PAA Submission

Income Inequality, Mobility, and Volatility Among U.S. Families

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Abstract

Most dominant explanations of rising family income inequality in the U.S. highlight differences between groups defined by such characteristics as education and family structure. However, growing inequality within finely-defined groups motivates research on variation across individual life courses. Cross-sectional measures obscure how individuals' situations change from childhood through adulthood. This paper introduces a comprehensive decomposition of income inequality, capturing differences between individuals and across time for each individual. It unites aspects of income dynamics that have generally been studied independently: mobility between generations, mobility within generations, and year-to-year volatility. Using data from the Panel Study of Income Dynamics and the Current Population Survey, this paper studies cohort change in the relative contributions of interpersonal inequality, inter- and intra-generational mobility, and volatility to overall income inequality. Preliminary results suggest that individual income dynamics are non-trivial but interpersonal inequalities are much larger, and their relative contributions have been rather stable across cohorts.

Extended Abstract

Over the past four decades in the U.S., inequality in wages and family income increased substantially (McCall and Percheski 2010, Morris and Western 1999). Evidence of these trends comes from repeated snapshots of the population, which follow demographic groups, but not individual people, over time. Many theories of why inequality rose also focus on differences between demographic groups. For example, changes in the supply and demand for college-educated workers shifted the relative wages of high school and college graduates (Katz and Murphy 1992, Autor, Katz and Kearny 2008). Likewise, changes in the prevalence of single parents and mothers' labor force attachment altered the distribution of incomes across families (Western, Bloome and Percheski 2008).

However, recent inequality trends have also sparked interest in individual income dynamics, not only group-level income differences, for two primary reasons. First, income inequality rose even within relatively finely-defined demographic groups (McCall 2000, Acemoglu 2002). This rise in residual inequality may be partly driven by increasing year-to-year variability in individuals' incomes (Gottschalk and Moffitt 1994, 2009). Understanding the

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contribution of this variability to overall economic inequality is important because it may stem from different sources than more enduring group-based differences (e.g., labor market de-institutionalization, as evidenced by declining unionization and employment stability). It may also have different consequences (e.g., leaving workers more insecure but with higher average welfare).

Second, rising inequality across annual cross-sections may misrepresent inequality trends when considering multiple years of income. Perhaps rewards are increasingly disparate but the individuals receiving these rewards are also changing over time; if so, equality over the life course may remain stable (Shorrocks 1978). Conversely, stable or declining mobility may signal reductions in individuals' opportunities for economic success, since rising inequality makes the size of initial differences more consequential. These concerns have generated interest in longer-term income dynamics, trends not in transitory fluctuations but in income mobility across generations (e.g., Lee and Solon 2009, Bloome and Western 2011) as well as mobility across several years of a career, within a single generation (e.g., Kopczuk, Saez and Song 2010, Bradbury 2011).

Although researchers have recognized the potential relationships between different types of economic variation, the literatures on inequality, inter- and intra-generational mobility, and volatility have developed largely independently of one another. This paper provides a more fully integrated analysis. It simultaneously examines all sources of income variation – including inequality between individuals, mobility between childhood and adulthood, mobility over the working life, and unexpected economic volatility – within a single framework. Unifying these sources of economic variation not only permits assessments of each source's relative importance for overall economic inequality (inequality both across individuals and within individuals' life courses). It also improves inferences about each source of variation, by avoiding the misattribution of trends in one to trends in another. Perhaps most importantly, it provides a theoretical framework for understanding how these different sources of variation may (or may not) shift together, by highlighting their different time scales. Using data from the Panel Study of Income Dynamics (supplemented with Current Population Survey data), this paper examines the relative contributions of interpersonal inequality and within-person income dynamics to overall income variation. It also investigates how these contributions changed across cohorts, focusing on individuals born between 1955 and 1976 whose incomes during childhood and adulthood are captured between the years 1967 and 2008, the most recent period of rising inequality in the U.S.

Theoretical Background

A Life Course Perspective

This paper takes a life course perspective on economic inequality by considering, first, how individuals' economic circumstances unfold across the life span from childhood to middle adulthood, and second, how these age-graded processes may change over time as socioeconomic circumstances shift (Elder 1994 provides a review of the life course perspective). In

this section I focus on the first consideration of change across the life span; I discuss how this intersects with change across historical time in the following section.

