Understanding the Great Gatsby Curve

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Overview I: Basic Claim

- This paper is designed to provide insights into the relationship between cross-sectional inequality in the United States and the associated level of intergenerational mobility.
- Originally identified for the OECD by Miles Corak (dubbed the Great Gatsby Curve by Alan Krueger) as a cross-section relation, we focus on intertemporal curve for the US.

- We argue that an intertemporal Gatsby Curve is a salient feature of inequality in the US and that this relationship is causal.

- In this analysis, inequality within one generation determines the level of mobility of its children, and so argue that the Gatsby curve phenomenon is an equilibrium feature where mechanisms run from inequality to mobility.

- Our analysis proceeds at both theoretical and empirical levels.

Overview II: Basic Ideas: Mechanisms and Implications

- Increases in cross-sectional inequality increase the magnitude of the differences in the characteristics of social contexts in which children and adolescents develop.

- This is so both because increased cross sectional inequality implies greater differences in the quality of social context experienced by the relatively rich and the relatively poor, conditional on to an initial income distribution, and because the degree of segregation of rich and poor into disparate social contexts is itself an increasing function of the level of cross sectional inequality and so can increase.

- We make these ideas concrete in the consensus of neighborhoods, so increased income inequality is linked to greater income segregation of neighborhoods which in in turn increases the intergenerational persistence of socioeconomic status.

- The model we develop constitutes an example of what Durlauf (1996c, 2006) titled the “memberships theory on inequality”: a perspective that identifies segregation as an essential determinant of inequality within and across generations. Benabou’s work in 1990’s essential predecessor.

- While we focus on education, the causal chain between greater cross-sectional inequality, greater segregation, and slower mobility may apply to a host of contexts.

What We Do

1. Theoretical model of neighborhoods, segregation and mobility formalizes the inequality/mobility nexus

2. Stylized facts organized to provide empirical support for general claims.

3. Reduced form intergenerational mobility regressions constructed to explore mobility dynamics

4. Structural model calibrated.

What We Conclude

- Evidence, in our judgment, supports perspective, but is not decisive.
- Magnitudes of Gatsby effects not large enough to come close to theory of everything.

Theory Background 1: IGE Regression and the Great Gatsby Curve

One way to understand our argument is to start with a linear model relating parental income Y_{ip} and offspring income Y_{io}

$$Y_{io} = \alpha + \beta Y_{ip} + \varepsilon_{io} \qquad (1)$$

As a statistical object, (1) can produce a Gatsby curve, but only one where causality runs from mobility to inequality.

In contrast, if the equilibrium model mapping of parent to offspring income is

$$Y_{io} = \alpha + \beta\left(X_i\right)Y_{ip} + \varepsilon_{io} \qquad (2)$$

for some set of variables X_i, a causal mapping from changes in the variance of income to the measure of mobility β, i.e. the coefficient produced by estimating (1) when (2) is the correct intergenerational relationship, can exist. If $X_i = Y_{ip}$ $\beta\left(Y_{ip}\right)Y_{ip} = f\left(Y_{ip}\right)$, then (2) becomes a nonlinear family investment income transmission model.

Theory Background 2: Our Model

- Our theoretical model is based on Durlauf (1996a,b) which developed a social analogue to the class of family investment models of intergenerational mobility developed by Becker and Tomes (1979) and Loury (1981).

- By social analogue, we mean a model in which education and human capital are socially determined and thereby mediate the mapping of parental income into offspring economic attainment. Relative to (2), we thus implicitly consider variables that are determined at a community level.

Summary of Environment and Equilibrium Properties

1. Labor market outcomes for adults are determined by the human capital that they accumulate earlier in life.

2. Human capital accumulation is, along important dimensions, socially determined. Local public finance of education creates dependence between the income distribution of a school district and the per capita expenditure on each student in the community. Social interactions, ranging from peer effects to role models to formation of personal identity, create a distinct relationship between the communities in which children develop and the skills they bring to the labor market.

3. In making a choice of a neighborhood, incentives exist for parents to prefer more affluent neighbors. Other incentives exist to prefer larger communities. These incentives interact to determine the extent to which communities are segregated by income in equilibrium. Permanent segregation of descendants of the most and least affluent families is possible even though there are no poverty traps or affluence traps, as conventionally defined.

4. Greater cross-sectional inequality of income increases the degree of segregation of neighborhoods. The greater the segregation the greater are the disparities in human capital between children from more and less affluent families, which creates the Great Gatsby Curve.

Alternative Routes to Gatsby Curve

- It is important to recognize that our social determination of education approach is only one route to generating equilibrium mobility dynamics of the form (2).
- Mulligan (1999) showed how credit market constraints, by inducing differing degrees in constraints for families of different incomes, could produce (2). In this case,   can be thought of as family income.
- Becker, Kominers, Murphy, and Spenkuch (2015) show how the Gatsby Curve behavior can emerge in a family investment model in which the productivity of human capital investment in a child is increasing in the level of parental human capital, which is another choice of in (2).

A Formal Model

a. demography

- The population possesses a standard overlapping generations structure.

- There is a countable population of family types, indexed by , which we refer to as dynasties. Each family type consists of many identical "small" families.

- This is a technical "cheat" to avoid adults considering the effect of their presence in a neighborhood on the income distribution. It can be relaxed without affecting any qualitative results.
- Each agent lives for two periods.

- Agent is the adult member of dynasty and so is born at time.

- In period 1 of life, an agent is born and receives human capital investment from the neighborhood in which she grows up. In period 2, adulthood, the agent receives income, becomes a member of a neighborhood, has one child, consumes and pays taxes.

b. preferences

The utility of adult *it* is determined in adulthood and depends on consumption C_{it} and income of her offspring, Y_{it+1}. Offspring income is not known at t, so each agent is assumed to maximize expected utility that has a Cobb-Douglas specification.

$$EU_{it} = \pi_1 \log(C_{it}) + \pi_2 E\left(\log(Y_{it+1}) \middle| F_t\right) \qquad (3)$$

where F_t denotes parent's information set.

c. income and human capital

Adult it's income is determined by two factors.

First, each adult possesses a level of human capital that is determined in childhood, H_{it-1}.

Income is also affected by a shock experienced in adulthood ξ_{it}. These shocks may be regarded as the labor market luck, but their interpretation is inessential conditional on whatever is assumed with respect to their dependence on variables known to the parents. We model the shocks as independent of any parental information, independent and identically distributed across individuals and time with finite variance.

and time with finite variance.

We assume a multiplicative functional form for the income generation process.

$$Y_{it} = \phi H_{it-1} \xi_{it} \qquad (4)$$

This functional form matters as it will allow the model to generate endogenous long term growth in dynasty-specific income. Equation (4) is an example of the AK technology studied in the growth literature.

We employ this technology in order to understand inequality dynamics between dynasties in growing economies.

d. family expenditures

A parent’s income decomposes between consumption and taxes.

$$Y_{it} = C_{it} + T_{it} \qquad (5)$$

e. educational expenditure and educational investment in children

Taxes are linear in income and are neighborhood- and time-specific

$$\forall i \in nt,\ T_{it} = \tau_{nt} Y_{it}\ . \qquad (6)$$

The total expenditure available for education in neighborhood n at t is

$$TE_{nt} = \sum_{j \in nt} T_{jt} \qquad (7)$$

and so constitutes the resources available for educational investment.

- We assume that the education process exhibits non-convexities with respect to population size, i.e. there exists a type of returns to scale (with respect to student population size) in the educational process.

Let p_{nt} denotes the population size of n at time t. The educational investment provided by the neighborhood to each child, ED_{nt} (equivalent to educational quality), requires total expenditures

$$ED_{nt} = \frac{TE_{nt}}{\nu(p_{nt})} \qquad (8)$$

where $\nu(p_{nt})$ is increasing such that that for some positive parameters λ_1 and λ_2, $0 < \lambda_1 < \frac{\nu(p_{nt})}{p_{nt}} < \lambda_2 < 1$

f. human capital

The human capital of a child is determined by two factors: the child's skill level s_{it} and the educational investment level ED_{nt}

$$H_{it} = \theta\left(s_{it}\right)ED_{nt}, \qquad (9)$$

where $\theta(\cdot)$ is positive and increasing. The term "skills" is used as a catch-all to capture the class of personality traits, preferences, and beliefs that transform a given level of educational investment into human capital.

- The linear structure of (9) is extremely important as it will allow dynasty income to grow over time. Together, equations (4), (8), and (9) produce an AK-type growth structure relating educational investment and human capital, which can lead family dynasties to exhibit income growth because of increasing investment over time.

Entry level skills are determined by an interplay of family and neighborhood characteristics

$$s_{it} = \zeta\left(Y_i, \bar{Y}_{-i}\right) \tag{10}$$

where ζ is increasing and exhibits complementarities. Dependence on Y_i is a placeholder for the role of families in skill formation. Dependence on $\bar{Y}_{-i}$ is readily motivated by a range of social interactions models.

g. neighborhood formation

Neighborhoods reform every period, i.e. there is no housing stock. As such, neighborhoods are like clubs. Neighborhoods are groupings of families, i.e. all families who wish to form a common neighborhood and set a minimum income threshold for membership. This is a strong assumption. That said, we would emphasize that zoning restrictions matter in neighborhood stratification, so the core assumption should not be regarded as obviously inferior to a neighborhood formation rule based on prices.

h. political economy

The equilibrium tax rate in a neighborhood is one such that there does not exist an alternative one preferred by a majority of adults in the neighborhood.

The Cobb-Douglas preference assumption renders existence of a unique majority voting equilibrium trivial because, under these preferences, there is no disagreement on the preferred tax rate. o desired budget share allocation.

i. borrowing constraints

Neither families nor neighborhoods can borrow. This extends the standard borrowing constraints in models of this type. With respect to families, we adopt Loury (1981) idea that parents cannot borrow against future offspring income. Unlike his case, the borrowing constraint matters for neighborhood membership, not because of direct family investment. In addition, in our analysis, communities cannot entail children who grow up as members to pay off debts accrued for their education. Both assumptions follow legal standards, and so are not controversial.

