

Measuring and Interpreting Inequality Working Group

Conference on Intergenerational Mobility

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Human Capital and Economic Opportunity Global Working Group

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Conference Summary

The purpose of this conference was to create an exchange of ideas and promote possible collaboration among a diverse group of scholars of the Measurement and Interpretation of Inequality network (MIE) on the general topic of intergenerational mobility. The goal of the MIE network is to understand and interpret inequality in all of its manifestations; intergenerational inequality is a key dimension of the group's research objective. Bhashker Mazumder of the Federal Reserve Bank of Chicago, and the co-leaders of the MIE Working Group, Steven Durlauf of the University of Wisconsin-Madison, and Scott Duke Kominers of the Becker Friedman Institute of Research in Economics at the University of Chicago organized presentations and discussions of the following research papers:

- "Early and Late Human Capital Investments, Borrowing Constraints, and the Family"
Lance Lochner (University of Western Ontario), joint work with Elizabeth Caucutt (University of Western Ontario)
- "Racial Peer Effects in the Classroom"
Daryl Fairweather (University of Chicago)
- "Rich Dad, Smart Dad: Decomposing the Intergenerational Transmission of Income"
Matthew Lindquist (Stockholm University), joint work with Lars Lefgren (Brigham Young University) and David Sims (Brigham Young University)
- "Nature and Nurture in the Transmission of Economic Status"
Ananth Seshadri (University of Wisconsin-Madison), joint work with Sang Yoon Lee (University of Mannheim)
- "What is the True Rate of Social Mobility? Evidence from the Information Content of Surnames"
Gregory Clark (University of California, Davis)

- “British, American, and British-American Social Mobility: Intergenerational Occupational Change Among Migrants and Non-Migrants in the Late 19th Century”
Joseph Ferrie (Northwestern University and NBER), joint work with Jason Long (Wheaton College)
- “Mismatch, Rematch, and Investment”
Andrew Newman (Boston University and CEPR), joint work with Thomas Gall (University of Bonn) and Patrick Legros (ECARES, Université Libre de Bruxelles; and CEPR)
- “Black-White Differences in Intergenerational Mobility in the U.S.”
Bhash Mazumder (Federal Reserve Bank of Chicago)
- “The Effect of Residential Segregation during Childhood on Life Changes: Causal Evidence Using Historical Railroad Track Configurations”
Rucker Johnson (University of California, Berkeley and NBER)
- “Gender, Geography and Generations: Intergenerational Educational Mobility in Post-reformed India”
Shahe Emran (IPD, Columbia University) and joint work with Forhad Shilpi (DECRG, World Bank)
- “The Measurement of Educational Inequality: Achievement and Opportunity”
Francisco Ferreira (World Bank and IZA), joint work with Jérémie Gignoux (Paris School of Economics)

I. Early and Late Human Capital Investments, Borrowing Constraints, and the Family

There is a large body of literature studying the role of borrowing constraints on college attendance. However, most of these studies take earlier investments and family transfers as given. These studies typically find adolescent abilities to be very important in determining future earnings. This paper aims to study the role of borrowing constraints on pre-college investments and family transfers in determining these abilities as well as later schooling choices and earnings.

There are several reasons as to why studying early life borrowing constraints is crucial for thinking about human capital investment and associated economic outcomes:

- Consumption studies have found that borrowing constraints are typically more salient for younger families.
- Younger parents may have large college debts and typically earn less when their children are young.
- In the US as well as many other countries, there are loan programs targeted toward college, but there are no loan programs that specifically target early investment in children.

Some studies have shown that early interventions, such as the Perry Preschool program, have large long-run effects on a range of socioeconomic outcomes; from a cost benefit perspective early childhood investment have high rates of return. However, credit constraints, especially for young parents, inhibit investment and can explain why most low-income children do not participate in quality preschool programs despite the high economic returns. Altogether, family's financial status at earlier ages has relatively large impacts on children's achievements and educational attainments.

The objective of this paper is to understand the following:

- The importance of borrowing constraints at different stages of development.
- The magnitude of dynamic complementarities in human capital investments and how they interact with borrowing constraints
- The effects of policies at one stage of childhood development on investments at other stages.
- Intergenerational transfers and their implications for policy in the short and long run.

