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The Female College Boom, Educational Mobility, and Overeducation in the United States

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by

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ABSTRACT

The Female College Boom, Educational Mobility, and Overeducation

by

Vedant Koppera

In this work I present three essays related to the rising number of female college graduates relative to men, intergenerational mobility in education, and the prevalence of overeducated workers during the great recession.

In the first chapter co-authored with Associate Professor Aashish Mehta (UC Santa Barbara), we ask whether shifting male and female employment patterns can help to explain why the US college boom between 1981 and 2005 was dominated by women. We make three contributions. First, we show that while a massive feminization of high-wage, high-skill occupations plausibly contributed to the female college boom, general, structural movements of labor (undifferentiated by gender) from industrial work into education-intensive services should have encouraged male rather than female college attendance. Previous work has suggested that both types of employment shifts would have contributed to the female college boom. Second, we show that women's occupational upgrading was too large and ubiquitous to be explained by their growing educational advantage. This is consistent with a causal connection running from gendered employment trends to a female college boom. Third, we show that gender specializations in many occupations deepened,

with college educated women gravitating towards jobs offering institutionally protected wages.

In the second chapter, I estimate the intergenerational transmission of education in the United States between 1980 and 2013. I find that intergenerational persistence in education has increased substantially among blacks in recent years while remaining stable among whites and Hispanics. I observe this trend when using data from the Panel Study of Income Dynamics as well as the National Longitudinal Surveys of Youth. I demonstrate that much of the increase in educational persistence among blacks is due to decreases in upward mobility. The increase in black educational persistence is found in both two-parent and single-parent households, and I do not find similar trends and differences when estimating intergenerational income persistence.

In the third and final chapter, I use the method introduced by Gottschalk and Hansen (2003) to analyze the rate of overeducation among workers with exactly a college degree between 2006 and 2013. To my knowledge, this is the first study to use this method to analyze trends in overeducation during the great recession in the U.S. I find that the proportion of workers with exactly a college degree working in occupations offering low college premiums increased during great recession and fell afterwards. An increase in the rate in overeducation could be due to more college-educated workers working in noncollege occupations that were noncollege in the past or because there was an increase in the number of noncollege occupations. I show that changes in the rate of overeducation are mostly due mostly to the latter. When shutting the down the flexibility for occupations to change from college to noncollege (and vice versa), the rate of overeducation increases only slightly between 2006 and 2013. Regardless, these findings run contrary to the secular decline of the rate of overeducation during the end of 20th century documented by previous research.

Gendered Employment Trends and the Female College Boom

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Abstract

We ask whether shifting male and female employment patterns can help to explain why the US college boom between 1981 and 2005 was dominated by women. We make three contributions. First, we show that while a massive feminization of high-wage, high-skill occupations plausibly contributed to the female college boom, general, structural movements of labor (undifferentiated by gender) from industrial work into education-intensive services should have encouraged male rather than female college attendance. Previous work has suggested that both types of employment shifts would have contributed to the female college boom. Second, we show that women's occupational upgrading was too large and ubiquitous to be explained by their growing educational advantage. This is consistent with a causal connection running from gendered employment trends to a female college boom. Third, we show that gender specializations in many occupations deepened, with college educated women gravitating towards jobs offering institutionally protected wages.

Keywords: Women, College Premium, Employment, Occupation

JEL Codes: J21, J16, I21, J24

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INTRODUCTION

The US college boom has been dominated by women. The share of female workers, aged 25-30 holding college degrees rose rapidly, from 25.6% in 1981 to 37.2% in 2005. Meanwhile, the corresponding male share edged up from 24.3% to 26%. Given that universities charge men and women equal fees, this suggests that demand for college education has grown much faster amongst women than amongst men. With the college wage premium rising for both men and women (Goldin and Katz, 2009), it is useful to ask why women have attended college in such numbers while men have not. Previous studies provide several explanations, which mostly involve gender differences in abilities, familial responsibilities and labor force participation trends.[1] This paper focuses on a different possibility: that shifts of male and female employment across industries and occupations (henceforth, "sectors") may have increased the benefits of college education more for women than for men.