Neighborhood Formation and Intergenerational Income Dynamics: Model Properties

Proposition 1. Equilibrium Neighborhood Structure

i. At each for every cross-sectional income distribution, there is at least one equilibrium configuration of families across neighborhoods.

ii. In any equilibrium, neighborhoods are segregated.

- Proposition 1 does not establish that income segregation will occur. Clearly it is possible that all families are members of a common neighborhood. If all families have the same income, complete integration into a single neighborhood will occur because of the nonconvexity in the education investment process. Income inequality is needed for segregation. Proposition 2 follows immediately from the form of the education production function nonconvexity we have assumed.

Proposition 2. Segregation and inequality

There exist income levels $\bar{Y}^{high}$ and $\bar{Y}^{low}$ such that families with $Y_{it} > \bar{Y}^{high}$ will not form neighborhoods with families with incomes $\bar{Y}^{low} > Y_{it}$.

Intuitively, if family incomes are sufficiently different, then more affluent families do not want neighbors whose tax base and social interactions effects are substantially lower than their own. Benefits to agglomeration for the affluent can be reversed when families are sufficiently poorer.

Income dynamics

Along an equilibrium path for neighborhoods, dynasty income dynamics follow the transition process

$$\Pr\left(Y_{it+1} \middle| F_t\right) = \Pr\left(Y_{it+1} \middle| \bar{Y}_{nt}, p_{nt}\right) \qquad (11)$$

This equation illustrates the primary difficulty in analyzing income dynamics in this framework: one has to forecast the neighborhood composition. This leads us to focus on the behavior of families in the tails of the income distribution, in particular the highest and lowest income families at a given point in time.

Proposition 3. Equilibrium income segregation and its effect on the highest and lowest income families

i. Conditional on the income distribution at t, the expected offspring income for the highest family in the population is maximized relative to any other configuration of families across neighborhoods.

ii. Conditional on the income distribution at t, the expected offspring income of the lowest income family in the population is minimized relative to any other configuration of families across neighborhoods that does not reduce the size of that family's neighborhood.

Proposition 4. Expected average growth rate for children in higher income neighborhoods than for children in lower income neighborhoods

Let g_{nt+1} denote the average expected income growth between parents and offspring in neighborhood n,t. For any two neighborhoods n and n' if $\bar{Y}_{nt} < \bar{Y}_{n't}$ $p_{nt} \geq p_{nt'}$, then $g_{nt+1} - g_{n't+1} > 0$.

Proposition 4 does not speak to the sign of g_{nt}. Under the linear assumptions of this model, there exists a formulation of $\Theta(\cdot)$ and $\xi(\cdot,\cdot,\cdot)$ such that neighborhoods exhibit positive expected growth in all time periods, i.e. $\forall nt$ $g_{nt} > g_{\min} > 0$. In essence, this will hold when educational investment is sufficiently productive relative to the preference-determined equilibrium tax rates so that investment levels grow (this is the AK growth model requirement as modified by the presence of social interactions). We assume positive growth in what follows.

Proposition 5. Decoupling of upper and lower tails from the rest of the population of family dynasties

i. If $\forall nt \ g_{nt} > 0$, then there exists a set of time t income distributions such that the top α% of families in the distribution never experience a reduction in the ratios their incomes compared to any dynasty outside this group

ii. If $\forall nt \ g_{nt} > 0$, then there exists a set of time t income distributions such that the bottom β% of families in the distribution never experience an increase in the ratios their incomes compared to any dynasty outside this group

Proposition 6. Intergenerational Great Gatsby curve

There are skill formation technologies such that there exists a set of time t income distributions such that the intergenerational elasticity of parent/offspring income will be increased by a mean preserving increase in the variance of logarithm of initial income.

Underlying the theorem, there are two routes by which Gatsby Curves can be generated.

First, mean-preserving spreads alter the family-specific IGEs, which in this model take the form $\beta\left(Y_i, \bar{Y}_i\right)$. Hence once can construct cases where the linear approximation, i.e regression coefficient, increases with a mean-preserving spread.

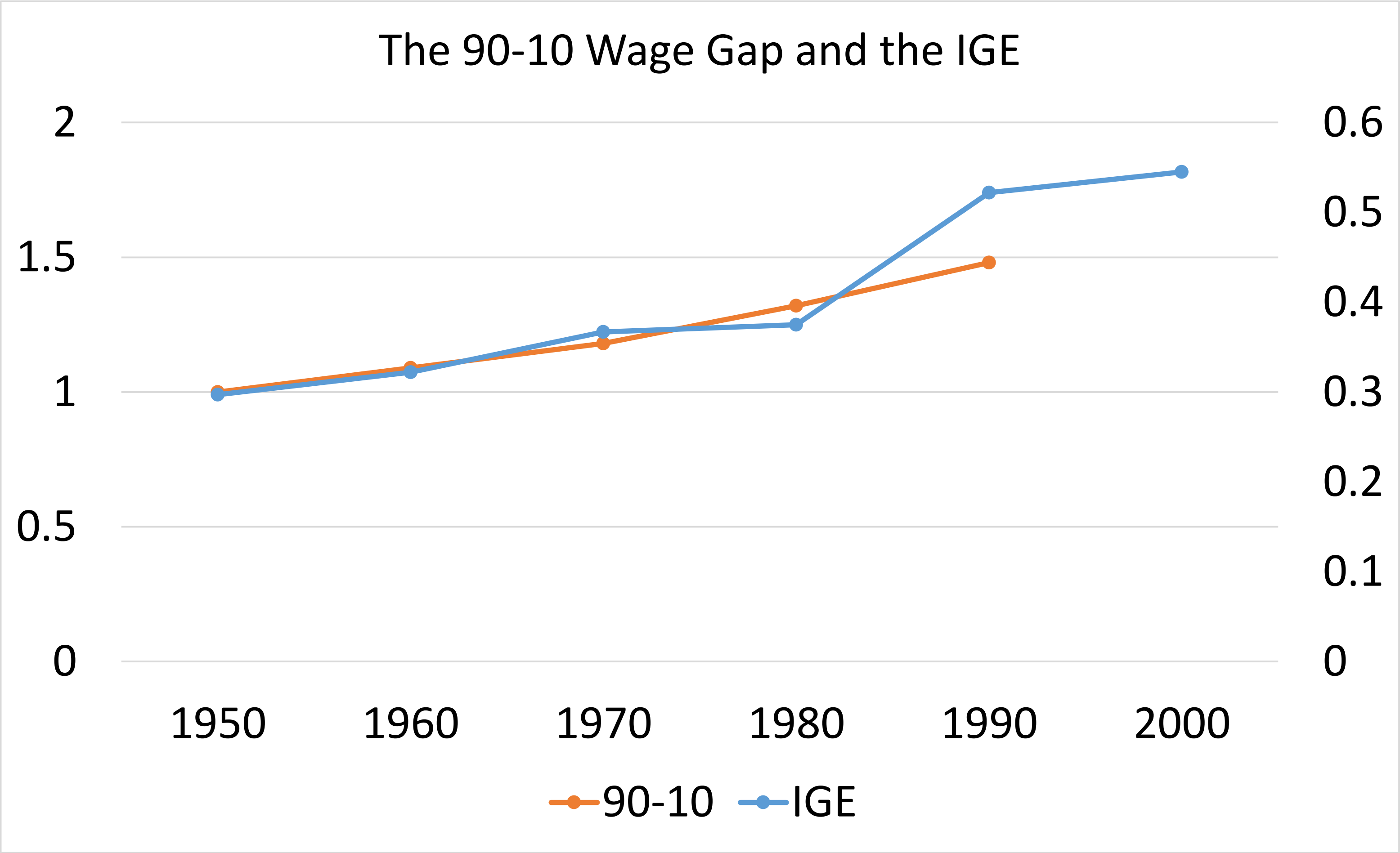
Second, increased inequality can alter segregation.

Proposition 7 does not logically entail that increases in variance of income increase the intergenerational elasticity of income. The reason is that the model we have set up is nonlinear and effects of changes in parental income inequality into a scalar measure of mobility such as the IGE will typically not be independent of the shape of the income density, conditional on the variance. Put differently, the construction of a Great Gatsby Curve from our model involves two moments of a nonlinear, multidimensional stochastic process of family dynasties, and so the most one can expect is logical compatibility. The subtleties of producing Gatsby-like behavior in nonlinear models of course is not unique to our framework; see discussion in Becker, Kominers, Murphy and Spenkuch (2015).