Investment in human capital is a multi-stage process that begins early in life. This paper develops a human capital based theory of the family that incorporates the dynamic nature of investment in children, intergenerational transfers, and borrowing constraints faced by parents and college-age youth.

The paper's theoretical model is based on an overlapping generation model with multiple human capital investment periods. Major findings of the theoretical analysis include

- Dynamic complementarity can play a central role in determining the impacts of investment subsidies and borrowing constraints on investment over the lifecycle.

- With sufficient complementarity, policies encouraging investment at one stage of development also increase investment at other stages.
- When investments are substitutable over time, a subsidy or loan increase at one stage of development tends to shift investment to that stage and away from others.

Data from Children of the National Longitudinal Survey of Youth (CNLSY) are used to calibrate the model. The calibrated model provides the following results:

- Raising borrowing limits for young parents produces mixed effects in terms of investment in human capital
 - o In the short run, increasing borrowing limits for young parents causes those parents that are constrained to borrow more
 - o In the long run, asset distributions shift left and there is slightly less overall human capital investments.
 - o Initial generations capture most of the benefits from relaxing borrowing limits.

This paper also simulates the long-run effects of permanent policy changes in addition to the short-run effects typically measured in empirical studies. While short-run effects are based on the current distribution of wealth and human capital in the population, long-run effects take into account changes in the distribution of assets and human capital over time. The simulation results show that:

- Later subsidies are less effective than earlier ones.
 - o There is a strong interaction between dynamic complementarities and borrowing constraints in terms of equilibrium educational investments.
 - o It is costly to increase early investment in response to later subsidies when early borrowing constraints bind.
 - o Subsidies for investment at either early or late stage raise investments at both stages. One should not neglect the response of early investment to late subsidies.
- A one-shot policy that provides income transfers to young parents increases human capital investments more than an equivalent loan to young parents. However, if the policy is permanently put in place, the loan policy increases human capital investment more.
 - o Policies that alter the borrowing constraints for parents directly encourage investment by increasing parental resources and transfers.
 - o Meanwhile, these policies discourage investment by lowering its return, since children will also receive the transfer when they grow up.

- A transfer policy has larger current effects from increasing the child's parental resources.
- Transfer policy has larger negative future effects by increasing the child's resources relative to a loan policy.

Discussion:

- It may be worthwhile to consider whether different sources of permanent income shocks affect optimal investment in children.
- From a policy point of view, it may be helpful if the paper is able to distinguish between policies that relax borrowing constraints and ones that provide education subsidies for families with lower incomes.
- One should also take into account of the neuroscience literature which examines the development of the brain at early ages as this implies that the overall return of the investment on child's human capital may be high regardless of future investments.

II. Racial Peer Effects in the Classroom: Evidence from a Randomized Experiment

Previous research on gender peer effects in school has found that increasing the share of female students in a class has positive effects on performance on both male and female students. On the other hand, previous research on racial peer effects in school has found that increasing the share of black students in the classroom has a negative effect on black, Hispanic, and white students. This paper employs data from the Tennessee STAR (Student-Teacher Achievement ratio) Project to study racial peer effects in the classroom.

Project STAR took place from 1985-1989 in 79 Tennessee public schools. Kindergarten students and teachers were randomly assigned within school to three different class types: small, large, and large with teacher aide. The project was put in place mainly to study the effect of class size on educational outcomes but has proven to be a useful source of evidence on peer effects.

This paper provides empirical evidence of the following:

- Black students perform better with a higher share of black students and lower share of other races in the classroom
- White students perform better with a higher share of white student and lower share of other races in the classroom.

- Results are similar with students of other races.

This paper suggests the following:

- It would be worthwhile to explore if the racial effects observed in the paper are driven by changes in student behavior or teacher behavior
 - o Teachers may give more attention to a given race, when more students of that race are present in the classroom.
 - o Students may be bullied more when they are in the minority.
 - o Student may view themselves different when they are in the minority.
- There may be benefits to keeping schools and classrooms homogeneous with regard to race.
- Programs that alter the racial composition of a student's school (examples include charter and magnet schools) should take racial peer effects into account.

