Ties that Bind?
Family Income Dynamics and Children's Post-Secondary Enrollment and Persistence

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Abstract: Using the Transition to Adulthood supplement of the Panel Study of Income Dynamics, we examine the relationship between family income dynamics—poverty, low permanent income, and income volatility—and high school graduation, college enrollment, and dropout among young adults. Our intent is to shed light on potential mechanisms driving the transmission of intergenerational advantage to help understand whether and how such income dynamics have played a role in the persistent gap in college achievement. We find evidence that poverty and income volatility exposure during adolescence negatively affect high school graduation, college matriculation, and persistence (2-year dropout). Of particular importance, it appears that the timing of poverty spells during adolescence is vital. Poverty occurring close to the end of high school drives has relatively large deleterious effects on educational attainment.

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1. Introduction

Children from low-income families are not only less likely to enroll in college, those who do are the least likely to persist and earn a degree. Recent estimates show that fewer than a third of children from families in the lowest income quintile who start college persist to earn a degree, compared to more than two-thirds of their peers in the highest quintile (Bailey and Dynarski, 2012; Haskins et al. 2009). Accordingly, the possibility that education is potentially reinforcing rather than ameliorating inequality across generations has received a fair amount of attention (e.g. Duncan and Murnane, 2012; Fischer, 2016). In this paper, we study the impact of time spent in poverty and family income volatility during adolescence on limiting children's access to post-secondary education. To the extent that such income dynamics occur throughout middle and high school, they could operate as important mechanisms limiting upward mobility for those who need it most.

Our work is related to a broader literature on the rapidly rising cost of college and its effects on enrollment decisions, college retention, and dropout rates (e.g. Hemelt and Marcotte 2011, 2015). While federal financial aid is the primary buffer against these costs for price-sensitive students, the provision of aid is complex and often difficult for families to negotiate (Dynarski and Scott-Clayton 2008, 2013). This is likely an especially complex problem for children of families in poverty. The economic and family instability that is inherent in poverty spells may be an important barrier to college matriculation and completion—and upward economic mobility—for students from low-income families.

We thus study the role of family income dynamics during secondary school on high school graduation, college enrollment, and college persistence (2-year dropout). Specifically, we evaluate the impact on these outcomes from exposure to (1) poverty over multiple years during

adolescence, (2) low average or "permanent" income over these same years, and (3) volatility in family income. We believe our paper contributes to a broader understanding of the capacity and limits of higher education as a means to disrupt the inter-generational transmission of poverty, by including poverty spells and family income volatility during adolescence as a potential determinant of post-secondary decisions and success. As opposed to income level at a point in time, these income dynamics are an under-appreciated determinant of social opportunity.

We know that families with the lowest incomes have the least predictable incomes (Hardy and Ziliak 2014; Hardy 2017), and the decision to invest in college can be substantially complicated by low income and income volatility. As a result, children from low-income families could face a double burden: family support that is low on average, and less reliable. This could have a range of negative impacts during middle school and high school, including reduced engagement in academic activities (Gennetian et al. 2015), degrading the capacity to graduate high school and the decision to both enroll and persist in college. Concurrent with issues of student engagement and aptitude, the incidence of poverty, low income, and income volatility could make it more difficult for a family to plan for college (e.g. Mullainathan and Shafir 2013). Among students enrolled in college, family income dynamics can affect persistence. For example, students may feel pressured to supplement family income during transitory declines in income. On the other hand, transitory windfalls can simultaneously increase potential financial support, but also negatively affect financial aid eligibility and awards.

In this paper, we make use of data from the Panel Study of Income Dynamics (PSID) and the PSID Transition to Adulthood supplement (PSID-TA) supplement to study the experiences of young adults as they finish high school and transition into the labor force and/or post-secondary education. We find that poverty, low-income, and intertemporal volatility in family income

during adolescents can have important and persistent effects on high school graduation, college matriculation, and college persistence (2-year dropout). Notably, students who matriculate to community colleges are less likely to graduate than comparable peers with similar academic profiles who enroll in four-year schools. This may reflect family commitment or social barriers that directed them to community college in the first place. Wealth positively predicts attendance and matriculation, though less so than other factors like lower income, poverty, and both family and residential stability (e.g. Addo et al. 2016).

These results are relevant to a number of policy debates and audiences. First, understanding the importance of economic deprivation and instability within the family during a child's "launch" into adulthood can help in developing a fuller picture of the potential mechanisms of the transmission of intergenerational advantage and disadvantage. Second, it suggests that repeated and recent exposure to poverty and low income, as well as family income volatility, may play a role in the disappointing and persistent gap in college matriculation and completion rates between high and low-income students.

Moving forward, the experience of young adults starting college provides a good opportunity to consider and evaluate the extent to which Pell Grants, federally subsidized student loans, and related subsidies serve to ensure access to higher education among students from vulnerable financial backgrounds, or whether such interventions occur too late. This is especially true for the timing of our analysis, given that students are facing this decision point roughly around the time of the Great Recession. Pell grants are the most important federal need-based financial aid program. So, understanding the ability or limits of Pell and related programs to provide affordable access to college is a policy evaluation question of real importance. Relatedly,

future work can provide additional evidence on the role of a college's institutional features, including measures of academic selectivity and affordability.

2. Background

Concerns about the rising costs of higher education are ubiquitous in the United States. A number of studies have documented both the extent and origins of this run-up in costs (Bailey and Dynarski, 2012, and Ehrenberg, 2002). Other studies have assessed the extent to which these increases have played a role in the decline in college completion rates over the past several decades (Turner, 2014). This is a special concern for low-income families, who have experienced a relative increase in the rate of college matriculation over the late 20th century compared to the rates of students from higher SES families, for whom college access has long been assured.

Over the past two or three decades, however, the growing equality in college attendance has been accompanied by a divergence in rates of college completion (Oreopoulos and Petronijevic 2013). This growing inequality in college completion cannot be explained by differences in student ability (Bound, Lovenheim, and Turner 2010). Accordingly, a number of recent studies have explored institutional and other situational determinants that may have affected the ability of students from low-income families to succeed in college. Nonetheless, family income and wealth appear to be an important predictors of college persistence (e.g. Haskins et al. 2009; Pfeffer 2018).