General Evidence on the Inequality/Mobility Nexus

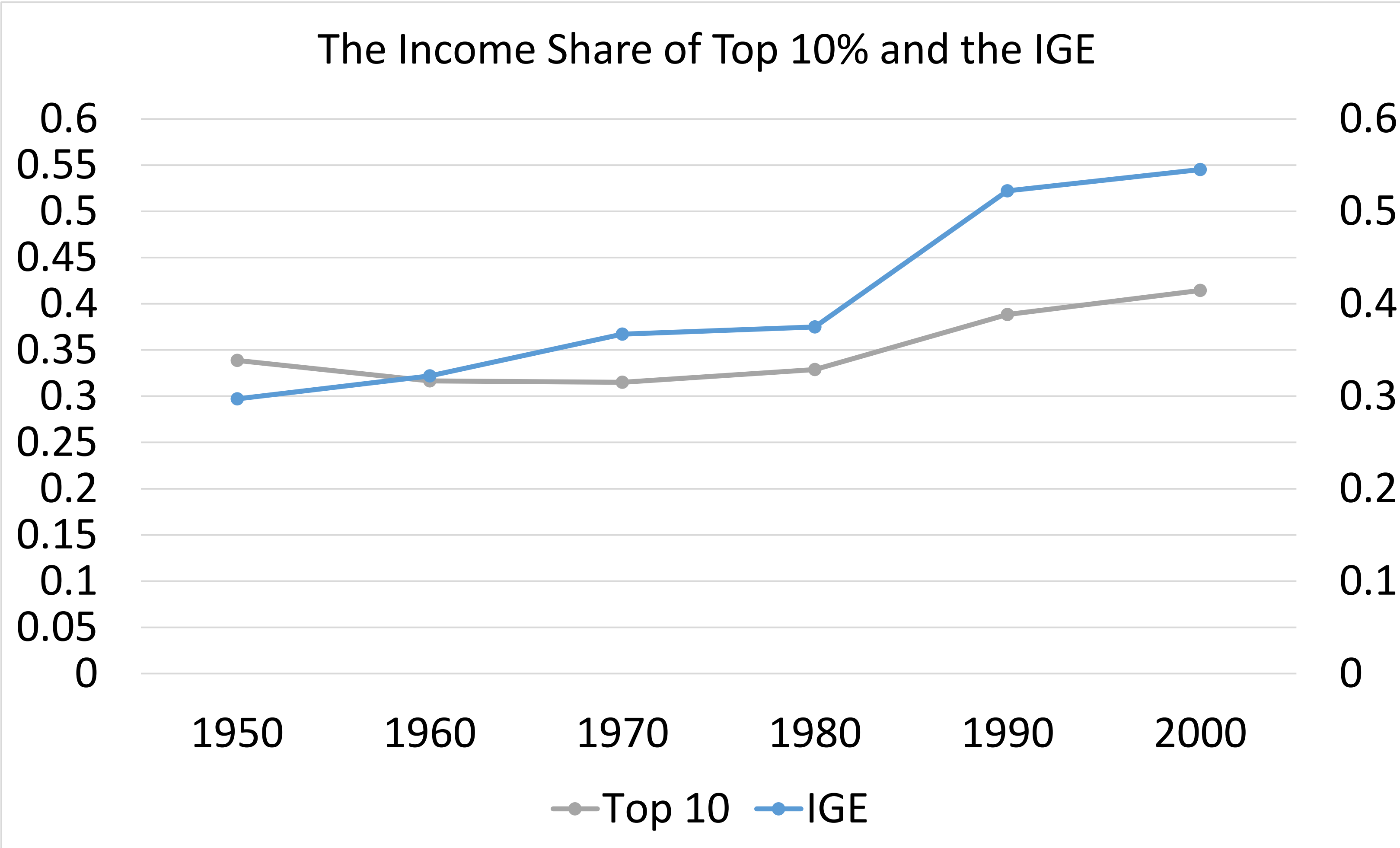
1. Direct evidence of an intertemporal Gatsby Curve: inequality and mobility are negatively associated.

Figure 1a: Aaronson and Mazumder Rising intergenerational elasticities



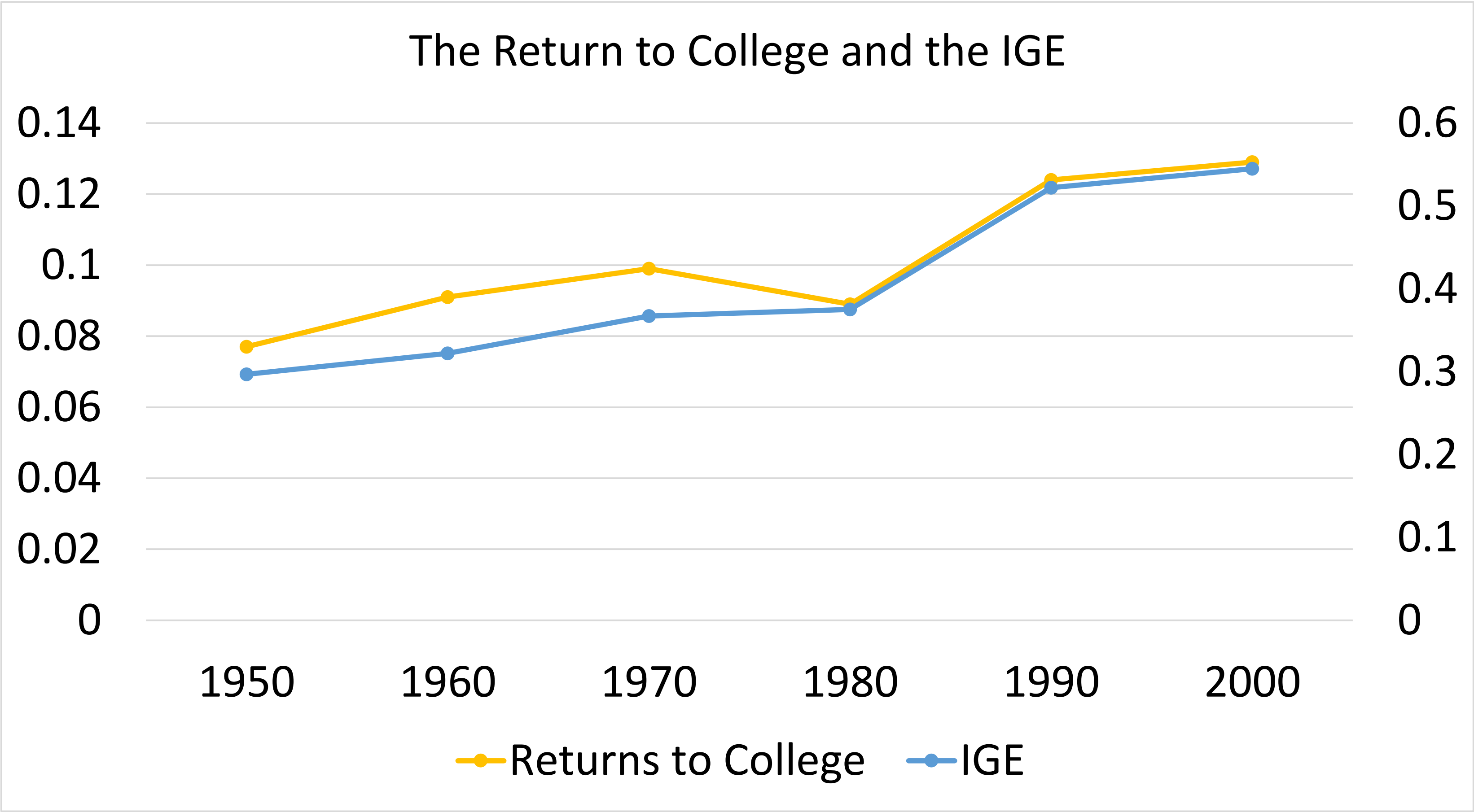
Source: Aaronson and Mazumder (2008)

Figure 1b: Aaronson and Mazumder Rising intergenerational elasticities



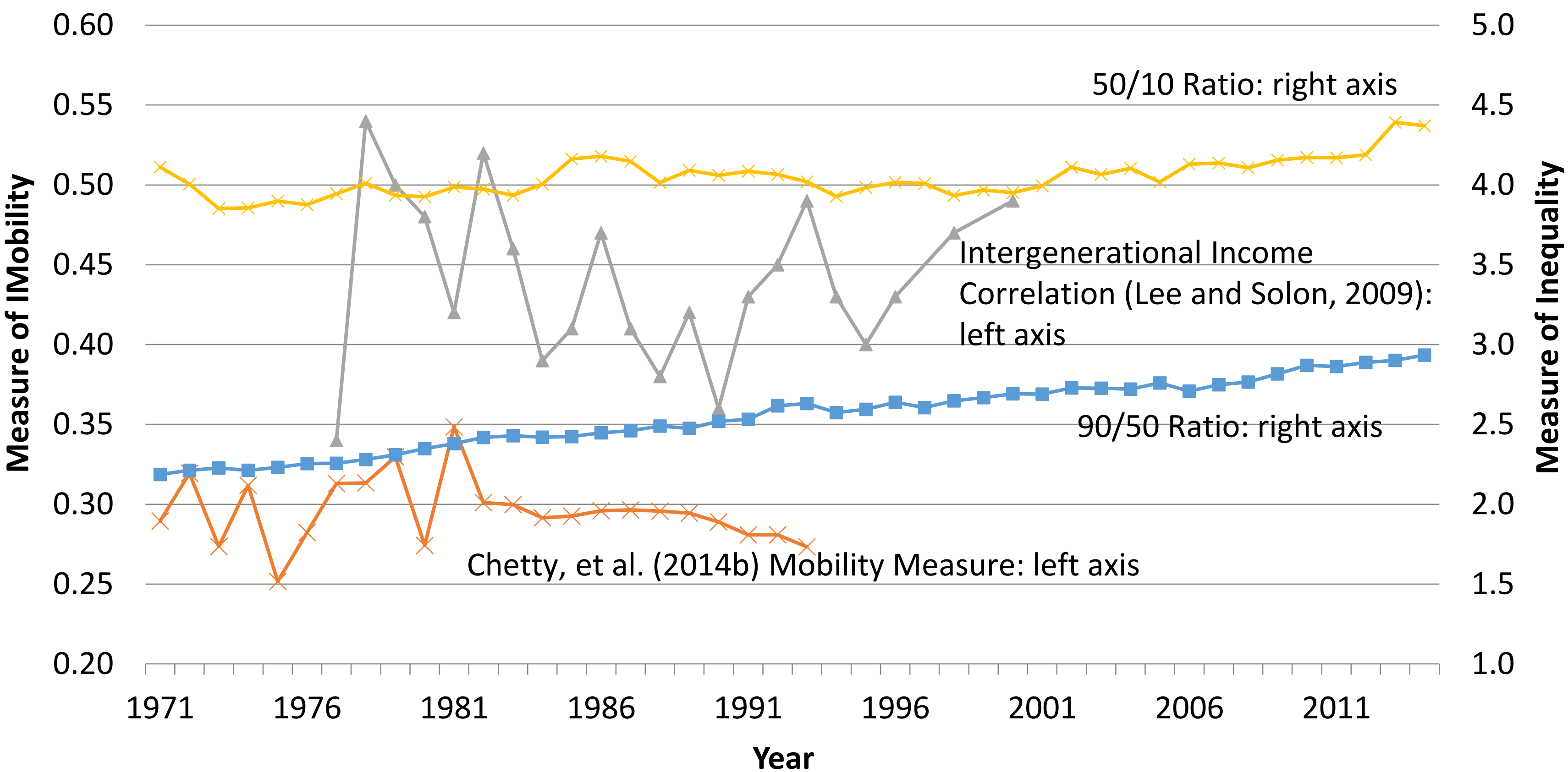
Source: Aaronson and Mazumder (2008)

