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Childhood Income Volatility and Adult Outcomes

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Abstract: Using data linked across generations in the Panel Study of Income Dynamics, I estimate the relationship between exposure to volatile income during childhood and a set of socioeconomic outcomes in adulthood. The empirical framework is an augmented intergenerational income mobility model that includes controls for income volatility. I measure income volatility at the family level in two ways. First, instability as measured by squared deviations around a family-specific mean, and then as percent changes of 25 percent or more. Volatility enters the model both separately and interacted with income level. I find that family income instability during childhood has a small, positive association with high school dropout– one which appears driven by volatility among children from lower income households. Evidence suggests that volatility exposure generally has a minimal impact on intergenerational outcomes relative to permanent income.

I. Introduction

Income volatility in the United States has been on the rise since the 1970's, increasing by at least one-third (Gottschalk and Moffitt 1994; Haider 2001; Keys 2008; Dynan et al. 2008; Ziliak et al. 2011). Driven largely by earnings, it exhibits cyclical behavior (Dahl, DeLeire, and Schwabish 2011) and is attributed to both short-term economic shocks and permanent structural change throughout the economy (Gottschalk and Moffitt 2009). Several studies focus on specific examples of volatility, finding that health shocks, workplace injury, divorce, plant closings, and job loss can have long term effects on adults (Currie et al. 2010; Woock 2009; Eliason and Storrie 2007; Charles and Stephens 2002; Huff Stevens 1997). For children, it is unclear whether membership in families with volatile incomes has any long term effect. While the literature does confirm that growing up in poverty is associated with lower education, earnings, and cognitive ability (Duncan and Brooks-Gunn 2000; Duncan et al. 2008; Dahl and Lochner 2005), we do not know if growing up in households with unstable incomes per se warrants concern.

Research examining the long term effects of volatility is lacking. Most volatility research has, up to this point, focused on trends, statistical measurement, and the implications such measures have when interpreting changes in income inequality in the United States (Burkhauser and Couch 2009). Although the literature relating income to long term outcomes and mobility mainly focuses on measured levels, not volatility, these studies help explain income's socioeconomic correlates. Studies identify a connection between early childhood poverty, and lowered education, earnings and receipt of public assistance as an adult (Magnuson and Votruba-Drzal 2009; Duncan, Telle, Ziol-Guest, and Kalil 2011; Duncan, Kalil, and Ziol-Guest 2008; Duncan, Brooks-Gunn, and Klebanov 1994). One channel enabling such relationships across generations may be human capital (Becker and Tomes 1979; Haveman et al. 2010; Lillard and Willis 1994; Blau 1999; Ludwig and Miller 2007). This paper draws motivation from a model of mobility where parental income determines human capital for children in the household, which then largely determines the children's adult earnings, income, and well-being (Becker and Tomes 1979). Work on early human capital formation describes how initial skills are necessary to acquire additional skills in the future (Cunha, Heckman, Lochner, and Masterov 2005), and modest, positive associations exist between income and educational attainment (Duncan et al. 2008), and performance on math and reading assessments (Dahl and Lochner 2005). Such skill deficits may drive findings in studies estimating intergenerational relationships.

In this paper I examine the long-term consequences of income volatility during childhood on subsequent adult outcomes. There has been extensive evidence on intergenerational economic mobility in earnings, income, education, and wealth (Becker and Tomes 1979; Mazumder 2005; Solon 1992; Zimmerman 1992; Meghir and Palme 2005; Black et al. 2005; Charles and Hurst 2003). The mobility model adopted here augments the standard intergenerational income elasticity (IGE) model to include income volatility. One mechanism that gives rise to the intergenerational transmission of volatility in the standard Becker and Tomes (1979) framework is imperfect capital markets (Loury 1981; Mazumder 2005). In this context imperfect capital markets imply that income shocks can persist. By accounting for the long term effect of shocks to income during childhood, this paper addresses a missing component in the literature on the transmission of mobility.

To empirically implement the model I link families in the Panel Study of Income Dynamics (PSID) across generations. Income volatility during childhood is defined as the volatility of family income from labor market earnings, total taxable non-labor income, and government transfers between ages 0 and 16. For each person, volatility is calculated in two ways. First, by decomposing total volatility into its permanent and transitory components (Gottschalk and Moffitt 1994; 2009). A second measure estimates volatility as the number of between-year income shifts of 25 percent or more (Dahl et al. 2011). Volatility enters the model both separately and interacted with income level.

The adult outcomes I examine include income level and educational attainment for children growing up in households with higher income volatility. Adult income is measured at age 25 and beyond, and educational attainment is measured both by whether the child completes high school and whether they attain post high school education. To capture the experiences of adults near the age thresholds of 25 and 30, linear dependent variable models examine outcomes at age groups 24-26 and 29-31. The OLS classical errors-in-variables assumption is violated in the income IGE models, as families with higher lifetime mean income typically experience relatively higher rates of income growth over the lifecycle. This leads to intergenerational estimates that are too low if second generation income is recorded while primary earners are in early adulthood and too high as workers approach older age. To address this, the income IGE models account for lifecycle earnings growth and adopt specifications found to minimize left-side measurement error in second generation incomes (Haider and Solon 2006; Lee and Solon 2007).

I find that on average higher income volatility exposure during childhood is associated with lower educational attainment, though the magnitude of this association is small. The sample families predominantly experience positive income change between years, and I control for lifecycle growth in family incomes to address this concern.

II. Background

Intergenerational transmission and mobility

While relatively little work exists on the intergenerational aspects of volatility, the inheritability of economic status is well documented in the literature on intergenerational transmission (Solon 1992; Zimmermann 1992; Charles and Hurst 2003; Altonji and Dunn 2000). In these models, IGE's are summary measures of the relationship between income, earnings, or wealth across generations and, by design, known causal factors are omitted in the regressions. An IGE of 1 denotes no mobility across generations and a value of 0 denotes perfect mobility. Becker and Tomes (1986) find an intergenerational elasticity of 0.2 for the United States using single year measures of fathers' income and earnings, providing initial evidence of a highly mobile society. Recent work estimating IGE's has generally overturned this finding by accounting for lifecycle effects and measurement error using longer measures of permanent earnings or incomes, with IGE estimates ranging between 0.4 and 0.6 (Solon 1992; Zimmerman 1992; Mazumder 2005; Gouskova et al. 2010a).

Shore (2012) presents evidence that volatility is passed across generations. He models the intergenerational transmission of risk, using income volatility as a proxy for riskiness. Prior to Shore (2012) income shocks have typically been described as a measurement problem to overcome in explaining permanent income (Duncan 1988; Blau 1999) or assumed to be mean zero over time (Becker and Tomes 1979). Thus the introduction of volatility as an explanatory variable in mobility models is rare up to this point. The volatility literature has documented trends in instability, or volatility, over the past 40 years with a focus on the United States. Gottschalk and Moffitt's (1994) work in the area established the method of applying permanent income decompositions to volatility studies. In their seminal piece, they introduce permanent and transitory earnings volatility as underlying explanations for observed wage gaps of the 1970's and 1980's. They find that transitory volatility explains between one-third and one-half of the increase in overall earnings variability over this time period, underscoring the importance of accounting for economic risk in the discourse on rising income and earnings inequality. Many recent analyses documenting historical trends conclude that income and earnings volatility rose over the past 30 to 40 years (Dynan, Elmendorf, Sichel 2008; Ziliak et al. 2011). This increasing trend occurs across race and education groups since the 1970's, though groups with fewer skills and lower earnings exhibit higher levels (Gottschalk and Moffitt 1994; Keys 2008; Ziliak et al. 2011). If family income volatility during childhood has an intergenerational effect, the adult outcomes of children from the

1970's and 1980's, who faced relatively high volatility during childhood, would reflect this (Gottschalk and Moffitt 2009).