Discussion:

The structure of the empirical exercise done in this paper is to pool all schools in one regression rather than taking each school in isolation and averaging. If there is heterogeneity in the student populations of different schools, such as differences in family background of the student body in terms of socioeconomic characteristics across schools, this would alter the interpretation of the results and potentially invalidate the interpretation given to the paper's regressions in terms of peer effects.

The results are largely driven by classroom in which a single student is in the minority racial group. One may question whether, if adding one black student to an all-black/all-white classroom has such a strong effect, then why is this particular student there? Why does his family choose to live in the neighborhood where the school is located? It is not clear that the effect of this "type" of student can be generalized to the effect of adding "average" black and white students.

III. Rich Dad, Smart Dad: Decomposing the Intergenerational Transmission of Income

The empirical literature on measuring intergenerational income correlation has provided us with valuable cross-country information on the role of family background in determining economic success. However, it remains an open question as to what the structural mechanisms underlie the transmission of income from one generation to the

next. In particular, it remains unclear whether an intergenerational income correlation estimate should be interpreted as the causal effect of financial resources on child quality, the mechanistic persistence of genetic or human capital differences, or something else entirely.

This paper aims to develop an approach to the identification of the mechanisms through which the intergenerational income correlation operates. This approach can be used to discern the relative importance of paternal income versus human capital in intergenerational income mobility. The main research questions of this paper are:

- Why is income correlated between fathers and sons?
- How much of the intergenerational income correlation can be attributed to the causal impact of fathers' income and how much can be attributed to the transmission of his human capital?

This paper proceeds as follows:

- This paper builds a theoretical model in which paternal human capital and financial investments have separate effects on child quality as measured by income.
- Ordinary least squares (OLS) estimates of the intergenerational income correlation are shown to converge to a weighted combination of these two effects.
- The weight on each factor depends on the relative importance of luck and human capital in determining paternal income.
- Instrumental variables (IV) estimates of the intergenerational income correlation identify different combinations of the paternal human capital and financial resource effects with weights that depend on a particular instrument's covariance with paternal human capital and income due to luck.

One can test the assumption that the intergenerational income correlation operates through multiple mechanisms by comparing the IV and OLS estimates.

- Under the null hypothesis that the intergenerational income correlation operates through a single mechanism,
 - o OLS and IV estimates (or any two IV estimates obtained from different correlates of paternal income) should be statistically indistinguishable.
 - o Rejecting this null hypothesis requires the IIE to operate through at least two mechanisms.

- Given an instrument which is correlated with only the luck component of paternal income and another instrument which is correlated with only the human capital component, one can identify the structural parameters underlying the IIE in the model.
- Even if such instruments are not available, IV estimation allows us to identify upper bound estimates of the role of financial resources and lower bound estimates of the importance of human capital using instrument sets derived from correlates for father's income that satisfy a simple monotonicity condition. The paper also demonstrates how to bound the structural parameters in the absence of an instrument that effectively isolates variation in paternal income due to luck.
 - o Identification is achieved with an instrument that isolates variation in paternal income due to human capital combined with an estimate of the fraction of the variance in paternal income attributable to human capital.
 - o The R-squared from a simple Mincerian regression of paternal permanent income on measures of human capital provides a lower bound of this latter quantity.
 - o These in turn provides an alternative method to identify a lower bound of the mechanistic impact of human capital and an upper bound of the causal effect of paternal income.
- In the absence of experimental data and perfect instruments, IV bounding methods can be a valuable tool for understanding causal relationships.

Using a large Swedish dataset, this paper provides the following empirical results:

- The intergenerational income correlation is 0.29, which is consistent with prior estimates in the literature of Scandinavian countries.
- At most, 37% of intergenerational income correlation is due to the causal impact of fathers' financial resources
- The remainder is due to the transmission of fathers' human capital

Discussion:

- This paper does not distinguish between an individual's natural endowment, for example, ability, and an individual's choices, for example, effort and time spent. It may be worthwhile to include these distinct income determinants since their respective roles have different policy implications.

- The paper needs to be clearer about how to choose instruments. The degree of orthogonality between the instrument and the error term in the explanatory equation needs to be addressed carefully.

IV.



China and Taiwan 1700-2011, and tries to recover the long-run measure of social mobility across countries, time periods, and different measure of social status.