[Figures 1 and 2 about here]

[1]There are three prominent explanations for this. First, women are often better prepared academically and psychologically for higher education than men, which should make their attendance rates more responsive to increases in college premiums (Becker et al., 2010; DiPrete and Buchman, 2013; Goldin et al., 2006; Perkins, 2004). There is also evidence that women's academic advantage has grown in recent decades (Cho, 2007). Second, given that women bear the majority of the cost of raising children post-separation, rising rates of divorce increase the incentives for women go to college to ensure that they will have the means to take care of themselves and their children (Bronson, 2013).Third, improvements in family planning technology have lifted female labor force participation rates (Bailey, 2006), possibly encouraging more women to invest in college in order to take advantage of high labor market returns to education (Goldin et al., 2006).

The literature identifies two types of employment shifts that may have had this effect. The first type involves *changes in gender representation* within industries and occupations. The key shift of this type is an increase in the representation of women in high-skill, high-wage occupations (McDaniel et al., 2011). Figure 1 clearly shows that, on average, women have moved into better paying occupations while men have not. Figure 2 shows that this has resulted in a massive feminization of higher-wage jobs between 1981 and 2005: on average, the change in the share of each occupation that was comprised of women increases by 19.5 percentage points with each doubling of the average occupational wage. The second type of shift involves *structural changes*, arising from the growth and decline of employment (not differentiated by gender) in different sectors. For example, deindustrialization and the accompanying shift of workers into services may have generated larger incentives for women to attend college, because services tend to employ women and college graduates more intensively than manufacturing. Goldin et al. (2006) argue that shifts in gender representation within sectors and structural employment shifts both contributed to the female college boom.[2] In this study we carefully examine these two explanations.[3]

[2] Specifically, they note that one shift since World War II that "greatly increased the pecuniary return to women's higher education… was a large shift in female employment out of the most traditionally female occupations such as teaching and into many previously male-dominated jobs" (p. 151), and that (p. 152) this was "reinforced, first in the 1960s, but especially since 1980, by a rising college wage premium and by secular labor demand shifts favoring occupations and industries disproportionately employing college-educated workers, particularly female college graduates (Katz & Murphy, 1992)."

[3] Cho (2007) shows that aggregate employment shifts across industries cannot explain the female college boom. We go further by analyzing the effects of gendered employment shifts, as well as the

We will make three contributions to the literature on gendered education and employment trends. The first contribution is to examine, using decomposition methodologies, whether shifts in *pooled* and *gender-specific* sectoral employment shares were large enough and in the right direction to help explain why the college boom was dominated by women. Pooled employment shares are measured from samples that pool men and women, while gender-specific employment shares are measured after splitting our samples by gender. Shifts in pooled employment shares capture structural changes, while shifts in gender-specific employment shares capture the combined effects of structural changes and changes in gender-representation within sectors. Differences in the explanatory power of gender specific and pooled employment trends shed light on the role of changing gender representation within sectors.

We start with standard between-within sector decompositions of the changes in the utilization of male and female college graduates (Katz and Autor, 1999). We find that women have moved into high-skill occupations far faster than men, and that these employment trends account for 45-58% of gender differences in college attainment over time. Next, recalling that women have shifted into higher paying occupations while men have not, we conduct between-within sector decompositions of the shift in the male and female college wage premiums. Similar to the previous exercise, we find that women's occupational shifts were larger than men's and should have done more to lift women's college premiums than to lift

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role of *occupational* change, and the effects on the college premium of movements of workers between low and high-wage sectors.

men's college premiums. Thus, we argue that gender-specific employment trends went in the right direction to help account for the fact that women attended college in greater numbers than men. On the other hand, both exercises show that pooled employment trends do not shed light on why women went to college more than men. We reconfirm this negative claim using Katz and Murphy's (1992) between-sector demand shift index, which actually predicts a slight male college boom on the basis of pooled employment trends. Deindustrialization reduced demand for high-school educated men, which should have encouraged more men to attend college.[4]

Our second contribution, given that the feminization of high-paying occupations is important, is to ask and answer an obvious question. Couldn't these occupational shifts simply be a consequence of women's growing educational advantage? If this were the case, no causality could run back from shifting gendered employment opportunities to the female college boom. We provide three types of evidence that this is not the case. First, we show that female occupational upgrading and male occupational stagnation are observed even when we limit our samples to workers with exactly the same level of education. Second, a two-stage regression analysis shows that, no matter how occupations' pay-scales are adjusted for the education levels of the workers they employ, higher-paying occupations feminized