Instability

Like intergenerational elasticities, volatility is a summary measure. It captures events that add and take away income. Parents may maximize utility to the benefit of their children, but downward economic instability may threaten this effort. A variety of event studies have documented specific examples of volatility or instability. This work attempts to explain the role of job loss and income shocks in predicting earnings (Oreopolous, Page, and Huff Stevens 2005), health (Ruhm 2003; Eliason and Storrie 2007), marriage, and divorce (Mayer 1997; Eliason 2004; Charles and Stephens 2002; Conger et al. 1990; Nunley and Seals 2010; Hankins and Hoekstra 2010). The conclusions from these studies are mixed, due in part to methodological differences in modeling exogenous relationships (Mayer 1997).

When considering how volatility and labor market instability are related, the differences between permanent and transitory income volatility should be highlighted. Family income y_{it} can be decomposed into a permanent component μ_i and a transitory component v_{it}:

(1) $$y_{it} = \mu_i + v_{it}.$$

Like total income or earnings, total volatility can be decomposed into its permanent and transitory components (Gottschalk and Moffitt 1994):

(2) $$lny_{it} = \alpha_t\mu_i + \varphi_t v_{it},$$

where μ_i is permanent income, v_{it} is transitory income, and α_t and φ_t are time-varying factor loadings on the permanent and transitory components. Assuming the factor loadings are equal to 1 in all periods, and that the permanent and transitory components are independent, then the variance of log income in (2) is

(3) $$Var(lny_{it}) = \sigma_\mu^2 + \sigma_v^2.$$

This decomposition in (3) prevails in discussions of how the cross-sectional distribution of earnings and income has been affected by permanent and transitory volatility in recent decades (Ziliak et al. 2011). Transitory volatility, characterized by deviations from some individual-specific mean, might approximate risk due to temporary increases in economic hardship, but could equally result from voluntary or positive events including bonus or incentive pay (Dynan et al. 2008). A leading explanation for permanent volatility is skill biased technological change (Autor, Kearney, and Katz 2008), whereby structural changes in the functioning of the economy put a higher premium on skilled labor, with this premium being reflected by greater income and earnings inequality throughout society (Gottschalk and Moffitt 2009). Other studies attempt to combine both transitory and permanent volatility components via estimates of total volatility. For example, Ziliak et al. (2011), Dahl, DeLeire, and Schwabish (2011), and Dynan et al. (2008) measure total volatility with the percent change or close transformations, such as the standard deviation of income percent changes. In this paper, I use both transitory and total measures of volatility.

Facing income volatility from a variety of underlying sources, investment in children's human capital may change and preferences between current period consumption and future investment may also change (Attanasio and Meyer 2010). If volatility causes parents to reduce human capital investment, it can harm children. However, it is equally possible that volatility reflects income growth and intra-generational mobility, so that the variation of income within a family represents a wider set of investment possibilities for children.

III. A Model of Mobility with Volatility

The basic framework of the intergenerational mobility model is a log-linear regression of adult offspring income on the income level of the working-age parent(s):

(4) $$y_{it}^{child} = \alpha + \beta y_{i,t-1}^{parent} + \varepsilon,$$

where y_{it}^{child} represents adult offspring income in period *t* and $y_{i,t-1}^{parent}$ is the income of the working-age parent(s) in period *t-1*. Thus, β denotes the intergenerational income elasticity and is a summary measure of the relationship between incomes across generations, measured with mean zero error ε (Solon 1992; Zimmerman 1992). Causal parameters are not directly recovered in this framework, but the theory of human capital investment and mobility, described below, underscores the potential influence of parental income and investment in offspring human capital towards determining β (Becker and Tomes 1979; Solon 1999, 2004). The resulting empirical studies provide a straightforward description of the degree to which American families move up or down the continuum of economic status over time.

The theory of intergenerational mobility assumes that income volatility has no role in predicting income mobility. This is supported largely by the permanent income hypothesis, which predicts households borrow against negative income shocks by accessing perfectly functioning capital markets while saving positive income shocks. There are, however, reasons to expect that volatility does transmit across generations. Constant relative risk aversion utility models of family consumption and saving accounting for prudence (i.e. precautionary savings) by decision makers underscore the role of income variances in determining optimal choices. In these models, rising variability of income affects consumption, human capital investment, and utility (Attanasio and Weber 2010). Thus, previous intergenerational models relying on the permanent income hypothesis to justify omitting higher income moments exclude an important component of the family's utility maximization process in which parents provide resources for their children. Statistically, transitory shocks persist over several years (Hyslop 2001), and both permanent and transitory shocks contribute substantially to measured inequality (Gottschalk and Moffitt 1994). As mentioned previously, the timing of these shocks, possibly during early human capital formation, means that some children will be exposed to shocks at stages of child development where the acquisition of basic skills occurs (Cuhna et al. 2005). These skills allow for the acquisition of more complex skills later in childhood and into adulthood, which may largely determine labor market income and earnings.

Imperfections in capital markets (Loury 1981; Becker and Tomes 1986; Mazumder 2005) may constrain access to loanable funds and constitute a final reason motivating the inclusion of transitory income shocks in an intergenerational model. Imperfections of several kinds arise in this market, as future ability or income of the child investment is noisy to predict, but necessary to justify investment. If collateralized through a child borrower, a loan for human capital investment amounts to indentured servitude and cannot legally or realistically occur (Becker and Tomes 1986; Kane and Ellwood 2000). Recent educational attainment models have acknowledged this imperfection. In a study examining Black-White test score gaps, Rothstein and Wozny (2011) describe the human capital investment decisions of parents as a function of permanent income and recognize the impact that credit constraints or uncertainty would have on parental human capital investment decisions.

I adapt the theoretical model of mobility so that shocks from volatility eventually enter and influence the family's utility maximization problem. The optimizing decisions of parents with respect to their own consumption and human capital investment into offspring represent structural parameters underlying the reduced-form empirical mobility model specification as described in (4). These parameters include a decomposed definition of family income that recognizes the role of income fluctuations in determining adult outcomes.

Thus, the reduced-form intergenerational mobility model in equation (4) is augmented to include income volatility, $\mathrm{V}_{\mathrm{i,t-1}}^{\mathrm{parent}}$:

(5) $$\mathrm{y}_{\mathrm{it}}^{\mathrm{child}} = \alpha + \beta \mathrm{y}_{\mathrm{i,t-1}}^{\mathrm{parent}} + \gamma \mathrm{V}_{\mathrm{i,t-1}}^{\mathrm{parent}} + \varepsilon.$$

Moving forward, equation (5) is the basic augmented intergenerational elasticity model estimated throughout the paper. The addition of income volatility to the intergenerational mobility model shows that volatility may have an intergenerational relationship to income and well-being. Thus, γ is assumed to be non-zero. Through the mechanism of human capital investment, volatility is theoretically associated with higher overall volatility of human capital investment, which supports the inclusion of higher income moments empirically.

Estimating the intergenerational role of transitory income volatility amounts to testing, indirectly, how volatile or unstable incomes correlate with human capital investment, and the subsequent relationship to observable adult outcomes. As stated in Becker and Tomes (1979), substituting measures of offspring quality or welfare for adult income in the utility function yields similar theoretical results for income distributions and inequality. This lends support to the inclusion of education outcomes in the analysis – lifetime quality measures which, along with income, parents plausibly seek to maximize in their children (Haveman et al. 2010).