As generally conceived, inequality and mobility (be it very short- or very long-term mobility) have different perspectives on time (Hout 2004). Inequality is generally taken to refer to differences across the population at a given point in time; it is a cross-sectional measure. Mobility, in contrast, is longitudinal in nature, capturing differences across time. However, this need not be the case. We can conceive of inequality more broadly, capturing differences not only across individuals but also for each individual across time. When individuals "take turns" at the high and low ends of the distribution, then over the course of a lifetime, incomes might be considered equal although at any given point in time they are quite unequally distributed (Hout 2004). In terms of the broad version of inequality, this situation would entail the variation in the average person's economic positions over time equaling if not exceeding the variation across individuals in their average positions.

Variation in a given individual's income is patterned by age and family life. As a child, parental (or guardian) income determines an individual's economic wellbeing. Over the course of childhood, parental income varies. It may be moderate on average, but over time it may trend up or down, and it may stray from that trend over the years. Similar to childhood income, adult income varies over time, with each year's income departing from the average adult level due to both an age-graded trend and more random fluctuations around the trend. Total variation across the life span stems from differences across generations in average income levels as well as differences both across and within generations in age-graded trends and deviations from these trends. Generational differences are termed "intergenerational mobility." Differences over time within a generation are termed "intragenerational mobility" when they summarize an age-graded trend. They are termed "volatility" when they represent deviations from both the average and the trend, since (statistically, at least), these deviations are unexpected. Each of these sources of intra-personal variation evolves on a different time scale, linked to the aging process. Intergenerational mobility looks at changes over a long time horizon (in terms of an individual life cycle), stretching from childhood to adulthood. Intragenerational mobility measures changes over a shorter period, capturing income trends during a career. Finally, volatility captures the most transient form of longitudinal income variation.

Overall inequality, broadly conceived, captures all three of these income dynamics, as well as inter-personal differences in average incomes. This paper aims to assess the relative contributions of these different forms of economic variation to overall inequality, as well as how these contributions changed across successive cohorts.

Cohort Change

The life course perspective entails not only examining changes over the individual life span, but also understanding how these changes may vary across historical periods. The roles of inter-personal inequality, inter- and intra-generational mobility, and volatility may change

across successive birth cohorts, who encounter different social and economic circumstances as they pass through school and leave their parents' homes to join the labor force and create their own families.

Previous research on trends in mobility and volatility has often been framed in terms of period-specific effects (e.g., Featherman and Hauser 1978, Harding et al. 2005, Dynan et al. 2007, Winship 2009). However, it is well-known that, when conditioning on age, trends are a mixture of period- and cohort-specific effects, which are not separately defined without strong assumptions (e.g., Fienberg and Mason 1985). Certainly much of the rise of income inequality in the U.S. over the last 40 years was due to period-specific shifts that broadly affected individuals across age and cohort groups. Nevertheless, in this analysis I focus on how inequality evolved across cohorts for two reasons. First, the "taking turns" perspective on inequality (broadly defined over people and time) suggests that social and economic shifts impacting inequality in, say, 1990, may differentially shape the later economic outcomes of someone born in 1955, aged 35 in 1990, than someone born in 1975, aged 15 in 1990. Second, because single historical events may shape individuals of different ages in different ways, studying a succession of cohorts provides insight into how economic, social, and political affairs may shape stratification processes in the long-run, as demographic metabolism alters the population composition (Ryder 1965, Mare 1992). Thus, in this analysis I focus on how inequality within birth cohorts evolved across birth cohorts, as one cohort replaces another in different age-graded social and economic positions. However, I also hope to leverage period-specific information to combine cohort-specific estimates appropriately and generate predictions about period-specific trends.

Data, Measures, and Methods

The Panel Study of Income Dynamics (PSID) provides the primary data used in this paper. The PSID is the longest-running U.S. study providing income data on a national sample of individuals and families. Beginning in 1968 with approximately 5,000 families, surveys continued annually until 1997, biannually thereafter. I analyze incomes over the period 1967-2008, the most recent year of income data available. The survey followed children from interviewed families, permitting comparisons between family incomes in childhood and adulthood. Unlike previous studies of intergenerational mobility, which characterize childhood and adulthood each with a single number, summarizing "permanent" income for the life stage, in this study I use the variation within the individual time series as well as the variation across individuals.