[4] Diprete and Buchman (2013) hypothesize that structural shifts should have favored a male rather than a female college boom. Ours may be the first paper to test this idea. Our results complement those from Weinberg (2000) that computerization within sectors would also have encouraged a male college boom by decreasing the demand for male high-school graduates more than for female high-school graduates.

more rapidly than lower-paying occupations. This trend also is observed within groups of workers with equal education levels. Third, we show that women moved into high paid occupations much faster than their pace of educational advancement would have predicted. Conversely, modest improvements in male educational attainment predict some movement of men into high-wage jobs, but roughly none is observed. Thus, much of the female occupational upgrading is unlikely to be due to educational upgrading. This is consistent with a causal connection running from gendered employment trends to a female college boom.

Our final contribution is to identify the industries and occupations that may have driven the college boom by offering better job opportunities to college graduates. We show that the representation of women in these key sectors grew rapidly, and that some of these changes deepened gender specialization in occupations. In particular, we show that while male college attendance was sustained by employment in financial services, healthcare and education played this role for women. Moreover, college-educated women were disproportionately drawn to jobs offering institutionally protected wages, even as men were edged out of them. Thus, we show that men and women have utilized higher education in very different ways in the labor market, and that gender-specific employment trends are potentially useful to consider when attempting to explain why the college boom has been a predominantly female phenomenon.

DATA

Our data come from the Current Population Survey, survey years 1982 and 2006 (King et al., 2010). We created two samples, a count sample to capture total labor supply and a nested wage sample that captures the wages of all full-time workers in the United States. The creation of these samples closely follows the methodology of Katz and Murphy (1992). The count sample includes only workers who have worked at least one week in the preceding year, including immigrants. We calculated an individual's annual hours worked by multiplying weeks worked and usual weekly hours. Starting in 1992, the years of schooling variable was reported in multi-grade brackets. For individuals whose schooling levels are reported this way, we impute years of schooling at the middle grade level of their bracket. We calculate work experience based on schooling and age, and drop workers with more than 40 years of experience.

The wage sample excludes self-employed and unpaid family workers. It includes only full time wage and salary workers who were in the labor force for at least 39 weeks, and worked at least one week in the previous year. We also excluded individuals who did not work part of the previous year due to school, retirement, or military service. Our wage measure is log-weekly wages in 1999 dollars. Top-coded incomes are multiplied by 1.45

following the methodology of Katz and Murphy (1992).[5] Also following their trimming procedures, we dropped individuals who reported a weekly income of less than $115.24 in 1999 dollars (matching their cutoff of $67 a week in 1982 dollars).

COLLEGE ATTAINMENT AND COLLEGE PREMIUMS

[Table 1 about here]

Table 1 shows the percentage of workers with at least a college education, a post-college education, and the college premium by demographic group in 1981 and 2005. We define six demographic groups by sex and three experience levels: low (2-8 years); medium (9-16 years) and high (17-23 years). The attainment rates are calculated from the quantity sample, while the college premium is calculated from the wage sample.

The table shows that the higher-education boom was overwhelmingly female. College and post-college attainment rose far faster amongst women than amongst men in every demographic group. By 2005 low experience female workers were 35% more likely to hold a college degree than low experience men (35.9% vs. 26.5%), and 51% more likely to hold a post-college degree.

[5] Top-coding occurs only in the 1982 survey, where approximately 1% of the male population had top-coded incomes compared to .04% for the female population. Trimming the wage sample by dropping men/women in the top and bottom 1% of the male/female wage distribution does not qualitatively alter our findings.

We conceive of the college premium as a convenient measure of wage difference between workers who have obtained a college education and those who have not. We define it simply as the difference in average log-wages between workers with a college degree or higher, and workers with only a high school degree. Including workers with graduate education in the pool of college educated workers will allow us to investigate whether the female college boom is related to the growing importance of higher-paying jobs that may require post-college credentials.