IV. Empirical Model: Testing the Association between Volatility and Adult Outcomes

In my empirical model, holding the level of family income during childhood constant, I estimate the relationship between family income volatility during childhood V_i and a set of adult outcomes O_{iy}. For each adult individual *i*, I estimate regressions to determine if shocks are transmitted across generations:

(6) $O_{iy} = \alpha + \beta\overline{I_{0-16_i}} + \gamma V_{0-16_i} + \mathbf{X}\delta + \varepsilon_i.$

When outcome O_{iy} is adult offspring income, equation (6) yields the income IGE for offspring aged 25 and older. It is the canonical intergenerational elasticity model (Solon 1992; Lee and Solon 2007; Grawe 2006; Mazumder 2005; Gouskova, Chiteji, and

Stafford 2010a) estimated via OLS with controls for income volatility during childhood years 0-16. Non-income outcomes O_{iy} for high school dropout and post high school educational attainment are tested in (6) using an OLS binary linear probability model.[1] During childhood years 0-16, mean family income $\overline{I_{0-16}}_i$ is an approximation for permanent income. Family income is defined as the income, earnings, and transfers received in person i's household. To account for potential non linearities in mean income and income volatility, I use a logarithmic transformation of family income. Non-income outcomes are estimated over two age groups *y*: 24-26 and 29-31. These groups are selected to approximate smoothed results for 25 and 30 year old adults.

The separability of income and volatility is tested via interactions of the two variables. A vector of demographic **X**'s includes age A_i and race of parent, gender of offspring, education of parents, and the number of offspring. Education is a 0/1 variable equal to one if either parent attends college for four or more years. Age of the household head, A_i, most often the father, is averaged over the observed childhood years of the offspring. Properly accounting for life-cycle earnings profiles is important, as both earnings and income are known to follow a concave growth profile over prime age working years (Weiss 1986). In the volatility literature, life-cycle effects are often accounted for by replacing income with residuals from a regression of income on an age quartic (Gundersen and Ziliak 2008). For intergenerational studies, such effects are modeled with an age quartic within the set of explanatory variables. For estimates of transitory volatility, I combine both approaches, using an age quartic of household head's

[1] In results not shown, I use an alternative specification substituting parental education for permanent family income during childhood. The results are robust to this alternative specification.

average age A_i in the set of demographic variables while estimating volatility using residuals purging lifecycle effects. For percent change volatility, I elect to follow the intergenerational literature and rely on the age quartic controls to pick up lifecycle effects. Income IGE models also include an age quartic for offspring age interacted with mean family income during childhood. Intergenerational estimates are tabulated when all child volatility years V_i are available, requiring at least one observation across three defined child volatility developmental stages: ages 0-5, 6-10, and 11-16.

The estimation of intergenerational models, where the same individuals are followed over time, produces positive autocorrelation of the individual specific error terms over the panel. At the same time, the errors likely have unequal variances, violating the OLS assumption of identical, independently distributed errors. This implies the OLS standard errors are no longer consistent. To address this, the estimates are corrected for heteroscedasticity using Huber-White corrected standard errors, and they are clustered on a unique identifier for each child observation to account for autocorrelation.

V. Measurement and Data

The PSID is a longitudinal survey that began in 1968 and has continued to be administered at the University of Michigan. It consists of two independent samples, the Survey Research Center (SRC) sample and the Survey of Economic Opportunity (SEO) sample. Due to challenges in the SEO survey design, this paper uses the SRC sample of the PSID (Shin and Solon 2009). The PSID collects detailed economic, social, and demographic information on 1968 participant families and their descendents. Over time, offspring of the families are followed as they age and begin their own families. The PSID spans multiple generations between 1968 and 2007. It started with 4,800 families and is estimated to have reached over 7,000 families by 2001. As of 2003, the PSID collected information on over 65,000 individuals spanning as much as 36 years (Institute for Social Research 2006). Major changes in the collection of the PSID throughout the 1990's include a switch to biennial interviews in 1997 and a doubling in the length of interviews between 1995 and 1999 (Gouskova, Andreski, and Schoeni 2010b).

To construct the intergenerational sample, I use the Family Identification and Mapping System from the PSID, which links parents and offspring. Unique individual identifiers and yearly family interview numbers, along with demographic variables for age and marital status, indicate when offspring leave their childhood family units. The main income measure, family money income, can be tracked for offspring over the lifecycle. Individuals are observed as dependent children within families, though most of the information collected applies to adults. As subjects enter adulthood they participate in the PSID survey. The resulting panel is unbalanced since, depending on the age of the subject, there are a range of data on adult income and earnings.

The data file I construct is a sample of 2,186 unique offspring. The final file size ranges between approximately 1,400 unique adult offspring observations for 24-26 year olds and under 1,000 adult offspring observations for 29-31 year olds. This depends on cell sizes for dependent and independent variables. Sample sizes for each intergenerational outcome are reported in the regression tables.

Family money income, the main income measure used, is a summary measure of earnings and income for all members of the family. As described earlier, it is the summation of total taxable income, non-taxable transfer income, and social security income for the head (husband), wife, and other members of the family. Families, as defined by the PSID, include cohabitating adults and single individuals living alone in a distinct household. When the mother and father are both present, fathers are automatically assigned head status. The PSID assigns a family income value for all persons in a family based on the family interview number. As such, I have family income for mothers, fathers, heads of household, and offspring. Topcoding rules for family income change throughout the survey. Before 1979, the topcode value of income was $99,999, by 1980 it is $999,999, and in 1981 it increases to $9,999,999. During 1968-1993, family income was bottom coded at $1, but after 1994 the definition allows for negative family income of -$999,999 from business or farm losses. As with previous work on income volatility and dynamics, I address changes in the collection of PSID income and earnings data by imposing a consistent topcoding and bottomcoding strategy. The top 1 percent of family income (Shin and Solon 2009) is excluded, and I assign a value of $1 to family incomes of zero and below (Dynan et al. 2008).

For income elasticity models in (6) the offspring's age equals year minus birth year minus 40, *y-b-40*. It is then normalized so that offspring age equals zero at age 40. This has the useful feature of simplifying the interpretation of intergenerational elasticities at age 40, where several recent studies recommend evaluating the IGE to minimize bias in estimates of permanent income (Haider and Solon 2006; Lee and Solon 2007).

VI. Summary Statistics and Volatility Trends

Table 1 provides summary statistics for the intergenerational data sample. Average parental family income (in 2006 dollars) is approximately $67,000. Summary statistics for volatility, education, gender, age, and race are also included in Table 1. Upon comparing my sample volatility statistics to those of from other studies, I observe a 24 to 30 percent rise in income volatility between 1972 and 2007 and a 12 to 17 percent rise throughout the 1970s and 1980s (Figure 1). This is similar to the nearly 36 percent household income volatility increase in Dynan et al. (2008) and 15 percent increase in earnings volatility between the 1970s and 1980s in Ziliak et al. (2011).[2] The trend increase for offspring volatility (Figure 1, panel 1) is lower than that for heads (Figure 1, panel 2), though the level of volatility is the highest. Mean sample volatility is 0.409.

[Table 1] [Figure 1]

VII. Results

The regression results are reported in tables 2-10. Baseline results for volatility are shown along with interaction models allowing for the estimation of the average treatment effect of volatility on outcomes O_i (Wooldridge 2002). The interactions test

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[2] The volatility definition used for comparative purposes, the standard deviation of the arc percent change, $\sqrt{Var\left\{100 * \frac{y_{it}-y_{it-1}}{\bar{y}_i}\right\}}$, is the same or similar to total volatility definitions in Ziliak et al. (2011), Dahl et al. (2011), and Dynan et. al. (2008).

the separability of demeaned average log family income and volatility during childhood, but primarily are meant to transform γ, shown in equation (5), into the average treatment effect at the mean level of permanent family income within the population. The 24-26 and 29-31 age groups in non-income regression models are hereafter referred to as 25 and 30, respectively. The results presented are divided into sections based on the outcome being tested – income, high school dropout, or post secondary education. These sections summarize results from empirical models testing the association of outcomes to transitory volatility and percent change total volatility, respectively, as defined in section II.