We explore the potential role of exposure to poverty, low-income, and inter-temporal volatility in family income during adolescence in shaping high school graduation, college attendance, and college persistence. First, several previous studies have explored the link

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between family income, poverty, and socioeconomic outcomes (e.g. Duncan et al. 2011; Meghir and Palme 2005; Mullainathan and Shafir 2013). The low income associated with poverty could limit academic performance, therefore precluding college attendance for many otherwise capable young adults (e.g. Ladd 2012; Rothstein and Wozny 2013). Meanwhile, poverty is also often bundled with other forms of family and neighborhood instability—factors that enter negatively into an individual's human capital production function and therefore likely reduce high school graduation and college persistence. Students facing poverty and income volatility can face credit constraints and may also suffer disproportionately from information deficiencies related to financial aid throughout adolescence, the peak of the college-going process (e.g. Kane and Elwood 2000; Lochner and Monge-Naranjo 2012; Loury 1981). Even among families who typically live above poverty, many students and families will face one or more yearly spells in poverty (Hokayem and Heggeness 2014; Stevens 2012).

Income volatility potentially compounds the consequences of poverty and low income, as it is highest among socioeconomically disadvantaged groups—including blacks, low-income families, and those headed by an adult without a college degree (Hardy 2017; Hardy and Ziliak 2014; Keys 2009). Predating the Great Recession, survey data evidence suggests that income volatility among many American families has been on the rise[1] (Dynan et al. 2012; Gottschalk and Moffitt 1994; Ziliak et al. 2011). This increase has been attributed, at least in part, to increases in the volatility of labor market earnings, resulting from short term shocks and a structural change away from earnings protections traditionally offered by long-term employment contracts (Dahl et al. 2011; Gottschalk and Moffitt 2009). Low income families therefore rely on resources that are, on average, also more unpredictable. We do not yet have a full understanding

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[1] Dahl et al. (2012), using administrative data, find that there is no trend growth in the volatility of income over time.

of the implications of earnings and income volatility for workers' careers, their health, and family stability. Poverty and income volatility can result in stressors shaping development, attitudes, coping mechanisms, and problem-solving techniques later in childhood and into adulthood (Cunha et al. 2006; Gennetian et al. 2015; Hill et al. 2013; Lochner and Monge-Naranjo 2012). Through these channels, poverty and income volatility could impact educational outcomes for children.

While the transmission of socioeconomic status (SES) across generations is well established (Altonji and Dunn 2000; Charles and Hurst 2003; Solon 1992), less work exists examining the intergenerational educational consequences of repeated exposure to poverty or income volatility during adolescence. To help address this gap, we build on the work of Stevens and Schaller (2011), Hardy (2014), and Gennetian et. al (2015), which find that on its own, income volatility and job loss during childhood is associated with lowered child educational outcomes.[2]

To the extent that households can borrow to smooth consumption against unanticipated income shocks, the permanent income hypothesis would predict income volatility and poverty spells to have little, if any, impact on human capital accumulation relative to poverty or low permanent income, as reflected via high school graduation or college attendance. This theory argues that families could save positive unanticipated transitory shocks in anticipation of future income swings.

Still, constant relative risk-aversion utility models of family consumption show that higher income variances could negatively impact parental human capital investment in children (Attanasio and Weber 2010). Moreover, market imperfections faced by parent borrowers can

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[2] There are many candidate explanations for this relationship, including family stress and dissolution, frequent moves between schools, and the need for children to work to supplement parental income.

result in the denial of loans or credit that would facilitate college attendance and persistence (Heller 2008) in the face of negative income shocks. For families experiencing such market imperfections, poverty spells and income volatility could impact college persistence via lowered investments in adult children (Becker and Tomes 1986; Lochner and Monge-Naranjo 2012; Loury 1981; Mazumder 2005).

3. Empirical Model and Data

Our conceptual framework is rooted in human capital theory, and within the mainstream of the economics of education and labor markets. Formally, we estimate the following regression models of income dynamics and high school graduation, college enrollment, and college completion:

$$C_{it} = \alpha + \beta \sum_{t=1}^{t=5} P_{i,t} + \mathbf{X}\delta + \rho_t + \varepsilon_i \tag{1}$$

$$C_{it} = \alpha + \beta \bar{I}_i + \gamma V_i + \mathbf{X}\delta + \rho_t + \varepsilon_i, \tag{2}$$

where C_{it} measures various educational outcomes (e.g. high school graduation, college matriculation, or college persistence) for respondent i in year t, $\beta \sum_{t=1}^{t=5} P_{i,t}$ measures 1 to 5 survey years of exposure to poverty during adolescence and prior to the transition into adulthood, $\bar{I}_i$ captures the permanent income level of child i's family over 5 childhood survey years prior to the transition to adulthood, and likewise V_i measures income volatility of child i's family during adolescence. In models (1) and (2) we control for a vector $\mathbf{X}$ of socioeconomic factors including the family head's race and gender, family marital stability measured as the proportion of years the TA respondent resides in a household with married adults, residential stability as measured by the proportion of years the TA respondent moves, the year a respondent "transitions" out of adolescence, and SAT/ACT scores, measured with error ε_i, and ρ_t is a common year fixed effect.

For our study, transitory volatility (V_i) (Gottschalk and Moffitt 2009; Ziliak et al. 2011) will be

defined by yearly deviations $y_{it} - \bar{y}_i$ from mean parental income $\bar{y}_i$ over the relevant time period

m representing matriculation or graduation:

$$Transitory\ Volatility = \ \text{var}(v_i) = V_i = (\tfrac{1}{T_i-1})\sum_{t=1}^{T_i=m}(y_{it} - \bar{y}_i)^2. \qquad (3)$$

Transitory volatility is a measure of risk due to temporary increases in economic hardship

consistent with adverse events such as job loss, injury, divorce, or declining health (Dynan et al.

2012; Hardy 2014).

　　　To study the importance of family income dynamics on transitioning adults we use data

from the Panel Study of Income Dynamics (PSID) and its Transition to Adulthood survey (PSID-

TA). The PSID is a well-known data set begun in 1968, collecting detailed economic, social, and

demographic information on the initially surveyed families and their descendants. Over time,

offspring of the families are followed as they age and begin their own families, resulting in a

sample spanning multiple generations (McGonable and Schoeni 2006).

　　　Beginning in 2005, the PSID began supplemental interviews with members of PSID

households as they enter young adulthood. This supplement, the PSID-TA, was established to

understand the educational, family, and economic decisions of young adults that the standard

PSID missed in the past: young people who are dependent on parents and have therefore not

entered the full labor force as a head of household, but that are no longer within the CDS

module.[3] The PSID estimates that less than half of young adults will become heads or wives of

their own PSID family before age 24.

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[3] PSID-TA sample members are children from the CDS sample who have reached the age of 18. They are surveyed
as part of the Transition to Adulthood sample until they reach the age 25, or they form their own households,
whichever comes first.