College premiums for all three experience groups in 1981 were higher amongst women than men. Amongst low experience workers, the premium increased by a similar amount for both genders. Given that women and men pay the same direct costs for post-secondary education, this shared trend may indicate, consistent with the narrative thread of this paper, that younger women experience fewer social restrictions on their educational and work choices than older women did (Becker et al., 2010). Amongst medium and high experience workers, women also earned a higher premium in 1981, but this difference is completely reversed by 2005. Among medium and high-experience workers, the college premium increased much more for men than for women. This adds to the mystery of the female college boom – if male and female workers are fairly close substitutes, one might have expected the college boom to be disproportionately male.

The remainder of this paper asks whether shifts in employment across sectors account for gendered trends in college attainment. To keep our tables small, we will present results only for low and high experience workers.[6] The results of all of our analyses for the medium experience workers fall in between those for the low and high experience group, with a tendency to resemble the results for the high experience group more closely. This suggests that our findings are detecting accelerating trends.

BETWEEN-WITHIN ANALYSES

We begin analyzing the relationship between employment trends and the college boom using decomposition analyses with complementary strengths and weaknesses. The first is a standard shift-share analysis of the increase in college attainment (Autor et al., 1998; Berman et al., 1994). The second is a decomposition capturing how changes in employment opportunities should have influenced the college premium itself (Mehta et al., 2013). While the first approach directly accounts for increases in the quantity of college graduates, it does not involve any wage information. It therefore cannot shed light on how employment shifts from low- to high-paying jobs of equal education intensity may have increased the wage incentives to attend college. The latter approach illuminates the connections between employment shifts and incentives, but is mute on how many attend college in response to these changing incentives. In combination, the two approaches carry one robust message:

[6] Tables including results for medium experience workers are available on request.

gender-specific employment trends supported a largely female college boom, while pooled employment trends did not. Finally, we will show that a third, influential between-within decomposition of the relative demand for college graduates that suppresses gender differences in employment trends (Autor et al., 1998; Katz and Murphy, 1992) cannot shed light on the gender composition of the college boom.

Effects of employment shifts towards college intensive sectors.

Denote the share of employed workers in some demographic group (defined by age and sex) who have completed at least a college education by γ, the within-sector analog of this share by γ_s, and sectors' employment shares by $P(s)$. Time differencing these variables (Δ), and measuring their levels by the average of their start and end values, the change over time in the employment of college graduates can be decomposed as follows:

$$(1)\quad \Delta\gamma \equiv \underbrace{\sum_s \gamma_s \Delta P(s)}_{\text{Between Sector Shift}} + \underbrace{\sum_s P(s)\Delta\gamma_s}_{\text{Within Sector Shift}} \equiv \sum_s \theta_s$$

This identity provides an account of how the net influx of college-educated labor was absorbed into employment. Sector contributions to absorbing the net influx (θ_s) are large when a sector is college intensive and grows, (i.e. $\gamma_s \Delta P(s)$ is big), or when it is large and its college intensity rises, (i.e. $P(s)\Delta\gamma_s$ is large). Large between-sector shifts arise when employment in more college intensive sectors grows faster than employment in less college intensive sectors, so that the net influx of college graduates could be absorbed without raising college-intensity within sectors. If between-sector shifts can account for the bulk of the net influx of college graduates in each demographic group this suggests that employment shifts into college-intensive sectors created additional demand for college graduates that can explain rising college attainment in that group. Table 2 shows the between-sector component of decomposition (1) for four demographic groups within the count sample. It provides the between-sector shifts in college attainment under several industrial and occupational classifications, and the total shift to be explained $(\Delta\gamma)$.

[Table 2 about here]

The first four columns calculate between-sector shifts using the employment shifts, $\Delta P(s)$ actually experienced by the demographic group in question (i.e using gender-specific shifts). Three important trends stand out. First, occupational change absorbed many more college-educated women than men at any level of occupational disaggregation. For example, 4.2 out of a 9.4 percentage point gender difference in the increase in college attainment amongst low-experience workers can be attributed arithmetically to gender-specific shifts across ten industries and 17 occupations. Thus, 45% of the gender difference in college attainment among low experience workers can be accounted for by the fact that women moved into college-intensive sectors faster than men. This figure rises to 58% among high experience workers. In fact, among high-experience males, gender-specific shifts between disaggregated occupation groups would have reduced the employment of college graduates.

