increased population and as the population became more 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. By 1990 six states were entirely divided into census tracts. I use all the tract data available in a year, rather than using a consistent definition of tracts because the growth in census tracts largely reflects growth 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 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 the PSID sample by sample weights, more populous states get more weight than less populous states. In fact states, with large untracted areas get almost no weight in these analyses. There was no tract-level data available for Vermont or Wyoming in 1970 and these states are omitted from all analyses. There were no PSID respondents in the sample from Alaska, Hawaii, Idaho, New Mexico, or Rhode Island.

TABLE A2: Effect of Within-Tract Income Variance and Between-Tract Income Variance on Years of Schooling

	Model 1	Model 2	Model 3
Between-tract variance/10,000	2.620	1.769	1.422
	(2.632)	(1.638)	(1.485)
Within-tract variance/10,000	2.391	1.846	.975
	(2.384)	(1.890)	(1.066)
State mean income/10,000	–.076	–.060	–.076
	(–2.415)	(–1.894)	(–2.602)
State percentage African American	–.014	–.019	.009
	(–1.611)	(–1.929)	(1.000)
State percentage Hispanic	–.013	–.018	–.011
	(–.888)	(–1.132)	(–.842)
State unemployment rate		–.045	–.022
		(–2.267)	(–1.130)
State returns to schooling		23.716	10.556
		(2.155)	(1.005)
Log household income in 1998 dollars			.788
			(10.728)
Parents' years of schooling			.201
			(10.433)
Child is African American			.016
			(.138)
R^2	.033	.037	.193

Source: PSID sample described in Appendix.
Note: Models control region and year dummy variables. T-statistics are in parentheses.