Figure 1c: Aaronson and Mazumder: Rising intergenerational elasticities



Source: Aaronson and Mazumder (2008)

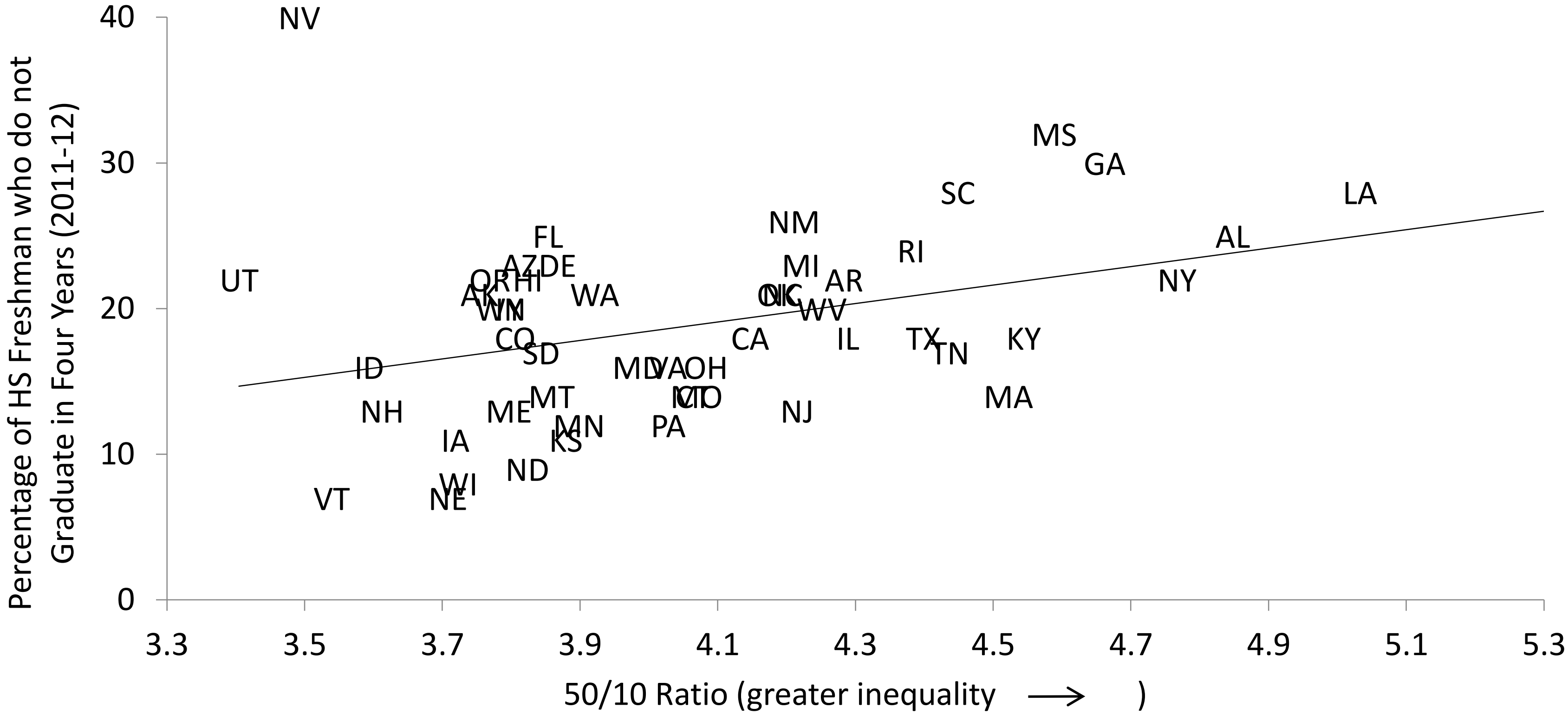
Figure 2: Kearney and Levine: 90/10 and other ratios



Source: Kearney and Levine (2016). Notes: The x-axis reflects the year in which income is measured for the 90/50 and 50/10 ratios. For the mobility measure in Chetty, et al. (2014b), year reflects birth cohort. For the mobility measure in Lee and Solon (2009), year reflects the year in which the son's income was recorded.

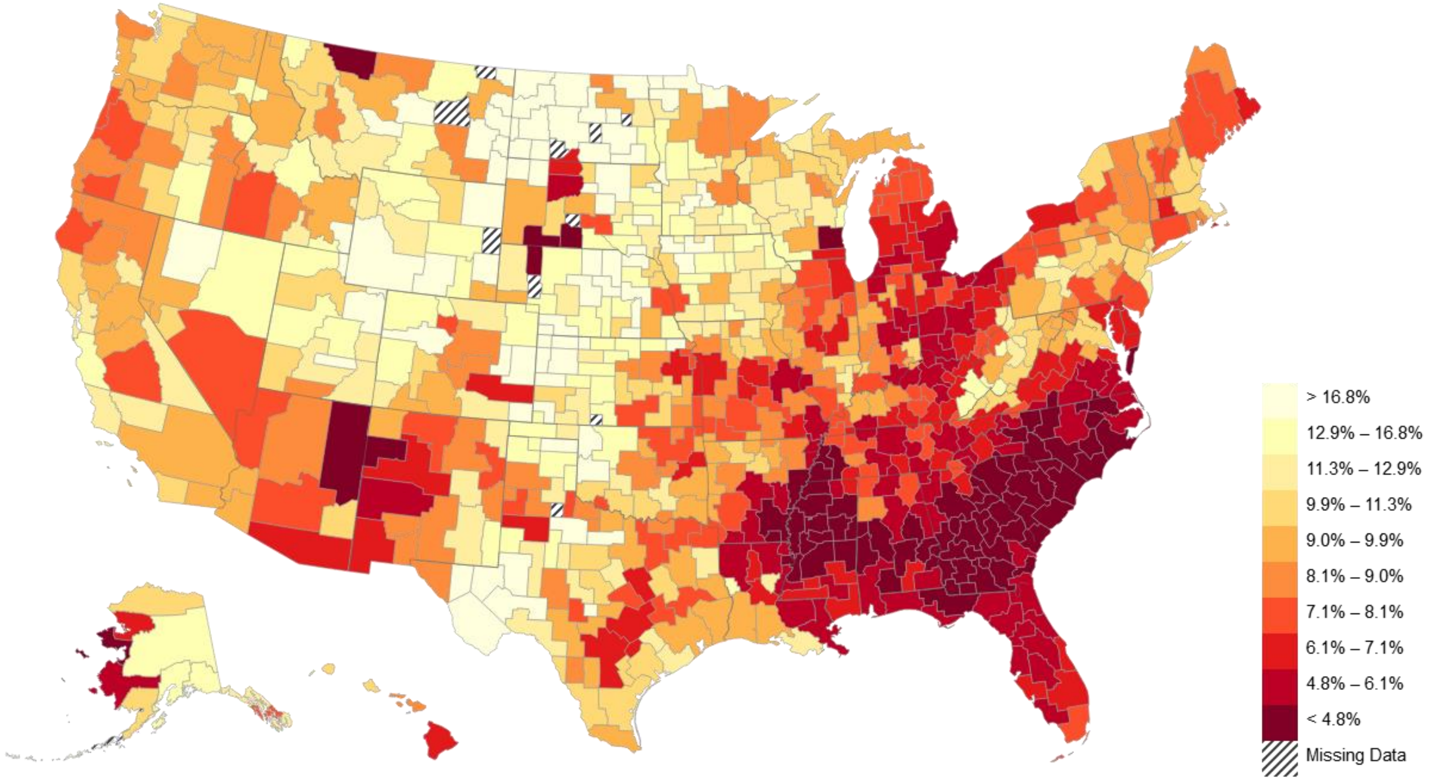
2. Location/Mobility Nexus

Figure 3: Relationship between inequality and the rate of high school non-completion



Source: Kearney and Levine (2016). Notes: The graduation data is from Stetser and Stillwell (2014). The 50/10 ratios are calculated by the authors. The District of Columbia is omitted from this figure because it is an extreme outlier on the X axis (50/10 ratio = 5.66).