To form our analytic data set we combine PSID family files (PSID-F) with PSID-TA files. We use the PSID-F to measure the income and structure (e.g. head's marital status) of the family in which a young adult spent her/his adolescence, prior to "transitioning" into adulthood. The PSID-TA collects supplemental information on PSID-F household members who: 1) are not household heads nor spouses of heads; 2) have turned 18 since the previous interview, and 3) have completed high school. Since 2005 the PSID-TA has been conducted biennially, collecting data on whether respondents have enrolled in, persisted in and graduated from college – as well as providing information on which college(s) a student attended.[4]

Using the PSID-TA, we define the transition year for each sample member as the first year in which they are observed after high school. We then use the PSID-F to measure family income level, poverty, income volatility, and head demographics during the five (biennial) surveys prior to the transition to adulthood. This period roughly covers the adolescent years of PSID-TA sample members. Our PSID-TA cohort sample contains youth transitioning to adulthood in 2005, 2007, 2009, 2011 and 2013. The 2015 PSID-TA data are used only to collect follow up information. Dollar denominated values are adjusted for inflation using the CPI-U personal consumption expenditures deflator.

We use these data to model how high school graduation, college enrollment, and college persistence of young adults are affected by inter-temporal changes in their parents' income during adolescence. Importantly, the results will describe whether and how these outcomes are differentially affected by parental income level and income dynamics—poverty spells and volatility. In each survey year, there are typically more than 1,000 young adult respondents. Of these, approximately 600 enroll at a post-secondary institution immediately after high school. In

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[4] The PSID-TA also collects information about respondents' employment, family formation and other topics.

one sample year (2005) 75 students stopped attending college (without earning a degree/credential). Over the course of 5 survey years, the size of the PSID-TA has increased.

4. Descriptive Statistics and Trends

[Table 1 here]

Our sample allows us to construct snapshots of the association between income dynamics, socioeconomic characteristics, and our selected set of outcomes: high school graduation, college matriculation, and dropout chances. About 17 percent of the respondents are black and 48 percent are female. 85 percent of the sample graduates from high school, while almost 70 percent enroll in college within a 2-year period from being surveyed. Among those, 55 percent are still enrolled in college within 2 years of initial enrollment. The average TA respondent lived in a household that experienced roughly ½ a year in poverty over a 5-year period. Measures of family stability show that adolescents in the sample move 25 percent of the time over the 5-year survey period, and the typical respondent lived in a married household almost 70 percent of the time.

[Figures 1-3 here]

To begin to understand the relationship between economic deprivation and educational outcomes, consider the unadjusted associations presented in Figures 1-3. Figure 1 focuses on exposure to poverty from 1 to 5 survey years. First, we observe that the proportion graduating from high school falls from almost 90 percent when never exposed to poverty, to just over 80 percent when exposed to poverty for 1 year. Additional years in poverty are associated with a lowered likelihood of graduating from high school, falling to as low as 60 percent for those exposed to 4 or 5 years in poverty. College attendance follows a similar pattern, falling from

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roughly 60 percent for young adults who do not experience poverty in adolescence, to just over 40 percent for those who experience 2 years in poverty—after which college matriculation falls to below 40 percent for those in poverty over 4 or 5 years. The proportion of attendees who persist in college falls from roughly 60 percent (no years in adolescent poverty) to under 30 percent with 3 years in poverty, falling further to under 20 percent with 4 or 5 years in poverty.

While poverty thresholds are important for assessing well-being and determining program eligibility criteria, it is worthwhile documenting the link between deep poverty exposure and educational outcomes. Deep poverty, defined as income below 50 percent of the poverty line, follows more of a u-shape with respect to educational outcomes. For high school graduation, exposure to deep poverty reduces high school graduation from over 80 percent (no years in deep poverty) to 60 percent with 2 years of deep poverty exposure, but this graduation rate rises from just over 40 percent to over 70 percent for young adults who experienced 4 to 5 years in deep poverty. A similar pattern holds for college matriculation within two years, though the levels of attendance are lower relative to high school graduation. On the other hand, no TA survey respondents who experience 4 or 5 years of deep poverty as adolescents go on to remain enrolled in college.

Though the plight of those in deep poverty is, by definition, admittedly dire (e.g. Shaefer et al. 2015), another group that merits attention include the near-poor—individuals and families who are above the poverty threshold but by margins small enough to put them at greater risk for transitions into poverty (Hokayem and Heggeness 2014). We observe (Figure 3) that high school graduation rates decline almost linearly with additional years in near-poverty, below 200 percent of the federal poverty level—from well over 90 percent with no near-poverty exposure to under 80 percent with 3 years of near-poverty exposure. College attendance seems to be more

immediately impacted by near-poverty exposure, falling from over 80 percent with no near-poverty exposure to roughly 50 percent with 3 years of exposure. College persistence drops from 60 to 50 percent and holds while moving from no near-poverty exposure to anywhere from 1-3 years of near poverty exposure, before dropping to 30 percent persistence rates with 4 and 5 years of near-poverty exposure.

5. Regression Results

The results shown in Tables 2-7 are linear probability models of high school graduation, college attendance, and college persistence. Table 2 estimates the relationship between time in poverty during adolescence and the likelihood of graduating from high school. In all models, we control for basic demographic characteristics and transition year fixed effects. These year effects are included to control for any impacts of changing labor market conditions during the Great Recession. As our models generally follow the same specification, we provide a detailed explanation of the contents of results in Table 2; we then provide a briefer summary of results shown in Tables 3 and 4.

[Table 2 here]

In the first column of Table 2, we estimate the relationship between family poverty in the survey just prior to transition and high school graduation. Recall that the transition year is the first survey conducted following a PSID-TA member's 18th birthday and completion of high school (whether or not a high school diploma was earned). These interviews were typically conducted when the teen would have been in 11th or 12th grade. We estimate that the likelihood of graduating from high school was 0.26 lower for adolescents whose families were in poverty during that period. This is a very large effect size – the mean graduation rate for the sample is

0.86. Of course, this estimate is affected by many potential confounders: Those in poverty just prior to finishing high school may have been in poverty for many years before that; or, their families experienced other problems that affected educational attainment. In these and all models, we control for transition year fixed effects.

To assess these threats, we use the panel features of the PSID to assess the impact of persistent poverty and family changes during adolescence on the likelihood of graduating from high school. In column 2, we include a series of indicator variables measuring the number of survey years that a respondent's family lived in poverty prior to transition. Since the PSID is biennial, this spans the period from approximately ages 8 to 18. It is clear that any time in poverty during this period limits the chances of graduating from high school. About 25 percent of adolescents live in a family that will experience a spell of poverty between the ages of 8 and 18. Even one year of poverty is associated with a 0.085 decrease in the likelihood of high school graduation. For those whose families experience more than one year in poverty (about 10 percent of our sample), the chances of high school graduation fall by 0.25 to 0.33.