Second, amongst young males, between-occupation shifts are approximately as large as the observed increase in college attainment. This implies that male employment shifts between-occupations provide an almost complete account of the male college expansion, leaving little need to invoke within-sector shifts (such as those arising out of skill-biased technological change) to explain why male college attainment rose.[7] Third, between-sector employment shifts account for more than half of the college expansion amongst young women.

The gender-specific employment trends whose effects we have just examined reflect a combination of two sets of changes: structural changes, such as those resulting from deindustrialization and the growth of the services economy, which would result in a general reallocation of workers in some experience group across sectors; and changes in the gender-mix within sectors. The last four columns of Table 2 focus on the former, structural shifts by measuring $\Delta P(s)$ after pooling genders in each experience cohort (i.e. using shifts in the employment distribution of all workers in an experience group, not shifts specific to men and women in that experience group). If the female college boom was driven by a general

[7] One of the few papers providing evidence connecting changes in production technology to the female college boom (Black and Spitz-Oener, 2010) shows that in West Germany computerization changed the task composition of work similarly for men with low, medium and high education levels. This suggests that technology would not have lifted relative demand for highly-educated men. They provide stronger evidence that technology boosted skill demand amongst women.

growth of college- and female-intensive jobs (due to the expansion of services employment, for example), we would expect similar gender differences in the results in the last four columns as in the first four. Instead, the gender differences in the between shifts are conspicuously missing from the last four columns. If anything, they appear to run in the wrong direction: the pooled employment shifts would have absorbed a slightly larger influx of male than of female college graduates.

Together, the results in Table 2 are consistent with the notion that a feminization of education-intensive jobs, not structural change, has supported the female college boom.

Effects of employment shifts between low-wage and high-wage sectors.

The preceding approach only considers the effects of rising employment shares of education-intensive sectors on the college boom. However, movements between low- and high-wage sectors of equal education intensity may have played a role as well. Consider, for example, the shift that would have occurred as new cohorts of female college graduates were able to enter supervisory positions, instead of the lower-paying secretarial pool. Other things equal, this would boost the female college premium and the incentive for women to attend college. Yet, if female secretaries and supervisors were equally likely to hold college degrees, a one for one substitution of secretaries with supervisors would not cause a net between-sector shift in identity (1).

We therefore employ a simple thought experiment to examine the effects of such shifts on incentives to attend college. Ignoring the non-pecuniary costs and non-wage benefits of post-secondary education, we consider a potential college attendee who must survey the likely employment landscape and decide whether to go to college or not. Other things equal, they are more likely to do so if it improves their odds of obtaining employment in a high-wage sector, or if, conditional on finding employment in some sector, it raises the wage they are likely to earn. Thus, as employment shifts towards sectors that pay well and favor college-educated workers in hiring, or towards those that pay the college-educated substantially more than high-school graduates, the incentive to obtain higher-education becomes stronger. Given that the direct financial costs of higher education are similar for men and women, we will ask whether the inter-sector employment shifts experienced by men and women of different cohorts were of the right sign and magnitude to have done more to incentivize women than men to attend college.

Denote average log-wages among some group of workers at a point in time by w, employment shares $P(\ )$, and college and high-school by *c* and *h* respectively. Restrict the sample to high-school graduates (*h*, workers with exactly twelve years of school) or with a bachelor's degree or higher (*c*). The college premium in some demographic group $(\beta \equiv w_c - w_h)$ can then be expressed as the difference of the employment-weighted average of the log wages earned in each sector by college graduates $(w_{s,c})$ and high-school graduates

$\left(w_{s,h}\right)$: $\beta \equiv \sum_s P(s \mid c) w_{s,c} - \sum_s P(s \mid h) w_{s,h}$. Defining the sector-specific college premium, $\beta_s \equiv \left(w_{s,c} - w_{s,h}\right)$, algebraic manipulation yields:

$$(2)\quad \beta \equiv \sum_s \left[P(s \mid c) - P(s \mid h)\right]\left[w_{s,h} - w_h\right] + \sum_s P(s \mid c)\beta_s \equiv \sum_s C_s$$

This says that a sector's contribution to the college premium $\left(C_s\right)$ will be large if the sector pays high base wages and is more likely to hire a college than a high-school graduate (the first summation), or if it hires many college graduates and offers them much higher wages than it offers to high-school graduates (the second). Growth in the unconditional employment share of such a sector should increase the college premium, other things equal.