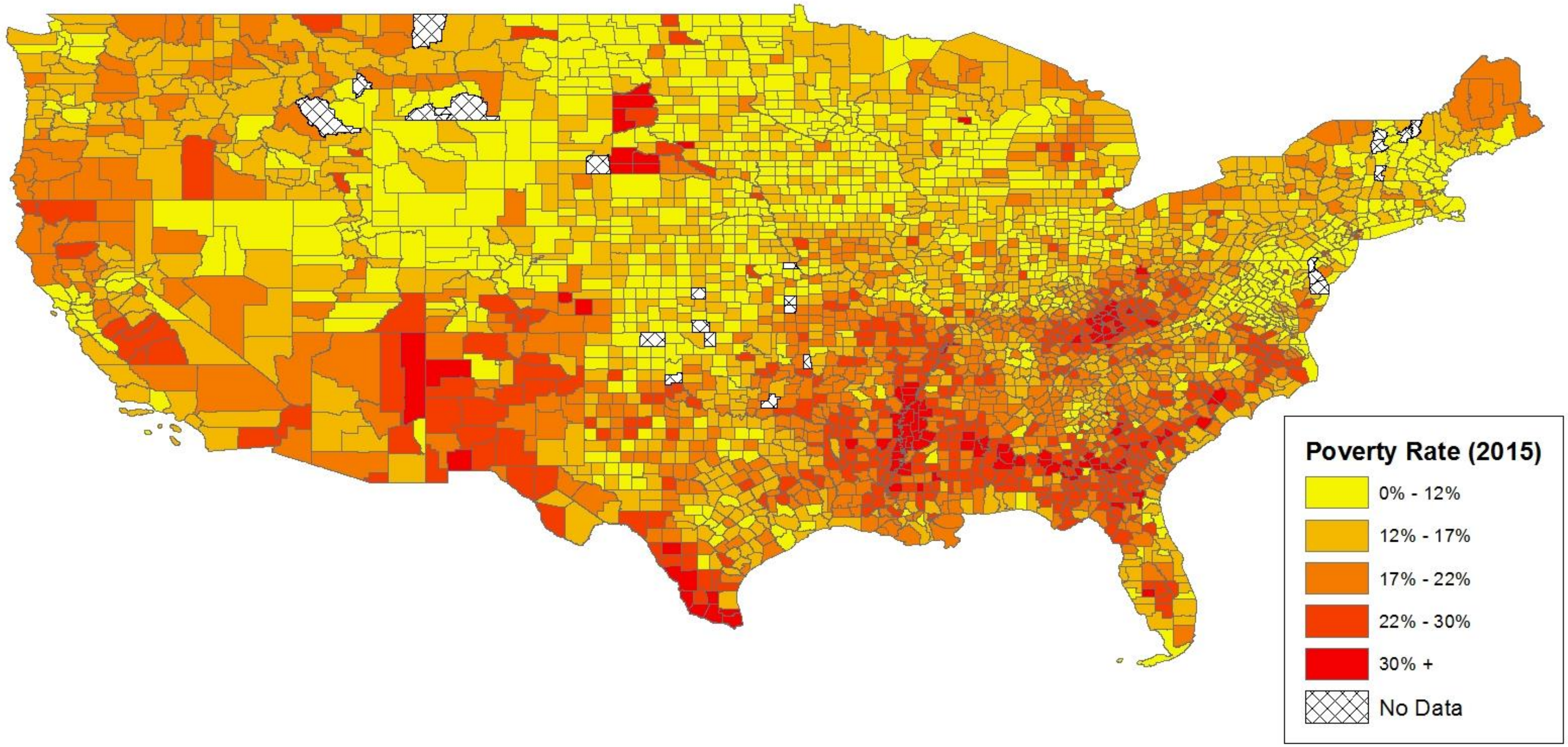
Figure 4: Chetty, Hendren, Kline, and Saez (2014): Spatial heterogeneity in rates of relative mobility



Note: This map shows rates of upward mobility for children born in the 1980s for 741 metro and rural areas ("commuting zones") in the U.S. Upward mobility is measured by the fraction of children who reach the top fifth of the national income distribution, conditional on having parents in the bottom fifth. Lighter colors represent areas with higher levels of upward mobility.

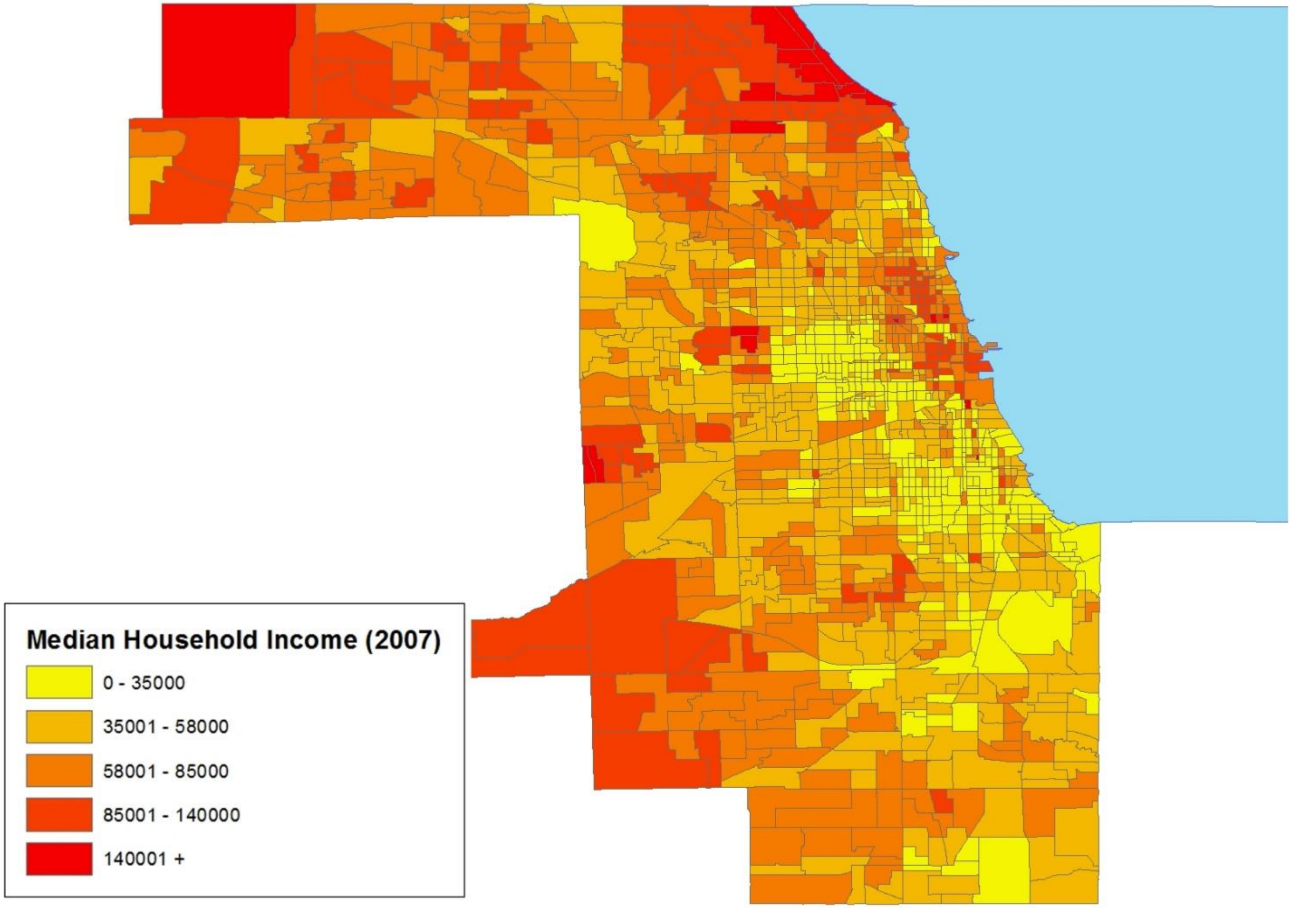
3. Income Segregation is pervasive and growing