In column 3 we add in controls for family disruptions that are associated with poverty. These include residential moves and the dissolution/formation of marriages. We find that the likelihood of high school graduation declines substantially with the number of residential moves a family makes during a child's adolescence and increases with the time her/his parents are married. Clearly these measures of household stability are related to family poverty. Nonetheless, controlling for household stability we estimate that even one year in poverty is associated with a 0.053 decrease in high school graduation propensity, while multiple years in poverty reduce the likelihood from 0.14 to 0.24. Informed by relatively recent scholarship emphasizing the potential role of family wealth (e.g. Hamilton et al. 2015; Pfeffer 2018; Reeves

2017), we include a set of models controlling for a logarithmic transformation of family wealth in the previous survey year. [5] This measure is inclusive of home equity, and we initially find that wealth is associated with an increased likelihood of high school graduation by 0.005.

In column 4 we add in controls for performance on standardized college entrance tests.[6] This further attenuates the impact of poverty on the likelihood of graduating from high school – the coefficient on one year in poverty is now statistically insignificant, though the coefficients on multiple years remain large and statistically significant, ranging from -0.09 to -0.20. Of course, it could be that poverty in high school affects attainment via reducing achievement in school as measured by standardized tests.

In column 5 we include measures of the number of years in poverty, as well as an indicator of whether one of those years was the year prior to transition, along with controls for family stability and achievement. Interestingly and importantly, it appears that the relationship between adolescent poverty and high school graduation is driven mainly by family poverty in the survey year prior to transition. We estimate that the likelihood of graduating from high school is 0.12 lower for teens living in poor families late in high school than comparable peers. This might be due to the financial demands that family poverty places on 17 and 18-year-olds to contribute to household income. Or, it could be due to changes in expectations about educational opportunities that poverty reveals to teens. Column 6 allows for debt, rather than bottom-coding wealth at zero as in column 5, by implementing an inverse hyperbolic sine transformation.[7] The results in column 5 are robust to this modification.

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[5] For families with negative or no wealth, we assign a value of one dollar prior to log transformation.
[6] We include math and reading scores on the SAT and/or ACT. We also include indicator variables measuring whether or not a student took these exams, as this may signal attainment goals.

[7] We use the STATA function ihstrans to compute the inverse hyperbolic sine transformation. This transformation facilitates processing of negative wealth values and zeros, the omission of which could understate the importance of wealth gaps and inequality.

[Table 3 here]

Moving to Table 3, we use the same set of covariates to assess the predictors of college enrollment. In column 1 we find that, just prior to graduation, adolescents exposed to poverty are 0.11 less likely to matriculate to college, though again this initial model does not control for number of adolescent years in poverty or measures of family stability. Poverty persistence, as proxied by multiple years in poverty (column 2), does not appear as important vis-à-vis any exposure to poverty, as a year in poverty lowers the college matriculation likelihood by 0.15, relative to 4 years in poverty lowering college matriculation likelihoods by 0.17. While these factors remain important, upon controlling for family wealth as well as family stability factors—residential moves and the dissolution/formation of marriages—we find that residential moves and wealth are important for explaining matriculation. Interesting, family wealth and marriage are highly related—in unpublished results we find that the proportion of time in a married household positively predicts college matriculation when we do *not* control for wealth. In absolute terms, residential moves loom larger than marriage as a predictor of college-going behavior, and the inclusion of these family stability measures does not greatly attenuate the role of poverty.

As in our models of high school graduation, controlling for SAT and ACT scores (column 4) lowers the importance of years in poverty during adolescence, though the relationship persists for 1 year of exposure. In column 5 we return to examining the role of poverty immediately before graduation, but within our fully-specified model, and find that here it does not predict matriculation per se, though any one year of poverty reduces the likelihood of college matriculation by 7 percent. As in Table 3, column 6 accounts for negative values of wealth and,

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as was the case for high school graduation, this modified definition has no qualitative impact on the results.

[Table 4 here]

Over the past 30 years, U.S. higher educational institutions have taken seriously, and moved to reduce, large socioeconomic gaps in college matriculation. While these gaps have been reduced substantially, a newer gap has formed, wherein students from low-income backgrounds are far less likely to graduate college, even after successfully matriculating. In Table 4 we therefore investigate the role of family income dynamics in predicting college persistence. First, in column 1 we find that the recency of exposure to poverty—just prior to graduation—is a large and statistically significant negative predictor of persistence, at -0.20. When we consider the role of poverty persistence—anywhere from 1 to 5 survey years in poverty during adolescence—we find that 1 and 3 years in poverty reduce the likelihood of persistence by about 0.22. Controlling for family stability factors and wealth in column 3 we find that marital stability increases the likelihood of persistence by 0.15; wealth increases persistence by 0.01, whereas residential moves do not have any negative association to persistence, unlike in Tables 2-3. Moreover, adolescent poverty exposure now negatively predicts persistence for any 1 year, and the magnitude is large at 0.17. These results are largely robust to including controls for SAT and ACT scores, as shown in column 4, though the role of 1 year of poverty exposure during adolescence is now reduced to a negative likelihood of 0.12, from 0.17. In our final models of Table 4, neither poverty before graduation nor poverty persistence are statistically significant— perhaps due to the fact that these factors operate together and are thus difficult to un-bundle. In column 6, we find that initial attendance at a community college stands as a large, negative predictor of college persistence, at -0.27. This descriptive finding could reflect personal and

economic circumstances, which we aim to account for, that contributed to the decision to choose community college as the entry-point into post-secondary education.

[Table 5 here]

We now move to examining the link between permanent income levels and income volatility of parents during adolescent years, and subsequent educational outcomes. First, in Table 5, we estimate equation (2) via OLS to determine the how these factors, alongside family stability measures and demographics, ultimately relate to high school graduation outcomes. Consistent with work by Hardy (2014) and others, we find that permanent income is a large and consistently positive predictor of high school graduation, with likelihoods ranging from 0.10 to 0.04 over columns 1-3. The permanent income-high school graduation link is attenuated by the inclusion of family stability measures and controls for SAT and ACT scores—which themselves likely capture a mix of ability, accumulated skills, and socio-economic advantage factors. It is worth noting that the estimated impacts of low permanent income persist across almost all models in Tables 5-6, but are notably smaller than many of the poverty-educational attainment associations documented in Tables 2-4. Here as before, residential moves negatively predict high school graduation, from -0.8 to -0.05, and marriage positively predicts graduation, with a likelihood of 0.09 to 0.10. Income volatility, as measured by the transitory variance definition discussed in equation (3), is consistently negatively associated with the likelihood of high school graduation, with a range of 0.08 to 0.05. This relationship is robust to the inclusion of family stability measures of residential moves and marital stability, as well as student test score measures. Wealth exhibits a small positive link to high school graduation of approximately 0.005.