There have been many measures of intergenerational correlation within the one-generation framework. These studies suggest the following:

- Intergenerational elasticities are typically of the order of 0.2-0.5 for income, years of education, occupational status, and wealth.
- Income, occupational and social mobility are all largely complete within 2-5 generations.
- The fraction of variance of social position explained by inheritance is low (4% in Scandinavia and 22% in the USA)
- Social mobility rates vary substantially across countries.
- Mobility rates are “too low” in some societies. With better opportunities for the children of low income or status families, more mobility would be possible.

As a measure of the intergenerational transmission of social status, the one generation studies mentioned above suffer a key limitation. Suppose one assumes that the various aspects of social status in the current generation, income, wealth, education, location, are all linked to some fundamental social competence or status, then the regression to the mean exhibited by each partial measure of underlying status will overestimate the regression to the mean of that underlying status. When we classify families as high or low status based on partial measures such as income, wealth, education or occupation, there will appear to be substantial regression to the mean. But if we took a more aggregate measure of status, the regression will be substantially lower. In short, intergenerational correlation estimated from two generation studies will greatly overestimate social mobility in the long run for two reasons:

- The two-generation intergenerational correlation measures the regression just of particular aspects of status;
- It incorporates a regression through those of measured high status having net positive random components in status only in the first generation, which will not occur across future generations.
 - o The greater are the random components in determining measures of status such as income, the greater will be the degree of mismatch between such partial one generation estimates of regression to the mean and the underlying regression of fundamental social status

This paper propose a surname method which measures social mobility not through individual family linkages, but by tracking wealth, income, and status by surnames over multiple generations. In many of the societies discussed in the paper, surnames represent social status of the family. The method proposed in this paper allows one to investigate the rate of regression to the mean of this deeper underlying social status and by implication the long run rate of regression to the mean of income, wealth, occupational status and education.

Studying the surname distributions among elites and underclass for a variety of countries and time period suggests the following about social mobility rates:

- Elites and underclass all tend to mediocrity at a constant rate.
 - o This rate of convergence to the mean is constant across generations.
- The intergenerational mobility measure is higher than conventionally estimated, between 0.7 and 0.8.
 - o Social mobility is extremely low
 - o Complete regression to the mean typically takes 10-16 generations.
- The measure of intergenerational mobility is constant across societies and social systems. It is constant across status-wealth, education, occupation, and across the entire distribution of status, being the same for the upper tail as for lower tail.
- Persistent elites and underclasses only occur in two cases:
 - o An isolated elite with marital endogamy (the Copts in Egypt)
 - o An elite or underclass that is maintained by selective retention of members with elite or underclass characteristics, and the recruitment of outsiders with the characteristics.
- Assortative mating is what makes the intergenerational persistence high. Mating has become more assortative in the modern world, so mobility rates may decline further.
- Social status is likely mainly of genetic origin.

Discussion:

- In the conventional literature of intergenerational mobility, one of fundamental issues is to distinguish permanent and transitory income across years. And this paper is addressing the same issue across families. It is worthwhile to think about heritability along with the results at hand.

VI. British, American, and British-American Social Mobility: Intergenerational Occupational Change Among Migrants and Non-Migrants in the Late 19th Century

Previous papers that study the trends in intergenerational social mobility in the US and Britain in the 19th century have found that mobility in the US in the 19th century is significantly greater than in Britain, unlike the present. The current paper complements this previous research by studying the social mobility of the British labor force that was most mobile, that is, the group of trans-Atlantic migrants that left Britain and entered America. Specifically, this paper attempts to answer the following question:

- How much intergenerational mobility did this group experience?
- How did their mobility experience compare with that of non-migrants in both countries?
- What can be said about the selectivity of the migrants? What is the effect of the migration on their mobility?

The previous literature on migration has a few limitations

- The “quality” of immigrants is usually assessed by examining their labor market performance relative to the native-born in the country to which they migrated.
 - o This approach cannot distinguish between the change in overall home-country quality and change in the selectivity of immigration.
 - o This approach focuses exclusively on immigrants’ experience after the arrival in the destination.
- A complementary literature focuses on the “brain drain”: selective immigration’s impact on home-country characteristics.
 - o This approach focuses exclusively on migrants’ experience before departure in the home country and the non-migrants’ experience in the home country before and after migrants depart. However, this may not capture the immigration experience of the migration from Britain to the US in this period.
- Though there are few studies examine the migrants before departure from home and after arrival at the destination and non-migrants before and after the migrants depart; data on both migrants and non-migrants are seldom available.