Figure 5: Spatial distribution of poverty rates



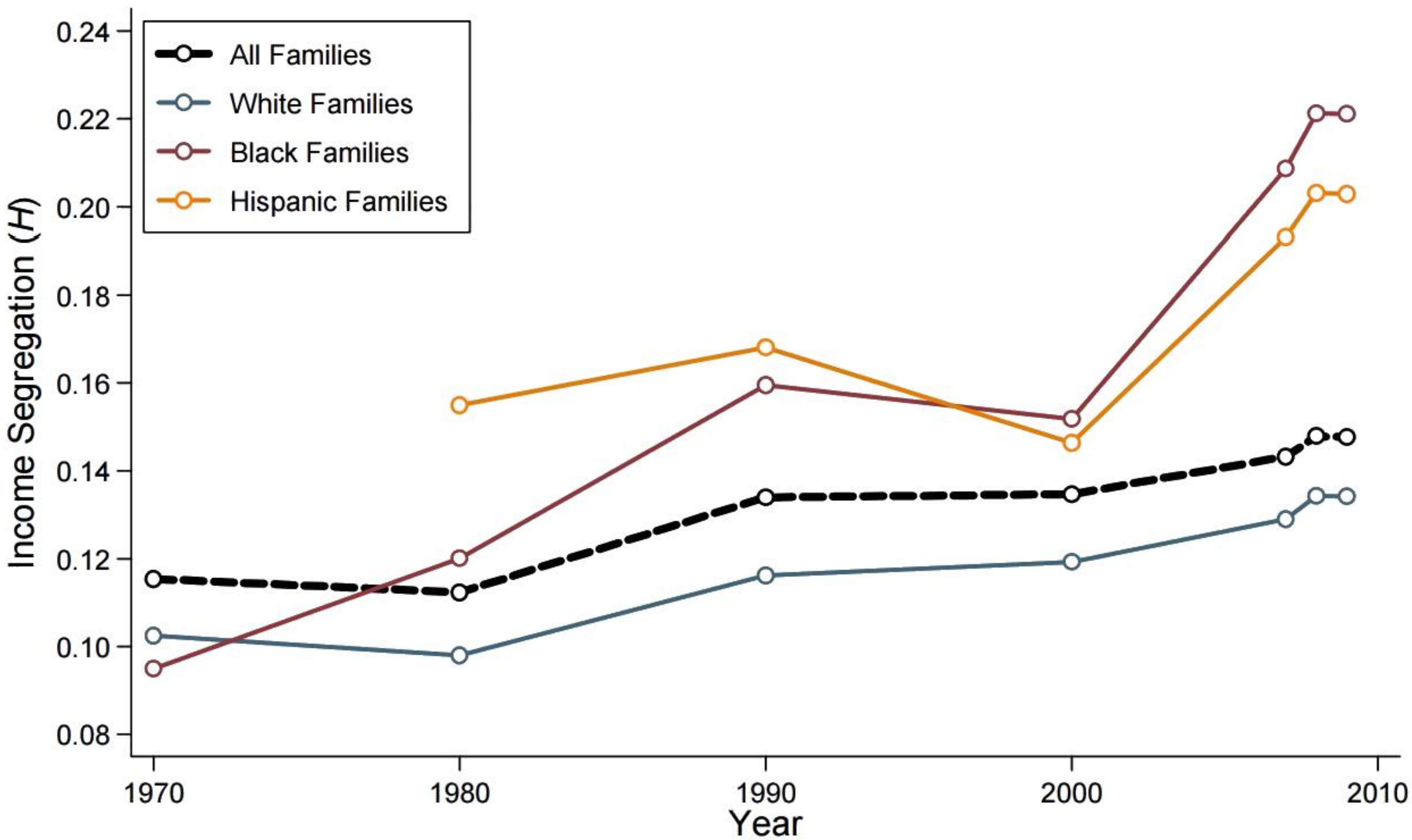
Source: US Census Bureau

Figure 6: Income segregation in Chicago



Source: US Census Bureau

Figure 7: Trends in family income segregation, by race

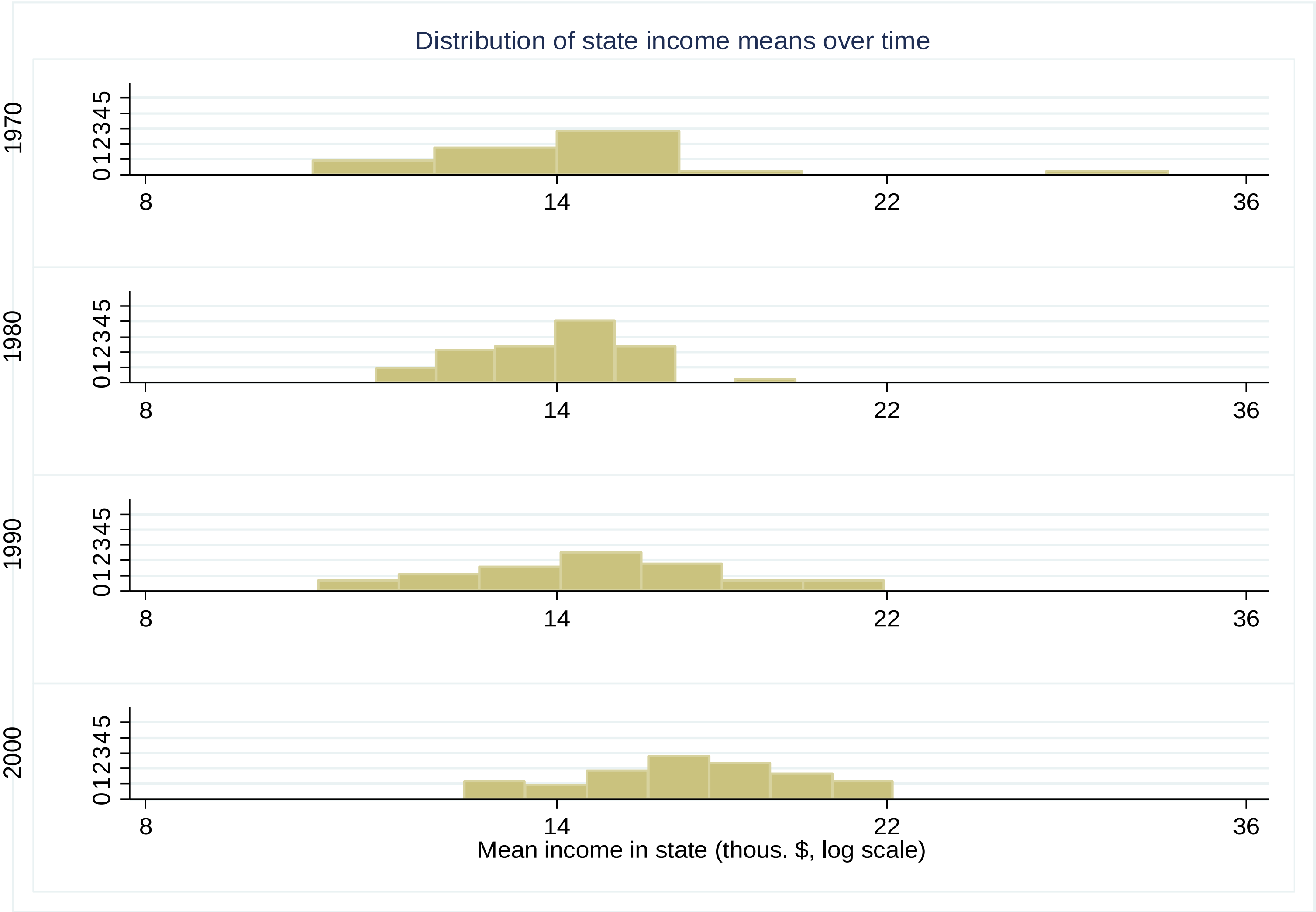


Source: Bischoff and Reardon (2013); authors' tabulations of data from U.S. Census (1970-2000) and American Community Survey (2005- 2011). Averages include all metropolitan areas with at least 500,000 residents in 2007 and at least 10,000 families of a given race in each year 1970-2009 (or each year 1980-2009 for Hispanics). This includes 116 metropolitan areas for the trends in total and white income segregation, 65 metropolitan areas for the trends in income segregation among black families, and 37 metropolitan areas for the trends in income segregation among Hispanic families. Note: the averages presented here are unweighted. The trends are very similar if metropolitan areas are weighted by the population of the group of interest.

Figure 8: Changes in census tract income averages over time

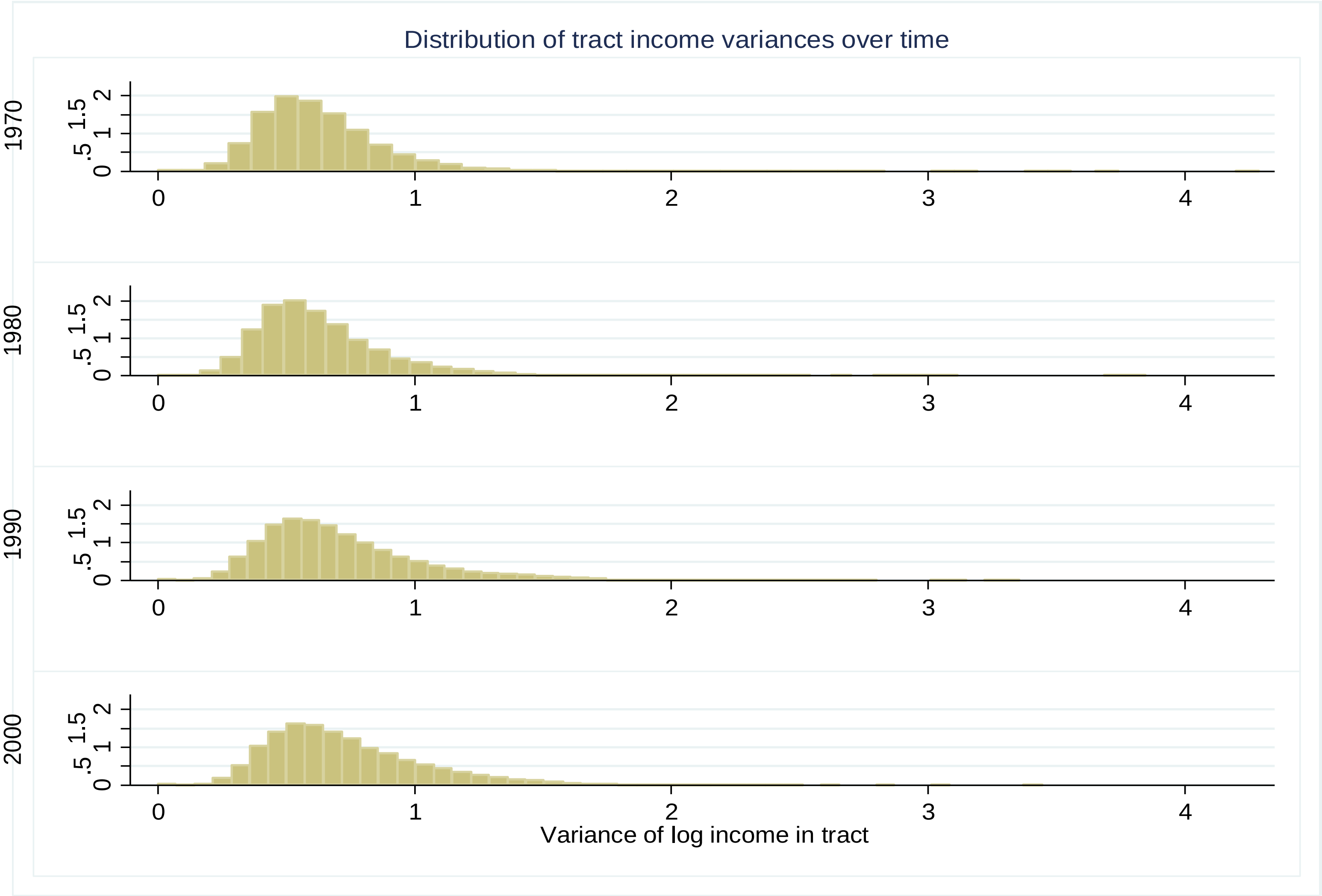
Note: All income deflated using CPI-U-RS and expressed in logs.