[Table 2]

Income

Earnings and income mobility are studied extensively using the PSID, and I estimate the relationship between parents' income (income during childhood), volatility between ages 0 and 16, and offspring adult income.   In log points, baseline childhood transitory volatility exposure during childhood is insignificant and negatively associated with income in adulthood between 0.019 and 0.021 (table 2); in models testing the separability of income and income volatility, transitory volatility has no statistically significant association to permanent income during childhood. These and all interaction models are evaluated at the mean level of income during childhood, $67,000, and the mean level of volatility (see table 1). Family economic background, as proxied by income during childhood between birth and age 16, exhibits a statistically significant income IGE between 0.408 and 0.460. The elasticities generated from transitory and total intergenerational mobility models are comparable to an elasticity of around 0.4 from Solon (1992) and 0.4 to 0.6 from Mazumder (2005) and Gouskova et al. (2010a). The intergenerational income elasticities generated in the process of estimating volatility's relationship provide a useful reference point to gauge the reliability of the estimates. From the set of demographic control variables, Black race and having additional siblings also predicts lower income in adulthood.

[Tables 3-4]

Education

To examine the impact of family income volatility on parental investments in child human capital, I test the role of volatility on the likelihood of high school dropout (tables 3-4) and post high school educational attainment (tables 5-6). Transitory volatility is associated with a statistically insignificant higher likelihood of dropout. Among 25 year olds, permanent income during childhood is related to a lower chance of dropout, as are Black race and Female. Individuals with additional siblings are more likely to drop out of high school, all else equal.

In table 4, the association between drop out and percent change childhood income volatility exposure is tested. Percent change volatility, defined as a count of instances where family income during childhood shifts by 25 percent or more, is associated with a statistically significant 0.005 to 0.007 increase in the drop out chance for both 25 and 30 year olds. 25 and 30 year old Blacks and females are less likely, holding other variables constant, to drop out of high school and having more siblings is associated with a greater risk of drop out among 25 year olds.

[Table 5]

While the results lend some support for a link between volatility and dropout, there is less apparent connection between volatility and education beyond high school (tables 5-6). Family income level, measured in log points, is the strongest positive correlate of post high school education. Females are generally predicted to have higher education attainment likelihood, and individuals with more siblings are less likely to pursue additional training beyond high school. In table 5, the relationship between post secondary education and family income is between 0.131 and 0.179. In table 6, joint significance between percent change volatility and permanent income during childhood suggests that, at the mean, post high school educational attainment may be less likely given exposure to percent change volatility (table 6, columns 2 and 4). As is the case in the previous estimates of adult post secondary education and volatility exposure, family permanent income, gender, and the number of siblings are the strongest predictors of educational attainment. Permanent income coefficients for post secondary education range from 0.126 to 0.333.

[Table 6]

Educational Attainment and Volatility across the Income Distribution

In tables 7-10, the intergenerational education outcomes are examined based upon where the adult child's parental family income lies within the distribution of family incomes. The families are divided into three groups: bottom 33 percent, 33-66 percent, and top 33 percent. These groups exclude the top and bottom 1 percent of family incomes of the sample. Across the income distribution, an insignificant, positive association emerges between lower and middle income transitory volatility and dropout. The results for high school dropout and percent change volatility (table 7) at least weakly confirm that the permanent income assumption holds for middle and upper income households and breaks down for lower income households, many which may lack the assets to insulate children from income shifts. Here, percent change volatility exposure is associated with a higher likelihood of dropout by 0.013 among the bottom 33 percent of family incomes (table 8), and otherwise has no significant link across the income distribution. It is noteworthy that the sign on volatility is negative for middle and upper income families, suggesting pooled estimates may be masking heterogeneity in the response to volatility across the income distribution. Across the income distribution, there are no clear links between volatility exposure and post secondary educational attainment (tables 9-10).

[Tables 7-8]

The results suggest collectively that volatility exposure and income level may be jointly related to lower educational attainment, but the magnitudes are small. Efficiency issues may potentially mask additional negative relationships between volatility exposure and post high school attainment in the transitory and percent change volatility models. Consistent relationships also emerge between family income, race, gender, number of siblings, and adult outcomes. In some cases, the results are not consistent across age, implying the determinants of education differ by age. Another plausible explanation for age-specific results here and throughout the study is sample attrition bias (Wooldridge 2002), whereby different types of persons respond as ages increase over time. Some study participants do leave the sample, and PSID attritors are less educated, have lower earnings, and are less likely to be married (Fitzgerald et al. 1998).

[Tables 9-10]

VIII. Conclusion

To estimate an intergenerational model with family income volatility, I link parents and offspring in the PSID between 1970 and 2007. The purpose of this is to identify what, if any, consequences occur for adult outcomes from growing up with volatile family income as a child. I find that volatility is associated with slightly lower educational attainment in adulthood, especially for descendants of lower income families. Within the bottom 33 percent of incomes, volatility exposure increases the likelihood of dropout by 1 percent. Though this link is far smaller than, say, the permanent income - educational attainment association, the substantial economic and social consequences of high school dropout must be accounted for. Dropouts experience far higher rates of unemployment, lower family income and earnings, and are more likely to engage in criminal activity (Blank 2008; Haskins et al. 2009; Lochner 2005) than their more educated counterparts.

The larger link between permanent income and education outcomes leaves open the possibility of imperfections within credit markets for human capital (Loury 81; Kane and Ellwood 2000; Mazumder 2005). In the U.S., where education is fully subsidized through the tax system from kindergarten through grade twelve, additional parental investments in human and financial capital must typically occur in order for offspring to successfully matriculate into education beyond high school. This connection of low permanent income during childhood to lower adult education could also reflect the presence of complex, potentially interactive socio-economic and behavioral environment influences coincident with income (Mason 2007). That adults with more siblings during childhood are predicted to have lower adult income and educational attainment may merely reflect the association between family structure and poverty (Cancian and Reed 2001). Collectively, these results may concern policymakers.

If educational outcomes are compromised by low, volatile incomes, efforts to help families reach their optimal private human capital investment level could improve the well-being of adult children (Mazumder 2005). A modest policy prescription to address the findings regarding educational attainment would promote precautionary savings among families to facilitate smooth child human capital investment profiles. A benefit of such a policy is that, whether volatility derives from income growth or decline, additional savings raises well-being among saver families by providing insurance against unanticipated events (Attanasio and Weber 2010). This may be appropriate given the negligible size of the volatility-education link in most of the models presented.

Beyond promoting precautionary savings, a more ambitious plan directing additional public resources to education may help improve the human capital investment disadvantaged families can make, raising incomes and improving adult well-being for descendants of lower-income families. The current safety net uses food, housing, and cash assistance programs to intercede for low and moderate income families, yielding real-time benefits. By comparison, a policy directing additional resources to childhood and young adult education might slowly weaken the link between low, unstable incomes and educational attainment. If policymakers' objectives include immediate needs as well as longer-term economic mobility, grants for education and training beyond high school might be made more available, not less. Over time, such a strategy could lower the apparently large consequences of low permanent income during childhood and loosen the link between low, volatile family incomes as a child and reduced human capital and income in adulthood.

References

Altonji, Joseph, and Thomas Dunn. 2000. "An Intergenerational Model of Wages, Hours, and Earnings." *Journal of Human Resources* 35(2): 221-258.

Becker, Gary, and Nigel Tomes. 1979. "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility." *Journal of Political Economy* 87(6): 1153-1189.

Becker, Gary, and Nigel Tomes. 1986. "Human Capital and the Rise and Fall of Families." *Journal of Labor Economics* 4(3-2): S1-S39.

Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes. 2005 "Why the Apple Doesn't Fall Far: Understanding Intergenerational Transmission of Human Capital." *The American Economic Review* 95(1): 437-449.