The data used in this paper are constructed as follows:

- For non-migrants in both countries, two samples of males are linked across censuses from 1861-1881 and 1881-1901 in Britain, and from 1860-1880 and 1880-1900 in the U.S.
- The linkages are made based on name, year of birth, parish or county (Britain) or state (US) of birth.
- Information from two censuses allows comparison of occupations of fathers and sons observed at the same life-cycle point.
- For migrants, two samples are carefully constructed:
 - o British-born males age 30-39 in the 1880 U.S. Census of Population linked back to the 1861 British Census.
 - o British-born males age 30-39 in the 1900 U.S. Census of Population linked back to the 1881 British Census.

Compared to the existing literature, this paper studies the intergenerational mobility of occupations. This measure can be assessed through the analysis of simple two dimensional matrices, with categories for fathers' occupations arrayed across one dimension and categories for sons' occupations arrayed across the other.

The results of this paper suggest that

- Intergenerational mobility in occupation was greater for the earliest migrants than both British non-immigrants and US native-born.
- Later migrants were still more mobile than British non-immigrants and just as mobile as US native-born.
- In thinking about the role of migration in causing differences in intergenerational mobility, this paper finds positive selection among migrants: they did better in the U.S. than non-migrants would have done in the U.S.

Discussion:

- One of the challenges of this paper is the lack of explicit explanation as to why migrants chose to leave for the US until one can sufficiently account for the differences in wages in Britain and the US. An important extension of this paper is to incorporate country-specific and time-specific wages into the analysis. This is an important future extension.

VII. Mismatch, Rematch, and Investment

Private and social payoffs of many activities depend not only on one's own characteristics, but also on those of one's partners, for example, in schools, firms, and marriages. And these characteristics are often the results of prior choices. The prospect of being able to select particular kinds of neighbors, associates or mates, or the environment those partners provide, affects the costs and benefits of the investment. The impact of those investments may extend far beyond our immediate partners to the economy as a whole.

One question arises naturally is whether the market outcome of the set of "matching" decisions leads to outcomes that are socially desirable. Some have argued that there are excessive segregation and social exclusion in many societies today. If the market does "mismatch" people in this way, policy remedies might include "rematching" individuals into other partnerships via affirmative action, school integration or corporate diversity policies. The rationale behind these rematching attempts is that if the degree of segregation in the labor market affects expected investment returns, then the disadvantaged groups may invest too little and the advantaged group may invest too much. This may generate high persistent inequality in income and investments, which lead to negative consequences for TFP and growth. Therefore, if excessive segregation is due to market failure, rematching individuals could raise total surplus compared to laissez-faire.

This paper constructs a formal framework to study market outcomes of an economy which is characterized by a particular source of market failure: rigidities in sharing joint payoffs within firms (non-transferability) so that only a single vector of payoffs is feasible in any firm: each partner obtains exactly half the output. This is the primary source of excessive segregation in labor or education markets. Mismatch and investment distortions in the laissez-faire allocation may generate a role for rematch policies, that is, policies that constrain some matching patterns by imposing conditions on the partners' attributes.

The paper examines in detail two frequently used policies:

- Affirmative action, which gives precedence to minority candidates only if they are equal in all other characteristics
- Background integration ("busing"), which priority is given to minority candidates unconditional on other characteristics, for instance with an aim to match background composition of teams to the population measures.
- This paper shows that these two policies may improve on the matching resulting laissez-faire and can be ranked in terms of aggregate performance.

- A comparison of these two simple policies suggests that their ranking in terms of inequality in achievement and earnings is a function of the relative proportions of privileged and under-privileged.
 - This argues against a one-size-fits-all approach for correcting mismatches.

This paper shows that

- Rigidities may generate excessive segregation, inequality, and distorted investment incentives.
 - Underprivileged individuals invest less than they would in an otherwise identical economy without rigidities, while privileged ones invest more.
- Rematching policies, in particular affirmative action, change market sorting and thus incentives
 - They can potentially increase surplus and output and lower inequality.