Figure 9: Evolution of state income averages over time



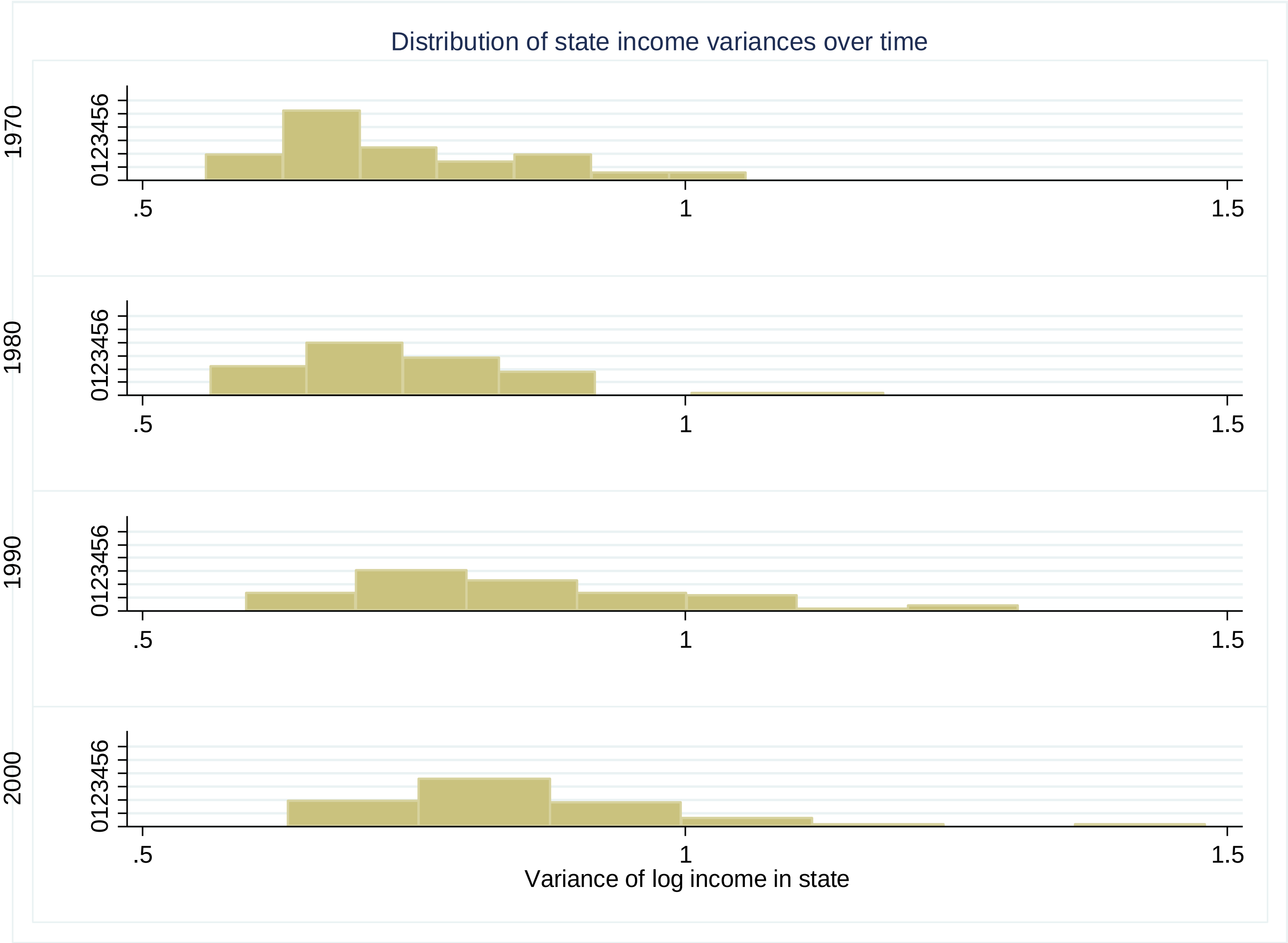
Note: All income deflated using CPI-U-RS and expressed in logs.

Figure 10: Evolution of census tract income variances over time



Note: All income deflated using CPI-U-RS and expressed in logs.

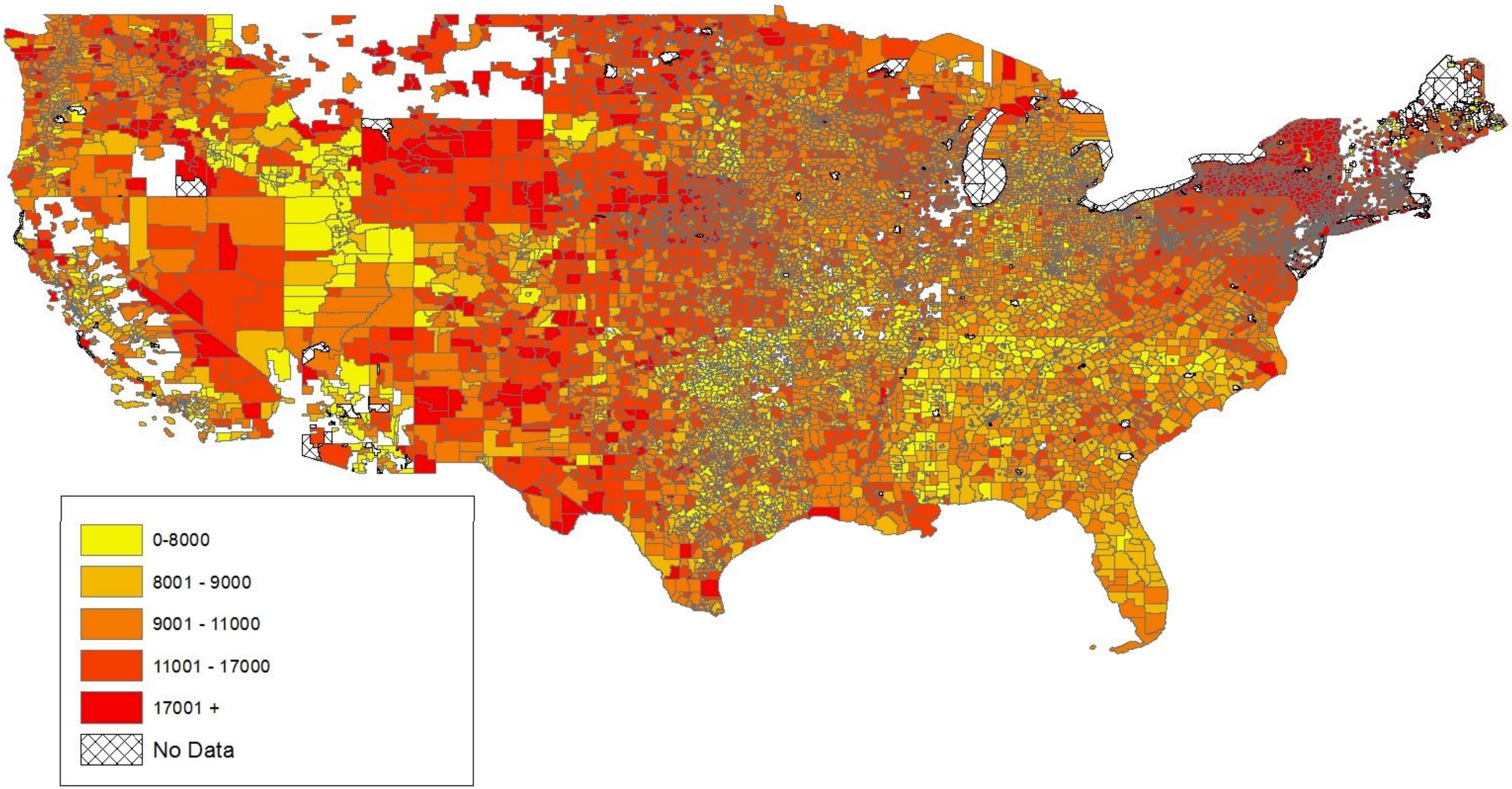
Figure 11: Evolution of state income variances over time



Note: All income deflated using CPI-U-RS and expressed in logs.

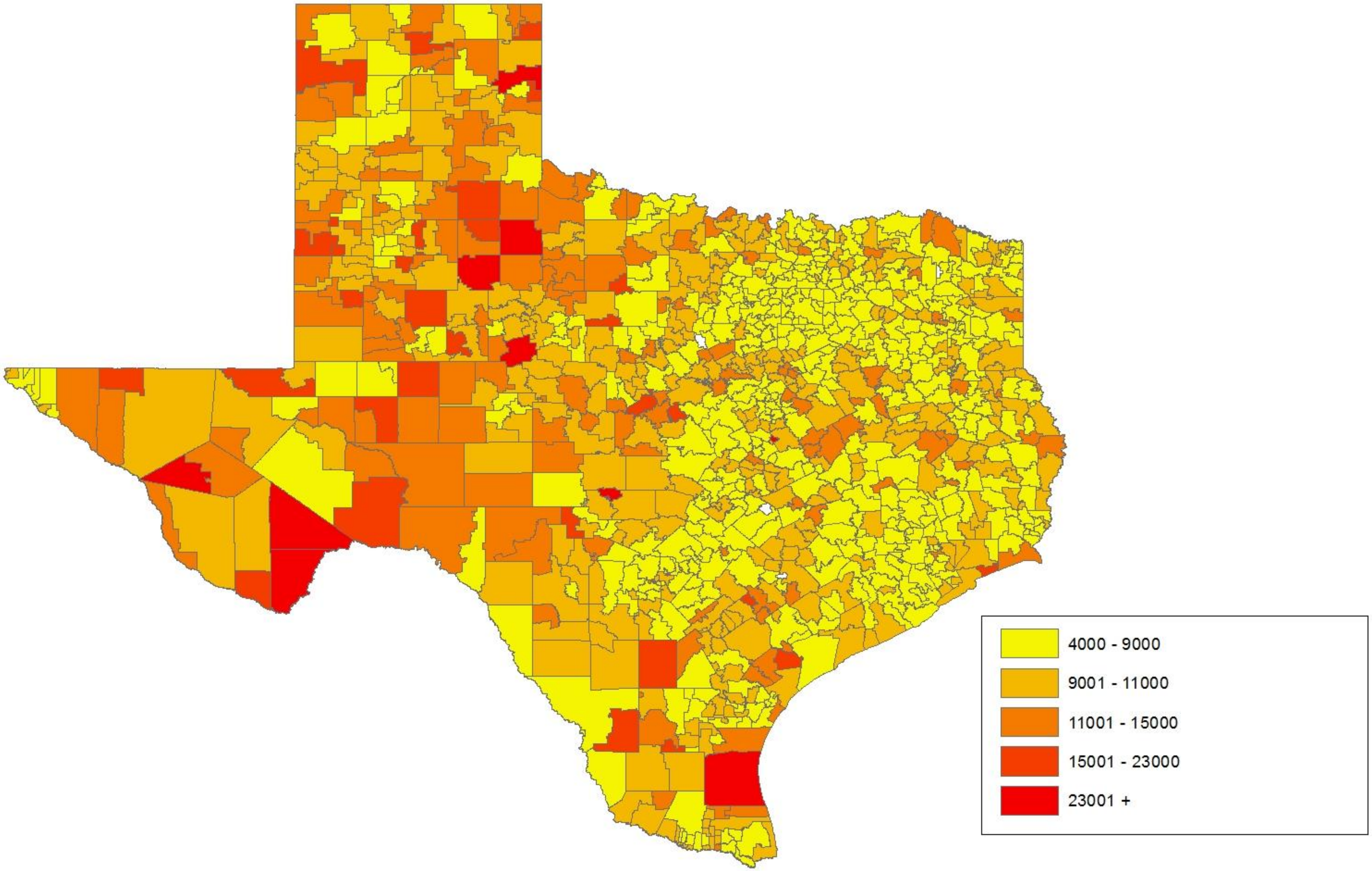
4. Spatial Heterogeneity in Factors Relevant to Human Capital/Sills Formation