Blank, Rebecca. 2008. "Economic Change and the Structure of Opportunity for Less-Skilled Workers." Prepared for the conference "Changing Poverty," organized by the *Institute for Research on Poverty,* May 29-30, 2008.

Blau, David. 1999. "The Effect of Income on Child Development." *The Review of Economics and Statistics* 81(2): 261-276.

Brooks-Gunn, Jeanne, Greg J. Duncan, Pamela Kato Klebanov, and Naomi Sealand. 1993. "Do Neighborhoods Influence Child and Adolescent Development?" *The American Journal of Sociology* 99(2): 353-395.

Burkhauser, Richard V., and Kenneth A. Couch. 2009. "Intra-generational Inequality and Intertemporal Mobility." In *The Oxford Handbook of Economic Inequality*, W.

Salverda, B. Nolan, and T.M. Smeeding eds. Oxford University Press: New York: 522-545.

Cancian, Maria, and Deborah Reed. 2001. "Changes in Family Structure: Implications for Poverty and Related Policy." in *Understanding Poverty*, S. Danziger and R. Haveman, eds. Russell Sage Foundation: New York: 69-96.

Charles, Kerwin, and Melvin Stephens Jr. 2002. "Job Displacement, Disability, and Divorce." NBER working paper series.

Charles, Kerwin, and Eric Hurst. 2003. "The Correlation of Wealth Across Generations." *Journal of Political Economy* 111(6): 1155-1182.

Conger, Rand, Glen H. Elder, Jr., Frederick O. Lorenz, Katherine J. Conger, Ronald L. Simons, Les B. Whitbeck, Shirley Huck, and Janet N. Melby. 1990. "Linking Economic Hardship to Marital Quality and Instability." *Journal of Marriage and Family* 52(3): 643-656.

Cunha, Flavio, James J. Heckman, Lance Lochner, and Dimitriy V. Masterov. 2005. "Interpreting the Evidence on Life Cycle Skill Formation." Prepared for *Handbook of the Economics of Education*. E. Hanushek and F. Welch, eds., North Holland.

Currie, Janet, Mark Stabile, Phongsack Manivong, and Leslie L. Roos. 2010. "Child Health and Young Adult Outcomes." *Journal of Human Resources* 45(3): 517-548.

Dahl, Gordon, and Lance Lochner. 2005. "The Impact of Family Income on Child Achievement." *Institute for Research on Poverty* DP1305-05.

Dahl, Molly, Thomas DeLeire, and Jonathan Schwabish. 2011. “Estimates of Year-to-Year Volatility in Earnings and in Household Incomes from Administrative, Survey, and Matched Data.” *Journal of Human Resources* 46(4): 750-774.

Duncan, Greg J. Kjetil Telle, Kathleen M. Ziol-Guest, and Ariel Kalil. 2011. “Economic Deprivation in Early Childhood and Adult Attainment: Comparative Evidence from Norwegian Registry Data and the U.S. Panel Study of Income Dynamics.” *In Persistence*, *Priviledge*, *and Parenting*, T.M. Smeeding, R. Erikson, and M. Jäntti eds. Russell Sage Foundation: New York: 209-236.

Duncan, Greg. 1988. “The Volatility of Family Income Over the Life Course.” In Life-Span Development and Behavior, Vol. 9, P. Baltes, D. Featherman, and R. Lerner, eds., Lawrence Erlbaum Associates: London: 317-358.

Duncan, Greg J., Jeanne Brooks-Gunn, and Pamela Kato Klebanov. 1994. “Economic Deprivation and Early Childhood Development.” *Child Development* 65(2): 296-318.

Duncan, Greg, and Jeanne Brooks-Gunn. 2000. “Family Poverty, Welfare Reform, and Child Development.” *Child Development* 71(1): 188-196.

Duncan, Greg J., Ariel Kalil, and Kathleen Ziol-Guest. 2008. “The Economic Costs of Early Childhood Poverty.” Partnership for America’s Economic Success, Issue Paper #4.

Dynan, Karen E., Douglas W. Elmendorf, and Daniel E. Sichel. 2008. "The Evolution of Household Income Volatility." http://www.brookings.edu/~/media/Files/rc/papers/2008/02_useconomics_elmendorf/02_useconomics_elmendorf.pdf

Eliason, Marcus. 2004. "Lost jobs, broken marriages." ISER Working Papers #2004-21.

Eliason, Marcus, and Donald Storrie. 2007. "Does Job Loss Shorten Life?" *The Journal of Human Resources* 44(2):277-302.

Fitzgerald, John, Peter Gottschalk, and Robert Moffitt. 1998. "An Analysis of Sample Attrition in Panel Data: The Michigan Panel Study of Income Dynamics." *The Journal of Human Resources* 33(2): 251-299.

Gottschalk, Peter and Robert Moffitt. 1994. "The Growth of Earnings Instability in the U.S. Labor Market." *Brookings Papers on Economic Activity* (1): 217–254.

Gottschalk, Peter, and Robert Moffitt. 2009. "The Rising Instability of U.S. Earnings." *Journal of Economic Perspectives* 23(4): 3-24.

Gouskova, Elena, Ngina Chiteji, and Frank Stafford. 2010a. "Estimating the intergenerational persistence of lifetime earnings with life course matching: Evidence from the PSID." *Labour Economics* 17(3): 592-597.

Gouskova, Elena, Patricia Andreski, and Robert F. Schoeni. 2010b. "Comparing Estimates of Family Income in the Panel Study of Income Dynamics and the March Current Population Survey, 1968-2007." PSID Survey Research Center: Technical series paper #10-

01. http://psidonline.isr.umich.edu/Publications/Papers/tsp/2010-01_comparing_estimates_of_fam.pdf

Grawe, Nathan D. 2006. "Lifecycle bias in estimates of intergenerational earnings persistence." *Labour Economics* 13(2006): 551-570.

Gundersen, Craig, and James P. Ziliak. 2003. "The Role of Food Stamps in Consumption Stabilization," *Journal of Human Resources* 38(Supplement): 1051–1079.

Gundersen, Craig, and James P. Ziliak 2008. "The Age Gradient in Food Stamp Program Participation: Does Income Volatility Matter?" In *Income Volatility and Food Assistance in the United States*, D. Jolliffe and J. P. Ziliak, eds., Kalamazoo, MI: W.E. Upjohn Institute.

Guryan, Jonathan. 2004. "Desegregation and Black Dropout Rates," *American Economic Review* 94(4): 919-943.

Haider, Steven. 2001. "Earnings Instability and Earnings Inequality of Males in the United States: 1967–1991." *Journal of Labor Economics* 19(4): 799–836.

Haider, Steven, and Gary Solon. 2006. "Life-Cycle Variation in the Association between Current and Lifetime Earnings." *The American Economic Review* 96(4): 1308-1320.

Haskins, Ron, Harry Holzer, and Robert Lerman. 2009. "Promoting Economic Mobility by Increasing Postsecondary Education." Economic Mobility Project. www.economicmobility.org

Hauser, Robert M., Solon J. Simmons, and Devah I. Pager. 2000. “High School Dropout, Race-Ethnicity, and Social Background from the 1970’s to the 1990’s.” CDE Working Paper No. 2000-12. http://www.ssc.wisc.edu/cde/cdewp/2000-12.pdf

Hankins, Scott, and Mark Hoekstra. 2010. “Lucky in Life, Unlucky in Love? The Effect of Random Income Shocks on Marriage and Divorce.” Forthcoming in *Journal of Human Resources*. http://www.uky.edu/~swhank2/research/lottery_divorce.pdf

Haveman, Robert, Timothy Smeeding, Kathryn Wilson, and Jo Blanden. 2010. “Comparing the Mechanisms Behind Intergenerational Mobility in the US and UK: Implications for Policy Interventions.” Presented at 32nd annual Association for Public Policy Analysis and Management Research Conference, fall 2010.