To capture this, define a sector's *per-job* contribution to the college premium: $\tilde{C}_s \equiv C_s / P(s)$. This allows us to express (2) as $\beta \equiv \sum_s P(s)\tilde{C}_s$. Time-differencing this identity yields:

$$(3)\quad \Delta\beta \equiv \underbrace{\sum_s \tilde{C}_s \Delta P(s)}_{\text{Between Sector Shift}} + \underbrace{\sum_s P(s)\Delta\tilde{C}_s}_{\text{Within Sector Shift}}$$

This says that the college premium increases either due to labor reallocations between sectors towards those offering high per-job contributions, or because of changes in the relative pay and utilization of college graduates within sectors.

[Table 3 about here]

Table 3 presents the between-sector components of identity (3) using several sector classifications. The bottom row presents the observed total shift in the college premium, as reported in Table 1. To allow for gender differences in education levels and pay within sectors, the per-job contributions, $\tilde{C}_s$, are in all cases estimated for the demographic group in question. As in Table 2, the first four columns of Table 3 provide results when we measure $\Delta P(s)$ using demographic-specific shifts in employment shares across sectors, and the latter four columns provide results when $\Delta P(s)$ is measured for all wage workers in that cohort (i.e. pooling men and women).

The results are similar to those in Table 2. The first four columns show that gender-specific occupational changes would have generated larger increases in the college premium for women than for men, suggesting that gendered employment trends would have increased the incentive to attend college much faster amongst women. Indeed, between-occupation shifts account for between 70% and 84% of the observed shift in the college premium for women, and even shifts between three broad occupation groups can account for around 60% of the rise in the college premium for women of both cohorts. The much smaller between-occupation shifts for men are consistent with the possibility that an inability to shift into high-paying occupations depressed male college attendance rates. Gender-specific occupational changes therefore plausibly increased the incentive to attend college more for women than for men.

Pooled employment shifts predict very similar shifts in the college premium for women and men (the last four columns of Table 3). This again suggests that structural employment trends cannot explain why the college boom was mostly female.

Between-sector shifts in relative skill demand

Katz and Murphy (1992) study the relative supply and demand for skilled workers. To do so, they assume that equally educated and experienced workers earn the same wage in all sectors. This permits them to impute the percentage shift in demand for college equivalent relative to high-school equivalent labor (ΔD) from the percentage shift in the relative supply of college graduates, the percentage shift in the college premium, and the elasticity of substitution between skilled and unskilled labor (σ). Let E denote total employment in efficiency units, with labor of two types: college-equivalent (c) and high-school equivalent (h). Formally, ΔD is imputed as follows:

(4a) $$\Delta \ln\left(\frac{W_c}{W_h}\right) \equiv \frac{1}{\sigma}\left[\Delta D - \Delta \ln\left(E_c / E_h\right)\right]$$

The between sector percentage shift in the demand for some subgroup of workers, k, identified by experience, sex and education, is defined as:

(4b) $$\Delta X_k^d \equiv \sum_s \frac{E_{sk}}{E_k}\frac{\Delta E_s}{E_s},$$

This is the subgroup's employment-share-weighted average of the growth rates of employment in each sector. Demand for subgroup *k* workers grows if sectors that they tend to be employed in grow faster than sectors that they are less frequently employed in. Thus, for example, growth in elementary education boosts demand for female college graduates, and the demise of manufacturing jobs reduces demand for male high-school graduates. We note that wage differences between sectors do not factor into between-sector shifts in this scheme (i.e. replacing secretarial with supervisory work has no effect on demands for college-educated women); and that sectors' employment growth rates $\left(\Delta E_s / E_x\right)$ are only calculated for the overall labor force (i.e. these are not gender-specific shifts).