In this draft, I focus on five years during childhood and five during adulthood, ages 13-17 and 30-34, to ensure that any cohort differences observed are not driven by differences in the ages at which income is observed (or the number of years of observation). However, in the future I hope to explore longer time series (from age 0 to 17 in childhood and age 25-55 in adulthood). I focus on individuals born between 1955 and 1976. These cohorts were chosen to ensure that at least two years of income data were available during childhood and adulthood. To aid estimation and smooth the trends, I study 5-year rolling cohorts. In

this draft I examine total family income, which includes income from labor earnings, assets, and transfers accruing to the family head, spouse, and other co-residential family members. Studying family income has theoretical benefits, such as capturing only the income volatility that has not been smoothed within families and providing more a comprehensive measure of childhood economic resources, which is especially important for cohort comparisons over a period of changing maternal employment and assortative mating patterns (Beller 2009). However, in future drafts I hope to examine different income components, since the aggregated family income measure may hide changes in the variance of any given component or the covariances of different components. I adjust for inflation by setting dollars to their 2008 purchasing power using the CPI-U-RS, and I account for changing topcoding across years by imputing the top two percent of incomes by year from a Pareto distribution as in West (1985), though I will explore the sensitivity of my results to this choice in future work.

I also examine data from the March Current Population Survey (CPS). I treat total family income the the CPS just as I do in the PSID in terms of inflation adjustment and topcoding, and I focus on the same birth cohorts, 1955-1976, at the same adult ages, 30-34. I draw the data from the 1986-2011 waves of data collection. Each nationally representative sample contains information on about 50,000 U.S. households. Unlike the PSID, the CPS data do not follow individuals over long periods of time. Currently, I only use the CPS to supplement the PSID, as the large CPS samples provides more accurate information on variances by cohort, aiding estimation. However, in the future I hope to use repeated cross-sections from the CPS to aid identification of period-specific trends, as distinct from the cohort-specific trends I emphasize in the PSID analysis.

I introduce a conceptually novel (though mathematically standard) decomposition of overall economic variation into components due to inequality between individuals, mobility between childhood and adulthood, mobility within adulthood, and unanticipated volatility over the life course. The proposed model uses information on economic trajectories aggregated over many individuals' lives to partition overall economic variability into components representing different types of inequality, mobility, and volatility. Though some fairly complex models have been proposed to distinguish economic volatility in particular, relying on long autocovariances and strong parametric and functional form assumptions, results from these models and more standard models appear quite similar (Moffitt and Gottschalk 2012). Consequently, for clarity of exposition I introduce a decomposition following textbook ANOVA principles.

Let Y_{ict}^{g} denote the log family income of individual i from birth cohort c in year t (where t runs from 1 to T, the total number of years of income observed in the generation; here, $T = 5$) and life stage g (such that Y_{ict}^{p} and Y_{ict}^{a} are disjoint sets covering income during the periods of childhood and adulthood, respectively). Now let $\bar{Y_{ic.}^{g}}$ be the average of this income for individual i from cohort c in life stage g over the T years. We can then decompose the total variance of adult income, Y_{ict}^{a}, into components due to the individual averages and the deviations from these individual averages,

$$Var(Y_{ict}^{a}) = Var(\bar{Y_{ic.}^{a}}) + Var(Y_{ict}^{a} - \bar{Y_{ic.}^{a}}) = Var(\bar{Y_{ic.}^{a}}) + Var(\tilde{Y_{ict}^{a}}).^{1}$$

[1]The connection between this decomposition and the standard decomposition $Var(Y) = Var(E(Y|X)) +$

We can then parameterize each of these components. Let the average incomes be a function of parental income, as in standard intergenerational mobility models,

$$\bar{Y^a_{ic.}} = \rho_c \bar{Y^p_{ic.}} + \epsilon^a_{ic},$$

and let the deviations from this average be a function of an intragenerational time-trend (capturing mobility over the adult working life) called l as well as income deviations within the parental generation, such that

$$\tilde{Y^a_{ict}} = \beta_c l + \rho_{2,c}(Y^p_{ict} - \bar{Y^p_{ic.}}) + \delta_{ic} + \nu^a_{ict}.$$