Huff Stevens, Ann. 1997. “Persistent Effects of Job Displacement: The Importance of Multiple Job Losses.” *Journal of Labor Economics* 15(1):165-188.

Hyslop, Dean R. 2001. “Rising U.S. Earnings Inequality and Family Labor Supply: The Covariance Structure of Intrafamily Earnings.” *The American Economic Review* 91(4): 755-777.

Institute for Social Research. 2006. “An Overview of the Panel Study of Income Dynamics.” http://psidonline.isr.umich.edu/Guide/Overview.html.

Kane, Thomas J., and David T. Ellwood. 2000. “Who is Getting a College Education? Family Background and the Growing Gaps in Enrollment.” in *Securing the Future*, S. Danziger and J. Waldfogel, eds., New York: Russell Sage Foundation.

Keys, Ben. 2008. “Trends in Income and Consumption Volatility, 1970–2000.” In *Income Volatility and Food Assistance in the United States*, D. Jolliffe and J. P. Ziliak, eds., Kalamazoo, MI: W.E. Upjohn Institute.

Lee, Chul-In, and Gary Solon. 2007. “Trends in Intergenerational Income Mobility.” NBER Working Paper 12007.

Lillard, Lee A., and Robert J. Willis. 1994. “Intergenerational Educational Mobility: The Effects of Family and State in Malaysia.” In *The Journal of Human Resources* 29(4): 1126-1166.

Lochner, Lance. 2005. “Education, Work, and Crime: A Human Capital Approach.” In *International Economic Review* 45(3): 811-843.

Loury, Glenn C. 1981. “Intergenerational Transfers and the Distribution of Earnings.” In *Econometrica* 49(4): 843-867.

Ludwig, Jens, and Douglas L. Miller. 2007. “Does Head Start Improve Children’s Life Chances? Evidence From A Regression Discontinuity Design.” In *The Quarterly Journal of Economics* 122(1): 159-208.

Magnuson, Katherine, and Elizabeth Votruba-Drzal. 2009. “Enduring Influences of Childhood Poverty.” In *Changing Poverty, Changing Policies*: 153-178.

Mason, Patrick. 2007. “Intergenerational Mobility and Interracial Inequality: The Return to Family Values.” *Industrial Relations* 46(1): 51-80.

Mayer, Susan E. 1997. “Income, Psychological Well-Being, and Parenting Practices.” In *What Money Can’t Buy: Family Income and Children’s Life Chances*. Harvard University Press: Cambridge, MA.

Mazumder, Bhashkar. 2005. “Fortunate Sons: New Estimates of Intergenerational Mobility in the United States Using Social Security Earnings Data.” *Review of Economics and Statistics* 87(2): 235-255.

Meghir, Costas, and Marten Palme. 2005. “Education Reform, Ability, and Family Background.” *The American Economic Review* 95(1): 414-424.

Nunley, John M., and Alan Seals. 2010. “The Effects of Household Income Volatility on Divorce.” *The American Journal of Economics and Sociology* 69(3): 984-1010.

Oreopolous, Philip, Marianne Page, and Ann Huff Stevens. 2005. “The Intergenerational Effects of Worker Displacement.” NBER Working Paper 11587.

Rothstein, Jesse, and Nathan Wozny. 2011. “Permanent Income and the Black-White Test Score Gap.” NBER Working paper 17610: http://www.nber.org/papers/w17610

Ruhm, Christopher. 2003. “Healthy Living in Hard Times.” IZA discussion paper No. 711.

Shin, Donggyun, and Gary Solon. 2009. “Trends in Men’s Earnings Volatility: What Does the Panel Study of Income Dynamics Show?” Working paper: http://www.hks.harvard.edu/inequality/Seminar/Papers/Solon09.pdf

Shore, Steven. 2012. “The Intergenerational Transmission of Income Volatility: Is Riskiness Inherited?” *Journal of Business and Economic Statistics* 29(3): 372-381.

Solon, Gary. 1992. “Intergenerational Income Mobility in the United States.” *The American Economic Review* 82(3):393-408.

Solon, Gary. 1999. “Intergenerational Mobility in the Labor Market.” In *Handbook of Labor Economics*, Orley C. Ashenfelter and David Card, eds., Amsterdam: Elsevier.

Solon, Gary. 2004. “A Model of Intergenerational Mobility Variation over Time and Place.” In *Generational Income Mobility*, Miles Corak, editor, Cambridge, UK: Cambridge University Press.

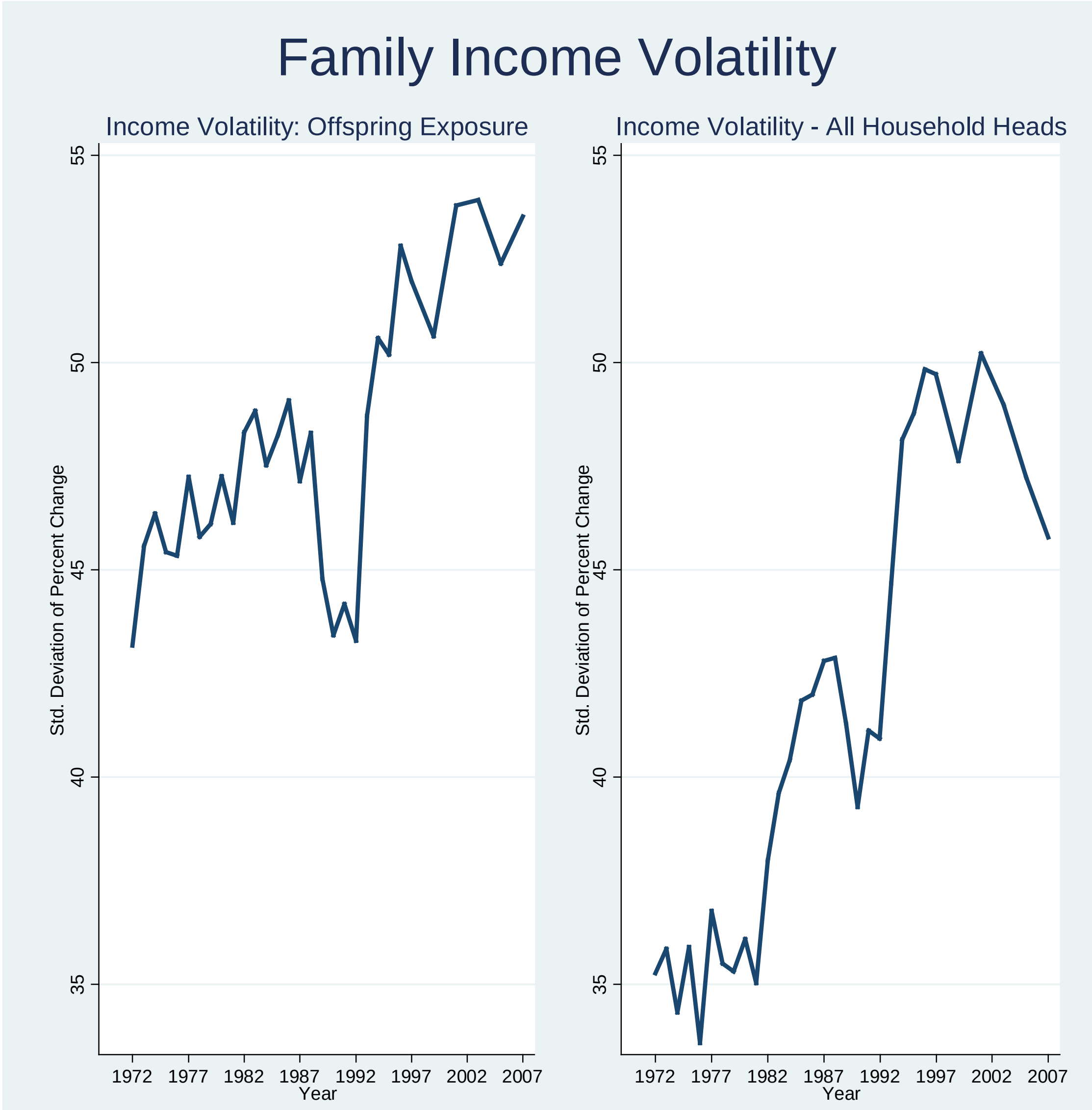
Weiss, Yoram. 1986. “The Determination of Lifecycle Earnings: A Survey.” In *Handbook of Labor Economics*, Orley C. Ashenfelter and David Card, eds., Amsterdam: Elsevier.