This model can be easily incorporated in other frameworks:

- Multi-stage matching:
 - One can consider matching happens in school as well as later in the labor market. Then should the rematching occur early, late, or both?
 - There can be hybrid policies that condition late matches on early ones to create new sorting incentives that may improve on “pure” policies.
- There are other factors to determine whether one belongs to the privileged or the non-privileged: race, caste, or gender.

Discussion:

- In a school setting, the difference between affirmative action and “busing” is the following: affirmative action is analogous to giving a couple of extra points of GPA to under-privileged group while “busing” is changing the letter grade from “F” to “A” for the under-privileged group.

VIII. Black-White Differences in Intergenerational Economic Mobility in the US

Intergenerational mobility of blacks is of long standing interest given the legacy of slavery and segregation in the United States. This raises the question of how long blacks may expect to remain a disadvantaged minority in the US: in other words, how long will the black-white inequality persist. A further question of interest is whether blacks today

enjoy the same opportunities for economic success as whites, despite differences in family background. Finally, understanding the causes behind racial differences in intergenerational mobility might also shed light on the more general question of the underlying mechanisms behind the relatively high degree of intergenerational persistence of inequality in the US.

Standard estimates of intergenerational mobility are inadequate to examine black-white differences in intergenerational mobility for the following reasons:

- Intergenerational correlation is not well suited for comparing black-white differences in mobility with respect to the entire income distribution (comprising of both blacks and whites). In other words, standard intergenerational mobility analysis does not explicitly incorporate inter-ethnic differences in the mobility process.
 - o Intergenerational correlation for any particular subgroup is only an estimate of the rate of regression to the mean for that particular subgroup, not for the overall distribution.
- Intergenerational samples of black families are relatively small, making it hard to make meaningful inferences about group differences.

This paper tries to overcome the above two limitations by the following:

- This paper proposes a new method to obtain the relevant estimates for measuring group differences in intergenerational mobility:
 - o By estimating transition probabilities, which measure the probabilities of moving across specific quantile intervals of the income distribution over generations, one can therefore compare group difference in mobility with respect to a common distribution.
 - o The inclusion of covariates makes it possible to better understand which factors (e.g. education, family background) are associated with racial difference in mobility

This paper uses transition probabilities and measures of “directional rank mobility” that can identify inter-racial differences in intergenerational mobility. Unlike the transition probabilities which impose arbitrary thresholds for measuring mobility, the directional rank measure uses one’s parent’s rank as a threshold.

The data sets used in the paper include National Longitudinal Survey of Youth (NLSY79), which contains a sample of over 2000 blacks. In addition, an intergenerational dataset that matches families in the Survey of Income and Program

Participation (SIPP) to administrative earnings data from the Social Security Administration (SAA) is also used in the paper:

- The SIPP-SSA data provides many more years of data on parents' earnings that are potentially less prone to measurement error since they are derived from tax records.
- The SIPP contains data on key characteristics of the parents (e.g. wealth, marital history) that are lacking in the NLSY and which could help explain racial differences in intergenerational mobility.

The richness of the data sets provide a more robust set of facts concerning intergenerational mobility differences by race and mechanisms that may account for these differences. Therefore, this paper is able to show how both upward and downward mobility, and racial gaps in these outcomes, are affected by a wide array of covariates concerning characteristics of the parents (e.g. family structure, and wealth) and children (e.g. cognitive skill, non-cognitive skills).

The empirical results of the paper suggest that:

- There is large and significant black-white gap in upward mobility from the bottom
 - o Measuring the difference of likeliness to move upward, blacks are around 25 percentage less likely to move out of the bottom quintile/bottom half of the income/earning distribution.
- Blacks are more downwardly mobile
 - o Blacks are about 15 to 20 percentage points more likely to drop out of the top half of the distribution.
- The implied steady state distributions show that there is no closing of racial gap suggesting that rather than convergence with whites, blacks could be permanently disadvantaged.
- Cognitive skills are highly associated with black-white mobility gaps.
- Education, mainly college attainment, plays an important role in black-white mobility gaps.
- Family structure matters for upward mobility but not downward mobility.
- Low levels of parental wealth among blacks also inhibit the prospects for upward mobility.