Proceeding further, between-sector shifts in the demand for subgroups can be aggregated, and these aggregates can then be differenced to yield estimates of the shifts in demand for one group of workers relative to another. Thus, for example, ΔD can be decomposed as:

(4c) $$\Delta D_t \equiv \underbrace{\sum_s \left[\frac{E_{c,s}}{E_c} - \frac{E_{h,s}}{E_h}\right]\frac{\Delta E_s}{E_s}}_{\text{Between Sector Demand Shift}} + \text{Within Sector Demand Shift};$$

Under these definitions, shifts between industries and occupations account for roughly 1/3 of the estimated shift in the relative demand for skilled labor in the US between 1967 and 1987 (Katz and Murphy, 1992). Similar figures have been reported from several other countries and time periods (Kijima, 2006; Mehta and Mohr, 2012; Sanchez-Paramo and

Schady, 2003). These between-sector shifts are smaller than the increase in the supply of college graduates, so that the college premium would have fallen unless there was some other source of higher skills demand. This type of analysis must therefore invoke large residual within-sector increases in skilled labor demand to explain why college premiums rose rather than fell.[8]

Table 4 updates this exercise for the years 1981-2005.[9] We begin with the relative demand for college graduates of either gender (row 9). Given an approximately 25% increase in the overall college premium over this period (not shown), 20.3% increase in the relative supply, and the standard assumption that $\sigma = 1.4$, equation (4a) implies a 55.3% shift in the relative demand for college graduates (of either gender). Between-industry shifts in relative demand (21.8%) account for roughly 40% of this increase in relative demand, and shifts between industries and occupations (9.5%) account for less than half that. Once again,

[8] This between-sector index underestimates the true rightwards shift in relative skill demand when applied to a period of rising skill premiums. However, correcting for this movement along the demand curve using typical values of σ does not alter the qualitative results just stated.

[9] We split the workforce in 320 cells defined by sex, four education classes (<12 years of schooling, 12 years, 13-15 years, >=16 years), and 40 experience categories. We then scaled the total hours supplied by all workers within a cell by the time-averaged relative wages of workers in these cells. We then aggregated these supplies of efficiency labor units up to 8 sex-education supply cells. Next, we measured the time-averaged utilization of labor in efficiency units from each of these 8 aggregated supply cells in 170 industry-occupation cells and the total efficiency labor units utilized in each year in each sector. We used these measures to calculate between sector demand shifts for the 8 supply cells (Equation 4b). We defined high-school as those workers with 12 or fewer years of schooling, and college as workers with 13 or more years of schooling. Table 5 provides the supply and demand shifts by high-school and college, separately by gender and for the entire population.

this suggests that between sector employment shifts should have raised demand for college education more among men than women.

[Table 4 about here]

Comparing between-shifts in rows 4 and 5 to those in rows 2 and 1 respectively, we find that pooled employment trends should have increased demand for female relative to male workers of both education levels. Employment trends should also have generated sharp reductions in demand for high-school educated men (row 1), but not for high-school educated women (row 4); along with smaller gender differences in the shifts in demand for the college-educated (rows 2 and 5). This decline in demand for high-school educated men should have generated larger increases in the relative demand for college amongst men (row 3), than amongst women (row 6). This finding is consistent with the argument that the demise of high-wage but low-skill, male-dominated manufacturing jobs should have increased the demand for college education more amongst men than amongst women (DiPrete and Buchman, 2013). Gender differences in the between-sector shifts in relative skills demand predicted by structural employment trends go in the wrong direction to account for the female college boom.

To sum up, our results so far are consistent with the possibility that gender-specific employment trends help to explain why the college boom was disproportionately female. Conversely, they show that pooled employment trends cannot account for the increase in relative demand for college-educated labor, and shed no light on why it was overwhelmingly met by women. Thus the female college boom was plausibly driven in part by a more rapid occupational upgrading amongst women than amongst men.

WOMEN'S OCCUPATIONAL UPGRADING CANNOT BE ENTIRELY EXPLAINED BY THEIR GROWING EDUCATIONAL ADVANTAGE.

The results thus far show that gender-specific employment shifts were large, and in the right direction to help explain the female college boom. However, as we have already noted, the direction of causality is unclear. Women may have gone to college because high-wage, high-skill jobs became more open to hiring women. Yet, it is also possible that these jobs opened up to women simply because they pulled ahead of men in educational attainment. While some causality likely runs in the latter direction, this section provides evidence that women's occupational upgrading was far too rapid and too pervasive to be entirely attributed to their growing educational advantage over men. This is consistent with a causal connection running from gendered employment trends to gendered educational trends.