For each cohort, we can then divide the total variance in adult incomes Y^a_{ict} into our substantive components of interest. Interpersonal inequality is captured by the sum $Var(\epsilon)+Var(\delta)$ (though in practice only the first term is important, as individuals vary much more substantially in their average residuals). Intergenerational mobility is captured by the variance of the predicted values from the equation for $\bar{Y^a_{ic.}}$ plus the portion of the variance of the predicted values from the $\tilde{Y^a_{ict}}$ equation attributed to parental deviations. Intragenerational mobility is captured by the portion of the variance of the predicted values from the $\tilde{Y^a_{ict}}$ equation driven by the time trend (I use a linear trend here, which fits the profile for the ages under consideration as well as a quadratic, though other specifications are possible). Finally, intragenerational income volatility is captured by the variance of the residuals from the $\tilde{Y^a_{ict}}$ equation, $Var(\nu)$. In future drafts I will explore additional specifications, but for now changes in the contribution of interpersonal inequality and intragenerational volatility are unconstrained across cohorts (beyond the simple constraint that all contributions sum to 1), while changes in the contribution of intragenerational mobility will be driven by changes in the β_c's, and changes in the contribution of intergenerational mobility derive not only from changes in the ρ_c's but also changes in the variance of parental incomes.

Preliminary Results

TO BE COMPLETED

Figure 1 shows that among adults age 30-34, the variance in log family incomes was about 35% higher among individuals born in 1976, who were age 30 in 2006, than among those born in 1955, who were age 30 in 1985. More recent birth cohorts experienced substantially more inequality in middle adulthood than members of older cohorts did at the same ages. How much of this inequality is interpersonal instead of within-person across time, and have the relative contributions changed across cohorts?

Table 1 provides descriptive statistics on individuals' log family incomes during childhood and adulthood, averaging over all cohorts. As expected, family incomes were much more unequal during adulthood than during childhood. Inequality rose both in average incomes

$E(Var(Y|X))$ is obvious in the first term, which is the variance of the group-specific averages. The second term of the standard decomposition is the average of the group-specific variances, which equals the variance of the individual deviations from their group-specific means.

as well as individual deviations from these averages. The increases were proportional, meaning that though inequality in both components grew, their relative shares of total inequality remained stable between individuals' childhoods and their adulthoods. About 78% of the variance stems from inequality in average incomes while only 22% derives from inequality in income deviations. While this evidence is suggestive, it does not answer our questions of interest. We must disaggregate these numbers in two ways. First, we must account for different type of mobility; for example, the variance in average adult incomes reflects not only interpersonal inequality but also intergenerational mobility. Second, we must examine the variation across cohorts.

Figures 2 to 4 provide some information on cohort changes in inter- and intra-generational mobility. They all plot cohort-specific coefficients along with pointwise 95% confidence intervals. Figure 2 plots what is generally termed the "intergenerational income elasticity," the coefficient predicting an individual's average adult income from his parents' average income when he was a child. Consistent with previous studies, it fluctuates between about .43 and .60 but without a strong or consistent trend across cohorts (e.g., Hertz 2007). Figure 3 plots the intergenerational elasticities linking not individuals' average incomes in childhood and adulthood but their income deviations. While average parental incomes are quite predictive of average adult incomes, the same is not true for deviations. There is virtually no intergenerational persistence in these deviations; though the size of the coefficient ranges between about -.07 and .06 across cohorts, these point estimates are never statistically distinguishable from zero. In sum, Figures 2 and 3 suggest that if the role of intergenerational mobility in overall inequality shifted over time, the shifts would be driven by changes in the variance of average parental incomes, not in the coefficients relating incomes across generations or in parental income deviations (given that there is little link between these deviations and adult incomes). Figure 4 plots the coefficients summarizing how income grows over time during adulthood. On average, income increases about 3% each year between ages 30 and 34. Though the magnitude of this intragenerational mobility is not large, it is statistically distinguishable from zero. It does not, however, differ significantly across cohorts.

Figure 5 illustrates that, as the proceeding evidence suggests, the relative contributions of interpersonal inequality, inter- and intra-generational mobility, and intra-generational volatility to overall inequality did not shift substantially across cohorts. Interpersonal inequality plays the largest role, at about 64% of overall inequality. The remaining 36% is divided mainly between intergenerational mobility and intragenerational volatility; income growth along a linear trend in the adult generation accounts for very little of overall variability. Figure 5 provides some suggestive evidence that the role of volatility was rising at the expense, mostly, of intergenerational mobility between the 1955 and 1965 cohorts, while between the 1965 and 1976 cohorts interpersonal inequality become more prominent. However, these estimates are fairly noisy and thus we cannot confidently claim that these shifts reflect true population processes. It appears that as inequality rose across cohorts, the relative contributions of interpersonal inequality and different forms of income dynamics remained relatively stable, with the magnitude of overall inequality driven largely by interpersonal differences that are relatively stable over time. "Taking turns" did not appear to reduce lifetime inequality as cross-sectional inequality rose across cohorts in the U.S.