Figure 12: Spatial variation in per capita public school expenditure



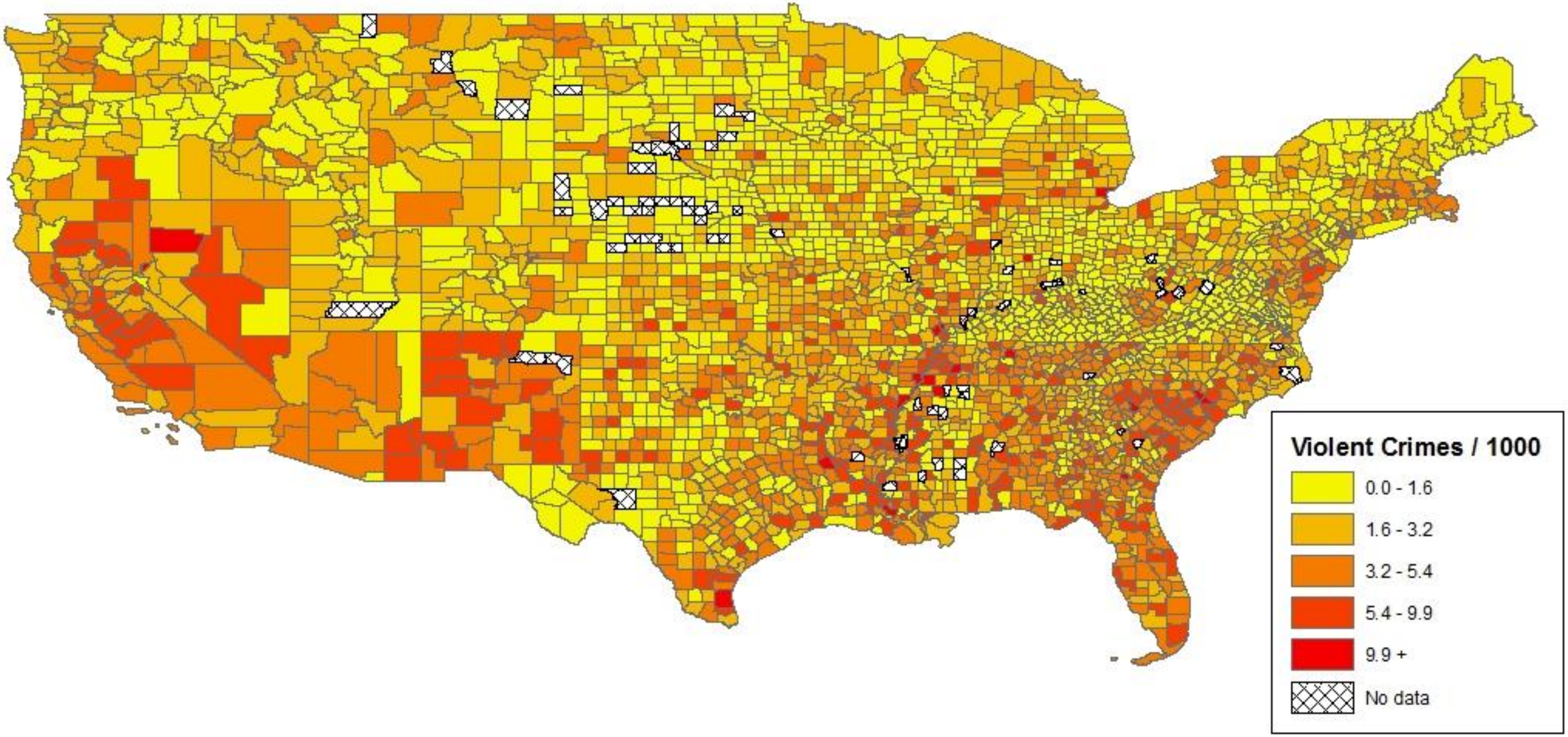
Note: 2014 per pupil expenditure, in dollars. Source: NCES.

Figure 13: Spending per student, by school district, Texas



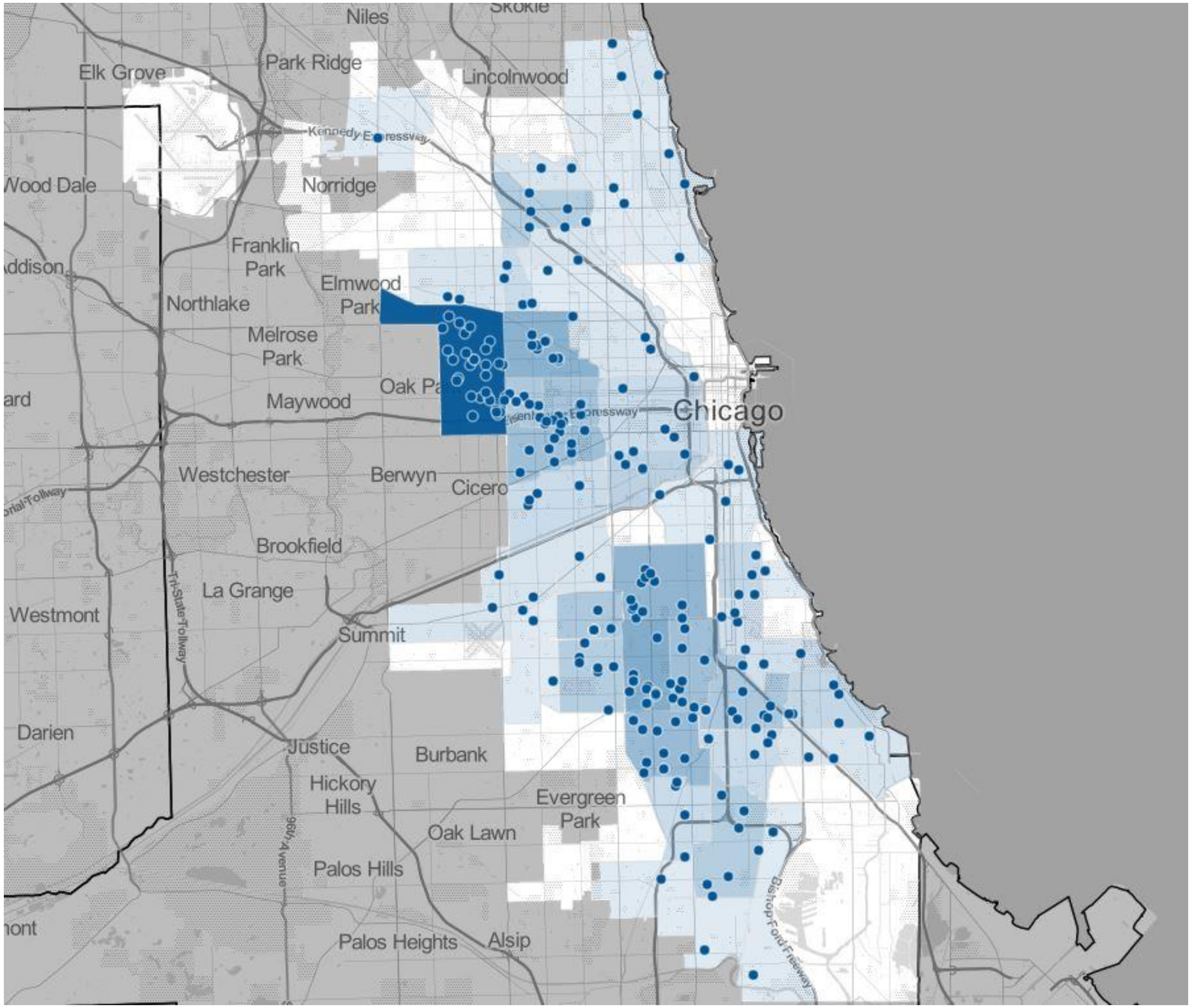
Note: 2014 per pupil expenditure, in dollars. Source: NCES.

Figure 14: Exposure to violent crime



Note: Violent crimes per thousand people, 2012. Source: Uniform Crime Reporting Program.

Figure 15: Distribution of homicides in Chicago



Source: Chicago Tribune. Accessed May 21, 2016.

Conclusions and Conjectures

Plausible theoretical conditions and suggestive evidence for the proposition that segregation-based phenomena induce Gatsby-like behavior.

Associational redistribution policies may be appropriate.