Woock, Christopher. 2009. “Earnings Losses of Injured Men: Reported and Unreported Injuries.” *Industrial Relations* 48(4): 610-628.

Wooldridge, Jeffrey. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: The MIT Press. pgs. 608-13.

Ziliak, James P., Bradley Hardy, and Christopher Bollinger. 2011. “Earnings and Income Volatility in America: Evidence from Matched CPS.” *Labour Economics* 18(6): 742-754.

Zimmerman, David J. 1992. “Regression Toward Mediocrity in Economic Stature.” *The American Economic Review* 82(3):409-429.



Note: Topcoded and Bottomcoded.

Table 1 Summary Statistics Adjusted for Inflation (2006 Dollars)

Variables	Mean	Standard Deviation
Earnings and Income		
Offspring Family Income in Adulthood ($)	$67,873.04	46,445.62
Head's Family Income in Childhood ($)	67,161.04	43,757.99
Average Childhood Transitory Volatility (Ln)	0.41	1.69
Average Childhood Pct. Change Volatility	3.90	2.93
Age of Offspring (if offspring over 25)	33.14	6.81
Age of Father (if offspring over 25)	61.87	8.51
Age of Mother (if offspring over 25)	59.16	10.03
Education		
% Less Than High School - Offspring	5.79%	23.34%
% High School - Offspring	31.74%	46.54%
% Some College - Offspring	27.57%	44.68%
% College - Offspring	34.91%	47.67%
% Less Than High School - Father	25.76%	43.73%
% High School - Father	36.56%	48.16%
% Some College - Father	15.22%	35.92%
% College - Father	22.47%	41.74%
% Less Than High School - Mother	20.65%	40.48%
% High School - Mother	48.87%	48.16%
% Some College - Mother	17.03%	37.59%
% College - Mother	13.46%	34.13%
Race & Gender		
% White - Head of Household	91.62%	27.71%
% Black - Head of Household	5.78%	23.33%
% Other - Head of Household	2.59%	15.90%
% Female	48.37%	49.97%
Sample – Observations with Child Income 0-16		
Number of offspring matched to parents	2,186	
Sample size (person-years)	57,395	

Note: Summary statistics are topcoded at 1% and bottomcoded at $1.

Table 2. Childhood Income Volatility Exposure and Adult Income (Transitory Definition)

ADULT INCOME	(1)	(2)	(3)	(4)
$Income_{0\text{-}16}$	0.460***	0.408***	0.456***	0.411***
	(0.119)	(0.118)	(0.130)	(0.128)
Transitory $Volatility_{0\text{-}16}$	-0.019	-0.021	-0.019	-0.021
	(0.038)	(0.037)	(0.038)	(0.037)
$Income_{0\text{-}16}$ * Transitory $Vol_{0\text{-}16}$			0.008	-0.007
			(0.079)	(0.076)
Black		-0.237**		-0.236**
		(0.102)		(0.102)
Other		-0.008		-0.008
		(0.104)		(0.104)
Female		0.047		0.048
		(0.035)		(0.035)
No. of Siblings		-0.041**		-0.041**
		(0.018)		(0.018)
Constant	26.589**	20.590*	26.574**	20.596*
	(11.615)	(11.519)	(11.614)	(11.517)
Observations				
R-squared	1,366	1,366	1,366	1,366
Joint F Test	0.0998	0.1167	0.0998	0.1167
			0.125	0.165

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$. Coefficients for education and age not shown. F-statistics tests joint significance of Transitory $Volatility_{0\text{-}16}$ and $Income_{0\text{-}16}$ * Transitory $Vol_{0\text{-}16}$. Intergenerational income elasticities include order 4 polynomial of offspring age normalized to age 40, as well as normalized offspring age interacted with income during childhood (parents' income), also not shown.

Table 3. Childhood Income Volatility Exposure and High School Dropout (Transitory Definition)

DROPOUT	24-26 (1)	24-26 (2)	29-31 (3)	29-31 (4)
$Income_{0\text{-}16}$	-0.054***	-0.050*	-0.031	-0.001
	(0.020)	(0.029)	(0.021)	(0.029)
Transitory $Volatility_{0\text{-}16}$	0.007	0.007	0.013	0.011
	(0.012)	(0.012)	(0.014)	(0.014)
$Income_{0\text{-}16}$ * Transitory $Vol_{0\text{-}16}$		-0.006		-0.057
		(0.030)		(0.037)
Black	-0.052**	-0.052**	-0.053***	-0.052***
	(0.025)	(0.025)	(0.012)	(0.012)
Other	-0.029	-0.029	-0.008	-0.004
	(0.018)	(0.018)	(0.030)	(0.030)
Female	-0.044***	-0.044***	-0.035***	-0.035***
	(0.012)	(0.012)	(0.013)	(0.013)
No. of Siblings	0.010*	0.010*	0.003	0.002
	(0.005)	(0.005)	(0.005)	(0.005)
Constant	-4.199	-4.204	-6.497*	-6.442
	(3.410)	(3.410)	(3.907)	(3.935)
Observations	1,401	1,401	873	873
R-squared	0.0475	0.0475	0.0291	0.0330
Joint F Test		0.156		1.460

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. F-statistics tests joint significance of Transitory $Volatility_{0\text{-}16}$ and $Income_{0\text{-}16}$ * Transitory $Vol_{0\text{-}16}$.

Table 4. Childhood Income Volatility Exposure and Post Secondary Education (Transitory Definition)

POST SECONDARY	24-26 (1)	24-26 (2)	29-31 (3)	29-31 (4)
$\text{Income}_{0\text{-}16}$	0.179***	0.160***	0.131**	0.097
	(0.039)	(0.052)	(0.051)	(0.070)
Transitory $\text{Volatility}_{0\text{-}16}$	-0.024	-0.025	0.011	0.013
	(0.024)	(0.024)	(0.031)	(0.032)
$\text{Income}_{0\text{-}16}$ * Transitory $\text{Vol}_{0\text{-}16}$		0.031		0.064
		(0.053)		(0.076)
Black	-0.001	-0.001	-0.043	-0.044
	(0.056)	(0.056)	(0.077)	(0.077)
Other	0.043	0.044	0.090	0.085
	(0.063)	(0.063)	(0.088)	(0.089)
Female	0.095***	0.095***	0.104***	0.104***
	(0.025)	(0.025)	(0.033)	(0.033)
No. of Siblings	-0.033***	-0.033***	-0.039***	-0.038***
	(0.010)	(0.010)	(0.013)	(0.013)
Constant	6.642	6.673	7.753	7.692
	(8.143)	(8.153)	(12.036)	(12.135)
Observations	1,401	1,401	873	873
R-squared	0.1674	0.1677	0.1329	0.1337
Joint F Test		0.599		0.443

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$. Coefficients for education and age not shown. F-statistics tests joint significance of Transitory $\text{Volatility}_{0\text{-}16}$ and $\text{Income}_{0\text{-}16}$ * Transitory $\text{Vol}_{0\text{-}16}$.