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Figure (1) Growth in variance of log family income, adults aged 30-34. Birth cohorts 1955-1976. CPS data, survey years 1986-2011.

Table (1) Descriptive statistics for parents' and children's log family incomes (2008 dollars). PSID data, birth cohorts 1955-1976.

	Averages		Deviations		Variance Decomposition		
	Mean	SD	Mean	SD	Total	% Between	% Within
Adulthood, Ages 30-34	10.980	.736	.000	.385	.690	78.483	21.517
Childhood, Ages 13-17	11.062	.603	.001	.316	.463	78.476	21.524
N	3,534		13,529			13,529	

Figure (2)

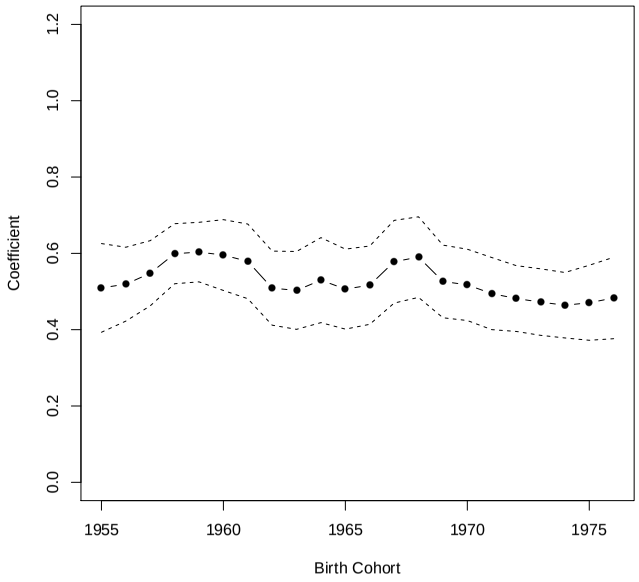
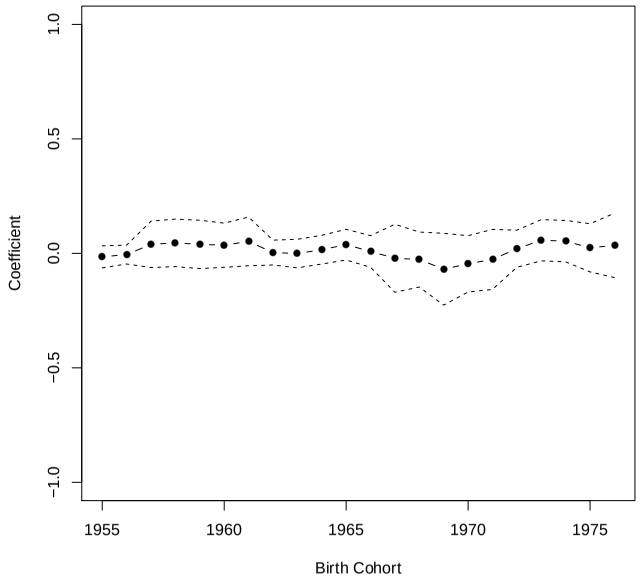


Figure (3)



Intergenerational family income mobility across birth cohorts, **(2)** average income coefficients and **(3)** income deviation coefficients. Solid line point estimates with dashed line 95 percent confidence intervals. PSID data, birth cohorts 1955-1976.