[Table 6 here]

Columns 4-6 of Table 5 focus on how average family income below the median—Low Income—potentially raises larger consequences separately as well as for families exposed to income volatility. One reason we might be concerned about income volatility in this specific context is that households with lower resources may lack the necessary buffers to withstand unforeseen shocks to income. We find that income volatility is not uniquely important in any non-separable manner for families with average incomes below the median relative to those with incomes above the median. This result is consistent across all three model specifications. Equally consistent is the finding that low income negatively predicts the likelihood of high school graduation by 0.12 to 0.07.

In a set of companion models, shown in Tables 6-7, we estimate the same model for college persistence. In columns 1 and 2 of Table 6, we find that permanent income during adolescence is a large, consistently positive predictor of college persistence; income volatility, on the other hand, has no statistically significant relationship. Moving to column 4, matriculating to a community college first, like in our prior models, lowers the likelihood of college persistence by 0.27. Moving to Table 7, we more closely examine the low-income-income volatility link, finding that income below the median is a large, negative predictor of college persistence. Troublingly, the likelihood of persistence for college-goers from families with average income below the median during adolescence ranges from -0.31 to -0.16; the -0.16 likelihood holds after controlling for family stability and wealth, as well as SAT and ACT scores (column 3). In column 4, the same strong, negative community college-persistence likelihood of 0.27 emerges as in Table 6.

6. Conclusion and Policy Implications

Using the Transition to Adulthood data along with the main family file from the Panel Study of Income Dynamics, we examine the link between parental income dynamics and educational persistence. Specifically, we examine how multiple years in poverty during adolescence as well as adolescent (parental) permanent income and income volatility predict educational attainment and persistence. Given the importance of educational attainment as a mechanism to facilitate upward mobility, our results are troubling, as parental economic conditions strongly influence high school graduation and post-secondary outcomes. That family economic background influences these educational outcomes is consistent with recent work by Pfeffer (2018), who finds wealth inequality to be a major driver of the intergenerational transmission of college degree attainment. Our examination is complementary and distinct, insofar as poverty spells, income volatility, and low permanent income represent unique channels through which the decision to attend college, as well as the likelihood of completion, could be impacted.

We find that multiple years of exposure to poverty during adolescence negatively predicts high school graduation, and the recency of poverty exposure seems to drive much of this association. This is important given that high school graduation is a necessary condition for matriculation into college of any type. Poverty exposure negatively predicts college attendance as well, though somewhat less once SAT and ACT scores are accounted for. Persistence of exposure to poverty is associated with college attendance and graduation, though this link is attenuated upon controlling for family stability measures often correlated with poverty, as well as test scores. Here again, poverty exposure just prior to graduation seems especially important, lowering the likelihood of college persistence by 0.20. Throughout our inquiry, family stability

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measures such as marital stability during adolescence positively predict high school graduation and college persistence, though for college matriculation family wealth renders marital stability as unimportant statistically.

Our evidence with respect to the role of permanent income, in Tables 5 and 6, is consistent with the evidence on poverty exposure. Within these same models, we find that family income volatility in the adolescent years leading up to high school graduation is negatively associated with the likelihood of either high school graduation or college persistence. As noted above, wealth has a consistent, albeit small, positive association with high school graduation and college matriculation; there is a weaker link between family wealth and college persistence. Finally, while policymakers have rightly emphasized the role of community college education as an affordable alternative, it is clear that young adults whose first college attendance is at a community college have lower rates of persistence. This may be due to the possibility that a share of these respondents did not intend to complete a two- or four- year degree; it is nonetheless important to note that entrance into a 2-year degree granting institution is associated with lower attainment for academically equivalent students.

The mechanisms driving the community college-4-year attainment relationship warrant further investigation. One possible explanation may be that many students choosing community colleges do so because of low tuition costs and the ability to enroll part time or at night, due to financial barriers and personal work or family obligations which themselves are likely to limit degree attainment. Indeed, we find in separate models (not shown) that poverty spells, low permanent income during adolescence, and family instability strongly predict community college attendance. At a minimum, these patterns raise questions about student readiness, and the varied

instances in which community college may serve as a bridge or roadblock towards post-secondary educational attainment.

These findings are subject to some important limitations and caveats. One source of limitations our findings are due to the structure of the PSID data. Families and the young adults surveyed in the PSID-TA are interviewed only biennially. This affects the precision of our measures of both the dependent variables and key independent variable of interest. At the time of each PSID-TA survey, young adults who had been members of a PSID household and had reached the age of 18 since the last family interview were selected for inclusion in the PSID-TA sample. Since the survey is biennial, at the time of the first PSID-TA interview, respondents can be anywhere from 18 to 20 years old. So, questions about a respondent's post-secondary enrollment (or dropout) are administered at different times, introducing measurement error. Similarly, measurement of income in the family files is irregular, and our measures of inter-temporal income variation understate volatility. Both sources of measurement error likely contribute to attenuation bias. With the relatively small sample size available in the PSID-TA, the limitations this imposes on power are consequential. In our continuing work, we plan to make use of more detailed questions available about the timing of transitions to limit these problems, and to explore the use of supplemental time diary data.

A second limitation for the current paper pertains to the research design. Naturally, poverty during childhood can only be studied using observational data, so the potential for omitted variables bias in models like ours is a persistent threat to validity. While we make use of the features of the PSID to control for parental and family changes that may coincide with adolescent poverty, standardized measures of achievement, as well as cohort fixed effects, our results cannot be interpreted as causal.

Despite these limitations, the current results do suggest implications relevant for policy, economic outcomes, and growth. In terms of policy, the ebbing of public funding for higher education in the United States has meant that need-based financial aid is becoming increasingly vital for access to post-secondary education for low-income families. Our findings suggest that inter-temporal variations in income—specifically poverty spells and income volatility—could negatively affect high school graduation, college going, and college completion for children from these families. This supports the possibility that need-based financial aid does not sufficiently buffer families from income loss, and that aid should not be withdrawn or limited in the case of financial windfalls. Our findings therefore suggest that, on net, these effects limit educational attainment.

A more complete understanding of how family economic circumstances, including income, exposure to poverty, and wealth, shapes young adults' educational outcomes is vital to better understanding how economic opportunity is transmitted, and how to enhance human development and growth in the future. We have not fully explored the mechanisms through which these dynamics operate, but we can rule out secular trends as well as race, gender, family marital status, family residential moves, and measures of student ability. Policymakers might consider the array of immediate financial and psychic costs imposed upon students in the event of short and longer-term economic shocks that families may face. Low cost interventions may include aggressive financial counseling to help students connect with loanable funds markets, while higher cost interventions would include generous supplemental school-level financial aid loans and grants distributed to students with sudden, urgent needs.