Table 5. Childhood Income Volatility Exposure and High School Dropout (25% Income Change Definition)

DROPOUT	24-26 (1)	24-26 (2)	29-31 (3)	29-31 (4)
$Income_{0\text{-}16}$	-0.043**	-0.044	-0.018	-0.002
	(0.020)	(0.042)	(0.022)	(0.042)
25% $Change_{0\text{-}16}$	0.005*	0.005*	0.007**	0.006**
	(0.003)	(0.002)	(0.003)	(0.003)
$Income_{0\text{-}16}$ * 25% $Change_{0\text{-}16}$		0.000		-0.002
		(0.005)		(0.005)
Black	-0.054**	-0.054**	-0.058***	-0.059***
	(0.026)	(0.026)	(0.013)	(0.013)
Other	-0.028	-0.028	-0.002	-0.003
	(0.019)	(0.019)	(0.033)	(0.033)
Female	-0.045***	-0.045***	-0.037***	-0.036***
	(0.012)	(0.012)	(0.013)	(0.013)
No. of Siblings	0.010*	0.010*	0.003	0.003
	(0.005)	(0.005)	(0.005)	(0.005)
Constant	-4.341	-4.334	-6.425	-6.649
	(3.410)	(3.409)	(4.065)	(4.047)
Observations	1,402	1,402	873	873
R-squared	0.0501	0.0502	0.0358	0.0362
Joint F Test		1.811		2.189

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. 25% $Change_{0\text{-}16}$ represents count of instances in which family income during childhood changes by +/- 25% between years. F-statistics tests joint significance of 25% $Change_{0\text{-}16}$ and $Income_{0\text{-}16}$ * 25% $Change_{0\text{-}16}$.

Table 6. Childhood Income Volatility Exposure and Post Secondary Education (25% Income Change Definition)

POST SECONDARY	24-26 (1)	24-26 (2)	29-31 (3)	29-31 (4)
$Income_{0\text{-}16}$	0.173***	0.296***	0.126**	0.333***
	(0.040)	(0.065)	(0.053)	(0.080)
25% $Change_{0\text{-}16}$	-0.002	-0.004	-0.002	-0.006
	(0.005)	(0.005)	(0.006)	(0.006)
$Income_{0\text{-}16}$ * 25% $Change_{0\text{-}16}$		-0.017**		-0.029***
		(0.009)		(0.009)
Black	0.001	-0.005	-0.044	-0.050
	(0.056)	(0.056)	(0.077)	(0.075)
Other	0.041	0.031	0.091	0.076
	(0.063)	(0.065)	(0.088)	(0.091)
Female	0.096***	0.096***	0.104***	0.106***
	(0.025)	(0.025)	(0.033)	(0.033)
No. of Siblings	-0.033***	-0.033***	-0.038***	-0.038***
	(0.010)	(0.010)	(0.013)	(0.013)
Constant	6.393	5.552	7.486	4.582
	(8.126)	(8.106)	(12.083)	(11.864)
Observations	1,402	1,402	873	873
R-squared	0.1668	0.1709	0.1329	0.1443
Joint F Test		2.160		5.340

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. 25% $Change_{0\text{-}16}$ represents count of instances in which family income during childhood changes by +/- 25% between years. F-statistics tests joint significance of 25% $Change_{0\text{-}16}$ and $Income_{0\text{-}16}$ * 25% $Change_{0\text{-}16}$.

Table 7. Childhood Income Volatility Exposure and High School Dropout by Position within Income Distribution (Transitory Definition)

DROPOUT	Bottom 33%	33-66%	Top 33%
Transitory $\text{Volatility}_{0\text{-}16}$	0.012	0.028	-0.001
	(0.023)	(0.029)	(0.013)
Black	-0.076***	-0.014	-0.028*
	(0.019)	(0.013)	(0.015)
Other	-0.086***	0.041	0.004
	(0.030)	(0.046)	(0.011)
Female	-0.036	-0.024**	-0.017
	(0.031)	(0.012)	(0.020)
No. of Siblings	-0.004	0.002	0.004
	(0.011)	(0.005)	(0.005)
Constant	-9.191	-15.450*	-17.361
	(7.464)	(8.537)	(12.974)
Observations	460	486	432
R-squared	0.0286	0.0741	0.0293

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. Income distribution location determined by mean family income during childhood. F-statistics tests joint significance of Transitory $\text{Volatility}_{0\text{-}16}$ and $\text{Income}_{0\text{-}16}$ * Transitory $\text{Vol}_{0\text{-}16}$.

Table 8. Childhood Income Volatility Exposure and Post Secondary Education by Position within Income Distribution (Transitory Definition)

POST SECONDARY	Bottom 33%	33-66%	Top 33%
Transitory $Volatility_{0-16}$	0.013	-0.026	0.034
	(0.054)	(0.057)	(0.053)
Black	-0.120	-0.031	0.192***
	(0.106)	(0.142)	(0.044)
Other	0.028	0.131	-0.054
	(0.342)	(0.125)	(0.106)
Female	0.093	0.151***	0.020
	(0.066)	(0.054)	(0.051)
No. of Siblings	-0.024	-0.019	-0.059**
	(0.023)	(0.022)	(0.026)
Constant	14.288	9.006	-74.256
	(18.216)	(21.824)	(57.395)
Observations	460	486	432
R-squared	0.0823	0.1290	0.0993

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. Income distribution location determined by mean family income during childhood. F-statistics tests joint significance of Transitory $Volatility_{0-16}$ and $Income_{0-16}$ * Transitory Vol_{0-16}.

Table 9. Childhood Income Volatility Exposure and High School Dropout by Position within Income Distribution (25% Income Change Definition)

DROPOUT	Bottom 33%	33-66%	Top 33%
25% Change$_{0\text{-}16}$	0.013**	-0.000	-0.001
	(0.006)	(0.003)	(0.004)
Black	-0.099***	-0.019	-0.029*
	(0.024)	(0.014)	(0.016)
Other	-0.125**	0.041	0.003
	(0.057)	(0.051)	(0.011)
Female	-0.034	-0.024**	-0.016
	(0.031)	(0.012)	(0.019)
No. of Siblings	-0.004	0.003	0.004
	(0.010)	(0.005)	(0.005)
Constant	-8.178	-16.096*	-17.735
	(7.242)	(9.192)	(12.194)
Observations	460	487	432
R-squared	0.0497	0.0618	0.0299

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. Income distribution location determined by mean family income during childhood. 25% Change$_{0\text{-}16}$ represents count of instances in which family income during childhood changes by +/- 25% between years. F-statistics tests joint significance of Transitory Volatility$_{0\text{-}16}$ and Income$_{0\text{-}16}$ * Transitory Vol$_{0\text{-}16}$.

Table 10. Childhood Income Volatility Exposure and Post-Secondary Education (25% Income Change Definition)

POST SECONDARY	Bottom 33%	33-66%	Top 33%
$25\%\ Change_{0\text{-}16}$	-0.009	0.009	-0.007
	(0.011)	(0.012)	(0.011)
Black	-0.108	-0.028	0.176***
	(0.106)	(0.142)	(0.041)
Other	0.054	0.138	-0.037
	(0.319)	(0.126)	(0.106)
Female	0.090	0.149***	0.021
	(0.065)	(0.053)	(0.051)
No. of Siblings	-0.023	-0.020	-0.060**
	(0.023)	(0.021)	(0.026)
Constant	13.256	11.007	-78.701
	(18.066)	(21.751)	(56.925)
Observations	460	487	432
R-squared	0.0849	0.1303	0.0995

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Coefficients for education and age not shown. Income distribution location determined by mean family income during childhood. 25% $Change_{0\text{-}16}$ represents count of instances in which family income during childhood changes by +/- 25% between years. F-statistics tests joint significance of 25% $Change_{0\text{-}16}$ and $Income_{0\text{-}16}$ * 25% $Change_{0\text{-}16}$.