Discussion:

Using the method developed in this paper, one may be able to look at the black-white difference of economic mobility over generations.

IX. The Effects of Residential Segregation during Childhood on Life Chances: Causal Evidence Using Historical Railroad Track Configuration

Human capital accumulation may depend on the neighborhood in which one grows up through a variety of channels, including access to school resources, health and social service funding, neighborhood crime, peer and role model effects, proximity to a chemical dumping ground or related environmental hazards, and connectedness to job networks and informal sources of support. Racial residential segregation patterns may provide us a way to understand and explore the causal factors of black-white gap in intergenerational mobility.

However, there are several challenges in estimating neighborhood effects:

- Neighborhood variables may capture unmeasured aspects of family background.
- Residential location patterns may reflect sorting of preferences for neighborhood amenities.
- It is difficult to measure neighborhood quality:
 - o The choice of factors is often driven by available data, which are limited. Hence causally relevant factors are likely to be missing.
 - o This data limitation requires “neighborhood to be defined as large, diverse areas. And this may lead to uninformative estimates.

This paper provides new causal estimates of the effects of racial residential segregation during childhood on subsequent adult attainment outcomes.

- This paper accounts for the potential endogeneity of segregation and neighborhood location choice using instrumental variables based on 19th Century railroad track configurations, historical migration patterns, political factors, and topographical features.
- It has been shown that cities that were subdivided by railroads into a greater number of physically-defined neighborhoods became significantly more segregated after the Great Migration of African-Americans to northern and western cities.

- To measure a city's railroad-induced potential for segregation, this paper uses a railroad division index (RDI) which quantifies the extent to which the city's land is divided into smaller units by railroad.
- The dissimilarity index is the percent of blacks who would need to be reassigned to a different neighborhood for perfect integration to be achieved given the city's overall racial composition.
 - o The RDI is shown to be positively correlated with the dissimilarity index,
 - o It is a measure of racial composition of the neighborhood.

This paper uses data from the Panel Study of Income Dynamics (PSID) which spans four decades and contains information on neighborhood attributes and school quality resources that prevailed at the time these migrant children were growing up. The data set allows one to examine the consequences of segregation during children and analyze the life trajectories of children born since 1950 and followed through 2009.

Results from 2SLS/IV models demonstrate that,

- For blacks, the level of racial residential segregation during childhood negatively impacts subsequent educational attainment, reduces the likelihood of high school graduation, increases the probability of incarceration, reduces adult earnings and the likelihood of intergenerational mobility, increases the annual incidence of poverty in adulthood, and leads to worse health status in adulthood.
- For whites, the segregation effects were not statistically significant across each of these outcomes but the point estimates were in the opposite direction of the corresponding estimates for blacks.
- The results above are consistent with prior studies that have found that increased segregation leads to more inequality in spending on education across districts of the same metropolitan statistical area, thus worsening the relative position of poorer districts.

Discussion:

- It would be worthwhile to think about how the measurement of income is affected by life-cycle bias. In the paper, a child's income is measured when they were at their 30's. It may be useful to measure their incomes when they were at their 40's as income tends to be more stable at this stage of life.

X. Gender, Geography and Generations: Intergenerational Educational Mobility in Post-Reform India

Following wide ranging economic liberalization in the early 1990s, India experienced sustained high economic growth. While growth led to a significant poverty reduction, it was also associated with a rise in inequality.

- For developed countries, intergenerational correlation between parents and children explains from 9 to 21 percent of variations in children's educational outcome.
- Previous studies have found that in developed countries, gender and geographic location (as measured by neighborhood effect) do not exert any significant influence on the intergenerational persistence in children's educational outcomes.
- Are gender and geography also largely irrelevant for educational opportunities faced by children in developing countries?