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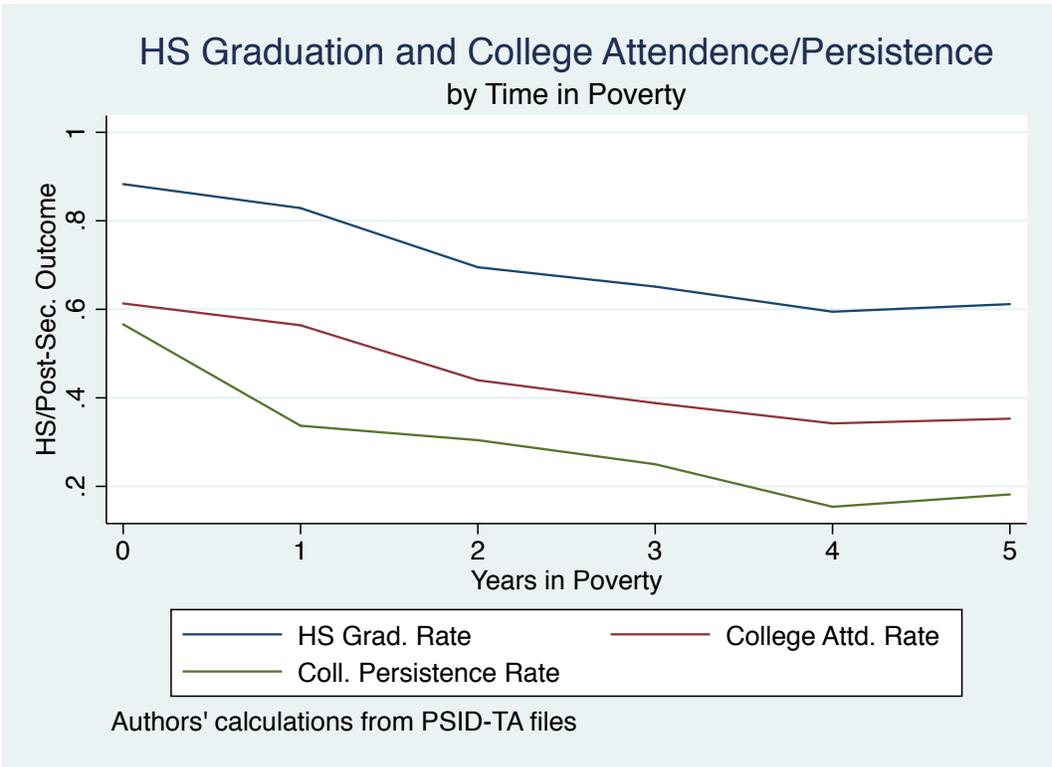
Figure 1. High School Graduation and College Attendance by Years in Poverty
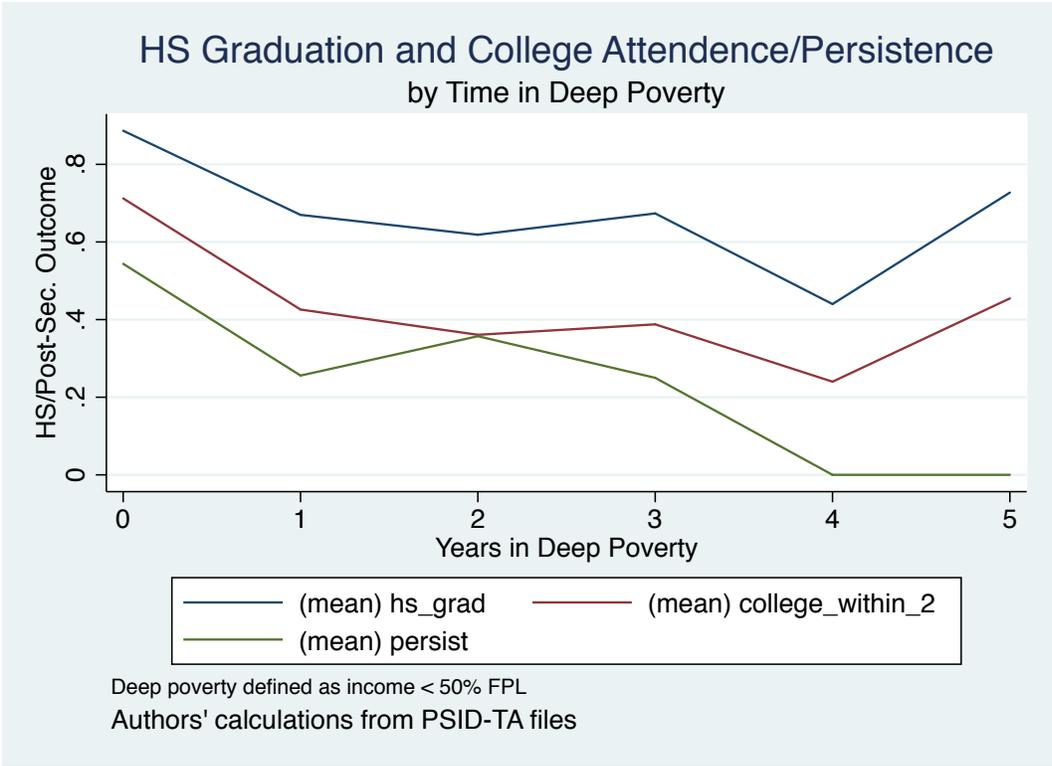
Figure 2. High School Graduation and College Attendance by Years Below 50% of Poverty