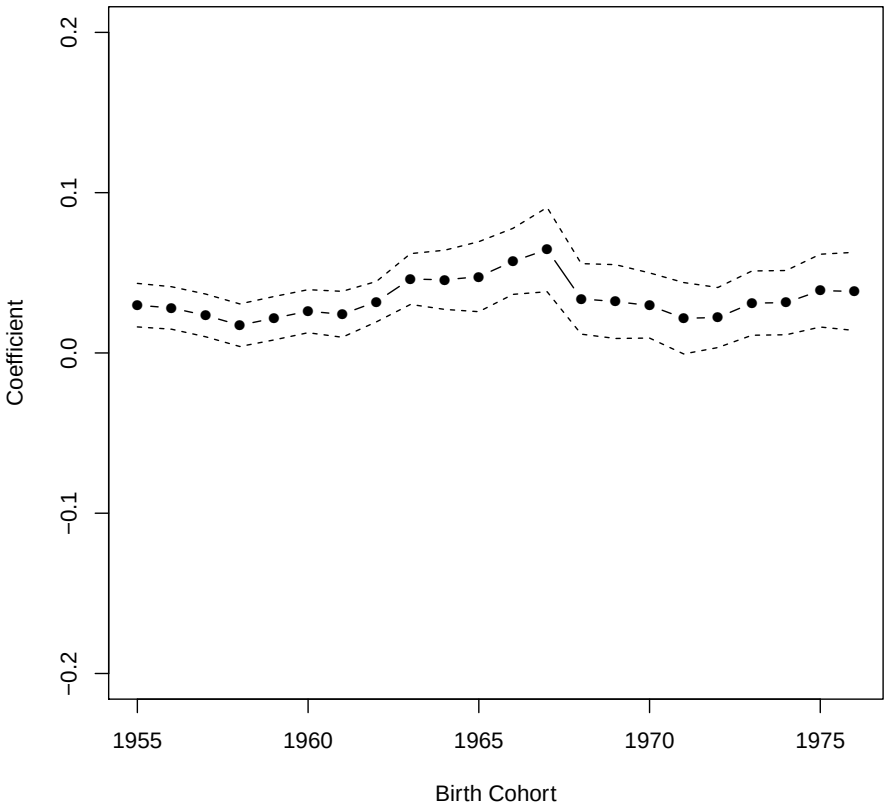


Figure (4) Intragenerational family income mobility across birth cohorts. Solid line point estimates with dashed line 95 percent confidence intervals. PSID data, birth cohorts 1955-1976.

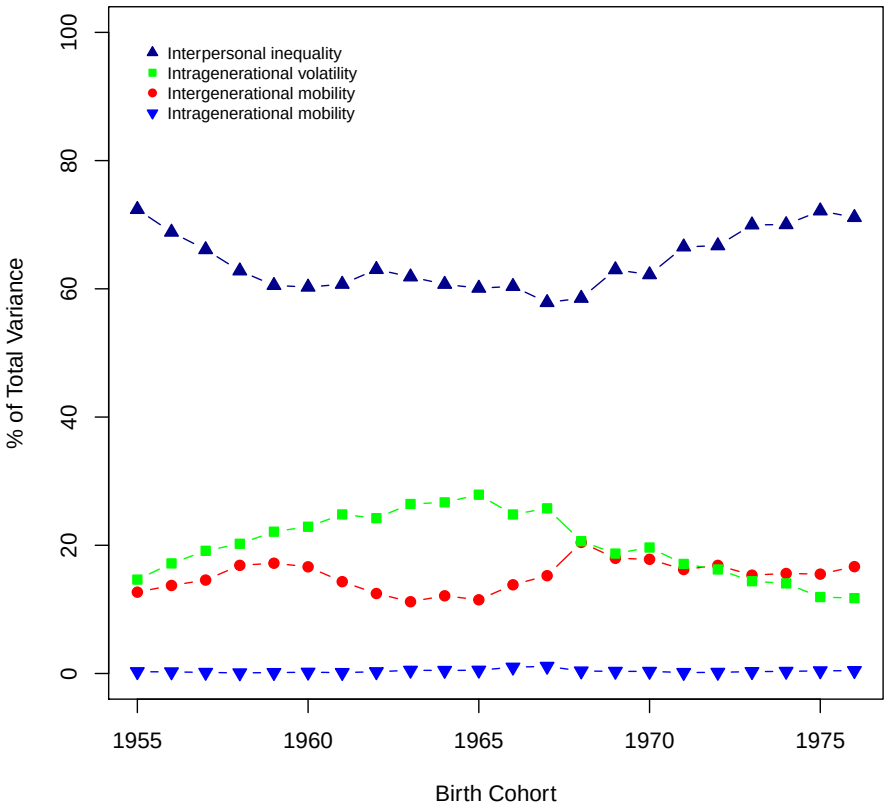


Figure (5) Percent of total family income variance attributed to interpersonal inequality, intergenerational mobility, intragenerational mobility, and intragenerational volatility. PSID data, birth cohorts 1955-1976.