To conduct the empirical analysis, it is important to note the following:

- The data comes from 1992/93 and 2006 rounds of the National Family Health Survey (NFHS) in India.
- To examine the spatial aspects in depth, the empirical analysis is done separately for families residing in different areas such as rural vs. urban areas and relatively developed vs. less developed states.
- To discern any possible gender bias, empirical analysis is done separately for male and female samples.
- A mixed effects model that uses iterated generalized least squares is used to estimate the sibling correlation
 - An advantage of this approach is that both the family and community level covariates can be included in the analysis to examine their relative influence on sibling correlation
- The paper examines the influence of two sets of covariates on sibling and intergenerational correlations
 - The first set relates to caste and religion of the household which are identified as important determinants of educational attainment in India.
 - The second relates to common neighborhood environment faced by all children growing up in a village/community.

The empirical results using the full sample suggest the following:

- Overall intergenerational correlation and sibling correlation declined between 1993 and 2006.
 - The decline is more substantial for women.
 - But the absolute differences are still higher for women

- Even in 2006, the sibling correlations are relatively high, higher than estimates for Latin American countries.
- The common family and neighborhood factors account for more than 60 percent of variations in schooling attainment
- Caste and religion do not play a significant role.
- Geographic location as measured by neighborhood fixed effects is very important; it explains 40 percent of sibling correlation for women and 33 percent for men.

It has been indicated by previous studies that India exhibits large inter-state differences in growth, poverty and inequality. Taken account for these differences, the paper further finds that

- Both sibling correlation and intergenerational correlation increased for men in less developed states.
- Both sibling correlation and intergenerational correlation remained stable for men in more developed states.
- Both sibling correlation and intergenerational correlation declined for women overall.
- Sibling correlation is slightly smaller for lower caste men and men.
- Sibling correlation among upper and lower caste women declined, while it remained stable for men.
- Women in urban areas experienced substantial decline in sibling correlation.
 - o The decline is especially large for lower caste urban women compared to upper caste urban women.

Discussion:

- The decline in sibling correlation does not necessarily point to lower overall inequality. For example, the poor are more mobile, but they just move within the lowest part of the income distribution. Therefore, it may be useful to see how educational attainment has changed over time conditional on parental income in thinking about how inequality evolves over time.

XI. The Measurement of Educational Inequality: Achievement and Opportunity

In the last decade, the emergence of test-based cognitive achievement surveys that are applied consistently across countries represents a major opportunity for understanding international differences in educational performances and measuring educational inequality. In particular, this paper aims to provide a set of statistically robust

international comparison of inequality in educational achievement and educational opportunity.

This paper mainly uses survey data from the Program of International Student Assessment (PISA) in 2006 which includes participating students' test scores in mathematics, reading, and science, as well as individual-level information such as schools and family backgrounds of participants from 57 countries. This paper also employs several ancillary household survey data sets to correct for the sample selection bias that may emerge from the possibility that the sample in the data is not representative of the population. In particular, this paper carefully addresses the following issues regarding measurements of educational achievement in a number of ways:

- One issue with the raw PISA score is that the test questions vary in their degree of difficulty. Simply adding up correct answers, or weighing them arbitrarily, does not correctly measure the latent variable of interest – cognitive achievement.
 - The educational community in charge of international tests such as PISA, TIMSS, PIRLS and IALS processes raw scores through statistical techniques known as Item Response Theory (IRT).
 - IRT is essentially a statistical technique to account for heterogeneity in the difficulty of test items on the basis of the observed distribution of responses.

- Many common inequality indices are not ordinally invariant in the standardization to which IRT-adjusted test scores are generally subjected.
 - No meaningful inequality index yields a cardinally identical measure for pre- and post-standardization distributions of the same test scores.
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measure the inequality of educational opportunity, which is the R-squared of an OLS regression of the child's test score on a vector of individual circumstances. It is also a parametric approximation to the lower bound on the share of overall inequality in educational achievement that is causally explained by pre-determined circumstances.

This paper provides empirical evidence that

- Inequality of opportunity accounts for up to 35 percent of all disparities in educational achievement.
- It is greater in most of continental Europe and Latin America than in Asia, Scandinavia, and North America.
- It is uncorrelated with average educational achievement and only weakly negatively correlated with per capita gross domestic product.
- It correlates negatively with the share of spending in primary schooling, and positive with tracking in secondary schools.

Discussion:

- It may be worthwhile to study whether performance differential is due to the inequality in opportunity or difference in the level of effort exerted. And these are not easily distinguishable because one's choice of how much effort to put in may depend on the environment he faces and the potential future outcomes.