HS Graduation and College Attendence/Persistence by Time in Near Poverty

Near poverty defined as income < 200% FPL
Authors' calculations from PSID-TA files
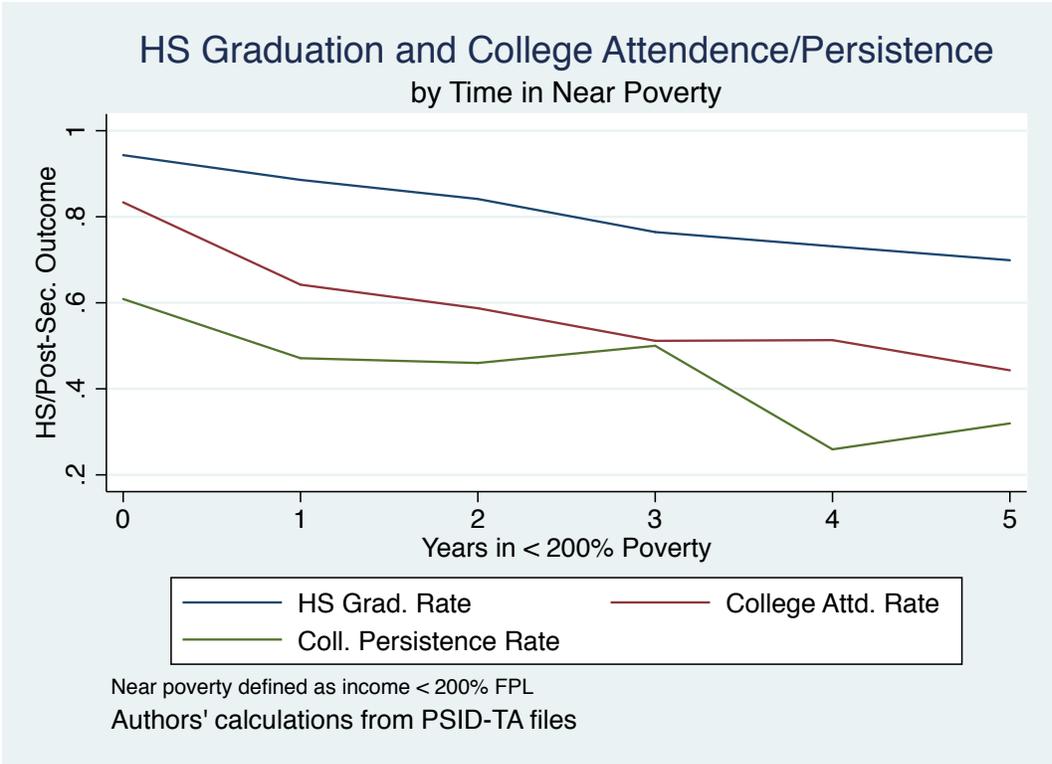
Figure 3. High School Graduation and College Attendance by Years in Near Poverty

Table 1. Descriptive Statistics

	Mean	sd
High School Graduation	0.855	0.352
College within 2 Years	0.693	0.461
College Persistence	0.551	0.498
No. Years in Poverty	0.554	1.166
Poverty Prior to Grade 11/12	0.113	0.317
Ln Permanent Income	11.13	0.799
Transitory Volatility	0.395	0.334
Black	0.171	0.376
Female	0.483	0.500
Prop. Years Family Move	0.240	0.303
Prop. Years lived with Married Parents	0.682	0.419

Table 2: Predictors of High School Graduation

	(1)	(2)	(3)	(4)	(5)	(6)
Poverty in Grade 11/12	-0.263***				-0.123***	-0.126***
	(0.022)				(0.030)	(0.030)
1 Yr. in Poverty		-0.085***	-0.045*	-0.018	0.012	0.011
		(0.021)	(0.022)	(0.022)	(0.023)	(0.023)
2 Yrs. in Poverty		-0.251***	-0.176***	-0.157***	-0.109**	-0.112**
		(0.033)	(0.034)	(0.033)	(0.035)	(0.035)
3 Yrs. in Poverty		-0.243***	-0.140***	-0.098**	-0.026	-0.032
		(0.034)	(0.036)	(0.035)	(0.039)	(0.039)
4 Yrs. in Poverty		-0.287***	-0.172***	-0.160***	-0.082	-0.089
		(0.040)	(0.043)	(0.042)	(0.046)	(0.045)
5 Yrs. in Poverty		-0.330***	-0.238***	-0.202***	-0.080	-0.085
		(0.049)	(0.050)	(0.048)	(0.056)	(0.056)
Ln (Wealth)			0.005**	0.003	0.002	
			(0.002)	(0.002)	(0.002)	
Wealth w/ Negatives						-0.000
						(0.001)
Black	-0.081***	-0.047*	-0.004	-0.013	-0.017	-0.019
	(0.018)	(0.019)	(0.020)	(0.019)	(0.019)	(0.019)
Female	0.072***	0.067***	0.073***	0.062***	0.064***	0.064***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Prop. Moves			-0.097***	-0.070**	-0.067**	-0.074**
			(0.025)	(0.024)	(0.024)	(0.024)
Prop. Time Married			0.101***	0.090***	0.090***	0.093***
			(0.020)	(0.019)	(0.019)	(0.019)
Constant	0.836***	0.857***	0.720***	0.955***	0.961***	0.978***
	(0.018)	(0.018)	(0.031)	(0.078)	(0.078)	(0.077)
Year fixed effect?	Yes	Yes	Yes	Yes	Yes	Yes
Control for SAT/ACT score?	No	No	No	Yes	Yes	Yes
R-squared	0.088	0.096	0.121	0.177	0.184	0.183
Number of Observations	2463	2500	2420	2420	2411	2411

All models control for transition year. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 3: Predictors of College Matriculation (within 2 Years)

	(1)	(2)	(3)	(4)	(5)	(6)
Poverty Before Graduation	-0.113***				0.027	0.015
	(0.032)				(0.042)	(0.042)
1 Yr. in Poverty		-0.148***	-0.089**	-0.060*	-0.071*	-0.072*
		(0.028)	(0.028)	(0.027)	(0.029)	(0.029)
2 Yrs. in Poverty		-0.150**	-0.056	-0.027	-0.040	-0.050
		(0.048)	(0.048)	(0.047)	(0.049)	(0.049)
3 Yrs. in Poverty		-0.187***	-0.088	-0.044	-0.062	-0.071
		(0.049)	(0.050)	(0.049)	(0.054)	(0.054)
4 Yrs. in Poverty		-0.171**	-0.029	-0.005	-0.025	-0.036
		(0.060)	(0.061)	(0.060)	(0.065)	(0.065)
5 Yrs. in Poverty		-0.045	0.038	0.069	0.040	0.031
		(0.075)	(0.074)	(0.072)	(0.083)	(0.083)
Ln (Wealth)			0.013***	0.010***	0.010***	
			(0.002)	(0.002)	(0.002)	
Wealth w/ Negatives						0.004***
						(0.001)
Black	-0.115***	-0.080**	-0.027	-0.028	-0.030	-0.036
	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)
Female	0.068***	0.065***	0.060***	0.058***	0.056***	0.056***
	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)	(0.016)
Prop. Moves			-0.170***	-0.149***	-0.146***	-0.158***
			(0.031)	(0.030)	(0.030)	(0.030)
Prop. Time Married			0.044	0.038	0.034	0.040
			(0.025)	(0.024)	(0.025)	(0.025)
Constant	0.818***	0.831***	0.661***	0.706***	0.711***	0.766***
	(0.022)	(0.022)	(0.039)	(0.095)	(0.095)	(0.094)
R-squared	0.033	0.047	0.091	0.140	0.139	0.134
Number of Observations	2055	2091	2019	2019	2011	2011

All models control for transition year fixed effects. Columns 4 and 5 control for SAT and ACT scores. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 4: Predictors of College Persistence

	(1)	(2)	(3)	(4)	(5)	(6)
Poverty Before Graduation	-0.204**				-0.099	-0.033
	(0.072)				(0.098)	(0.095)
1 Yr. in Poverty		-0.222***	-0.170**	-0.121*	-0.101	-0.099
		(0.061)	(0.061)	(0.060)	(0.064)	(0.062)
2 Yrs. in Poverty		-0.001	0.107	0.147	0.200	0.132
		(0.130)	(0.131)	(0.128)	(0.138)	(0.134)
3 Yrs. in Poverty		-0.218*	-0.100	-0.034	0.006	-0.062
		(0.111)	(0.113)	(0.110)	(0.117)	(0.114)
4 Yrs. in Poverty		-0.245	-0.087	-0.079	-0.018	0.011
		(0.147)	(0.149)	(0.146)	(0.158)	(0.153)
5 Yrs. in Poverty		-0.091	0.028	0.068	0.165	0.084
		(0.148)	(0.149)	(0.146)	(0.174)	(0.169)
Ln (Wealth)			0.014**	0.009	0.008	0.007
			(0.005)	(0.005)	(0.005)	(0.005)
Black	-0.187***	-0.169**	-0.091	-0.071	-0.071	-0.117*
	(0.052)	(0.053)	(0.056)	(0.056)	(0.056)	(0.054)
Female	0.060	0.060	0.070*	0.087**	0.085**	0.086**
	(0.033)	(0.033)	(0.033)	(0.032)	(0.032)	(0.031)
Prop. Moves			-0.034	-0.021	-0.020	-0.007
			(0.073)	(0.072)	(0.072)	(0.070)
Prop. Time Married			0.147**	0.140**	0.137**	0.103*
			(0.053)	(0.052)	(0.052)	(0.051)
1st Coll. a Comm. Coll.						-0.273***
						(0.037)
Constant	0.649***	0.664***	0.362***	0.024	0.035	0.295
	(0.038)	(0.038)	(0.080)	(0.177)	(0.177)	(0.175)
R-squared	0.036	0.043	0.066	0.115	0.115	0.167
Number of Observations	890	896	889	889	889	889

All models control for transition year. Columns 3 and 6 control for SAT and ACT scores. Standard errors in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 5: Predictors of High School Graduation

	(1)	(2)	(3)	(4)	(5)
Poverty in Grade 11/12	-0.263***				-0.123***
	(0.022)				(0.030)
1 Yr. in Poverty		-0.085***	-0.045*	-0.018	0.012
		(0.021)	(0.022)	(0.022)	(0.023)
2 Yrs. in Poverty		-0.251***	-0.176***	-0.157***	-0.109**
		(0.033)	(0.034)	(0.033)	(0.035)
3 Yrs. in Poverty		-0.243***	-0.140***	-0.098**	-0.026
		(0.034)	(0.036)	(0.035)	(0.039)
4 Yrs. in Poverty		-0.287***	-0.172***	-0.160***	-0.082
		(0.040)	(0.043)	(0.042)	(0.046)
5 Yrs. in Poverty		-0.330***	-0.238***	-0.202***	-0.080
		(0.049)	(0.050)	(0.048)	(0.056)
Ln (Wealth)			0.005**	0.003	0.002
			(0.002)	(0.002)	(0.002)
Black	-0.081***	-0.047*	-0.004	-0.013	-0.017
	(0.018)	(0.019)	(0.020)	(0.019)	(0.019)
Female	0.072***	0.067***	0.073***	0.062***	0.064***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Prop. Moves			-0.097***	-0.070**	-0.067**
			(0.025)	(0.024)	(0.024)
Prop. Time Married			0.101***	0.090***	0.090***
			(0.020)	(0.019)	(0.019)
Constant	0.836***	0.857***	0.720***	0.955***	0.961***
	(0.018)	(0.018)	(0.031)	(0.078)	(0.078)
Year fixed effect?	Yes	Yes	Yes	Yes	Yes
Control for SAT/ACT score?	No	No	No	Yes	Yes
R-squared	0.088	0.096	0.121	0.177	0.184
Number of Observations	2463	2500	2420	2420	2411

All models control for transition year. Standard errors in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 6: Income Volatility and College Persistence

	(1)	(2)	(3)	(4)
Permanent Income	0.141***	0.096***	0.043	0.020
	(0.023)	(0.027)	(0.028)	(0.027)
Income Volatility	-0.021	-0.007	0.013	-0.014
	(0.061)	(0.063)	(0.061)	(0.060)
Ln (Wealth)		0.009	0.006	0.006
		(0.005)	(0.005)	(0.005)
Black	-0.124*	-0.087	-0.068	-0.120*
	(0.052)	(0.055)	(0.055)	(0.054)
Female	0.067*	0.073*	0.090**	0.089**
	(0.032)	(0.032)	(0.032)	(0.031)
Prop. Moves		-0.047	-0.044	-0.022
		(0.074)	(0.073)	(0.071)
Prop. Time Married		0.096	0.119*	0.094
		(0.055)	(0.054)	(0.053)
1st College a Comm. Coll.				-0.274***
				(0.037)
Constant	-0.975***	-0.649*	-0.414	0.103
	(0.275)	(0.293)	(0.330)	(0.328)
R-squared	0.068	0.073	0.114	0.166
Observations	896	889	889	889

All models control for transition year fixed effects. Columns 3 and 4 control for SAT and ACT scores. Standard errors in parentheses * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 7: Income Volatility and College Persistence Among Low Income Respondents

	(1)	(2)	(3)	(4)
Low Income	-0.308***	-0.220***	-0.159*	-0.115
	(0.061)	(0.066)	(0.066)	(0.064)
Income Volatility	-0.101	-0.074	-0.046	-0.062
	(0.077)	(0.079)	(0.078)	(0.076)
Low Income × Volatility	0.213	0.173	0.162	0.137
	(0.125)	(0.125)	(0.123)	(0.119)
Ln (Wealth)		0.011*	0.007	0.006
		(0.005)	(0.005)	(0.005)
Black	-0.140**	-0.095	-0.072	-0.122*
	(0.052)	(0.055)	(0.055)	(0.054)
Female	0.065*	0.073*	0.091**	0.090**
	(0.032)	(0.032)	(0.032)	(0.031)
Prop. Moves		-0.034	-0.036	-0.017
		(0.074)	(0.073)	(0.071)
Prop. Time Married		0.091	0.102	0.078
		(0.055)	(0.054)	(0.053)
1st College a Comm. Coll.				-0.271***
				(0.037)
Constant	0.715***	0.486***	0.112	0.362*
	(0.044)	(0.088)	(0.181)	(0.179)
R-squared	0.068	0.073	0.117	0.168
Observations	896	889	889	889

All models control for transition year fixed effects. Columns 3 and 4 control for SAT and ACT scores. Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001. Low income is defined as family income below the median.