[Figure 3 about here]

We begin by showing that women have moved more rapidly than men into jobs that offer higher wages to *equally educated* workers. Figures 3a-b show that amongst post-college educated workers (those with a Master's, professional or doctoral degree, or with 18+ years of schooling), women moved into higher wage occupations, while men did not. Figures 3c-d show that among college educated workers (amongst those with a Bachelor's degree or 16 - 17 years of schooling) women moved into higher-wage occupations, while men moved into lower-wage occupations. Figures 3e-f also show that male high-school graduates moved into occupations that pay high-school graduates less, while the outcomes for female college graduates polarized, with the distribution shifting to the right above the 40^{th} percentile. Thus, female occupational upgrading is observed within every educational class. Changes observed within educational classes are difficult to attribute to educational upgrading.

We now consider the possibility that these shifts in the cumulative distributions were driven by a handful of occupations. We rule out this possibility using several variants of a two-stage regression framework, which shows that the feminization of high-paying jobs is a pervasive and robust phenomenon. In the first stage we use data from 1981, regressing workers' log-wages on a set of up to 254 occupation dummies (excluding the constant term). The dependent variable in the second stage is the change, between 1981 and 2005, in the share of workers in that occupation who are female. We regress this on the occupation wage coefficients from the first stage, and report the results on this coefficient in Table 5. A positive, significant coefficient indicates a greater feminization of higher wage occupations. If the increased representation of women in high-wage occupations was not pervasive, it would be difficult to detect in an analysis in which the unit of the observation is the occupation.

[Table 5 about here]

We experiment with the following variants of this framework to ensure that the finding is robust. Introducing a quartic in years of schooling to the first stage regression changes the definition of a "high-wage" occupation from one that pays well, to one that pays equally-educated workers well. Restricting the first stage sample to male or to female workers allows for the possibility that the occupations that pay women well are not those that pay men well. Weighting by occupations' employment shares in 1981 and 2005 ensures that the result is observed in occupations that were larger in the initial year and larger in the final year. Rows 1-5 of Table 5 indicate that the feminization of higher wage occupations was a pervasive phenomenon, broadly robust to these combinations.

To ensure that women's movement into high-wage occupations was both pervasive and observed within education classes, rows 6-8 of Table 5 present the regression results when the first and second stage samples are limited to workers with exactly high-school, college and post-graduate degrees. We find that the best jobs feminized even amongst groups of workers with the same education level.

[Figure 4 about here]

Finally, we ask counterfactually, *how much* occupational upgrading men and women (separately) should have experienced based only upon changes in their education levels. To simulate these counterfactuals we assume that the distribution of occupations within education groups for men and women remained as they were in 1981, and project the occupational employment shares predicted by for the observed increases in male and female educational attainment between 1981 and 2005.[10] Figure 4 depicts these counterfactual distributions alongside the actual cumulative occupation distributions observed in 1981 and 2005 (the same ones as appeared in Figure 1).

The counterfactual results show that a large portion of female occupational upgrading is not attributable to educational upgrading. The actual cumulative distributions shifted downwards for women at all levels of the occupational ranking. The proportion of this vertical shift that is not attributable to educational upgrading is 25% for the occupation ranked 100th from the bottom, 45% for the occupation ranked 150th from the bottom, and 65% for the 200th ranked occupation. Thus, the share of female occupational upgrading that cannot be attributed to educational upgrading is substantial, and is larger for higher paying occupations. For men, on the other hand, educational upgrading should have resulted in modest occupational upgrading, but none is observed.

These results indicate that women's more rapid occupational upgrading is partly driven by forces other than their growing educational advantage. We previously demonstrated that gender differences in occupational upgrading can account for much of the female college

[10] Figure 4 is calculated from the wage sample. We define five education classes by years of schooling: <12, 12, 13-15, 16-17, >17 years. To calculate the 2005 counterfactual share of employment in each occupation, we multiply the employment share of that occupation within each education class in 1981 by the change in the share of all employees belonging to that education class. We do this separately for men and women. Occupational rank is determined by the wage rank of an occupation calculated from the pooled (male and female) sample.

boom. Together, these results are consistent with a causal connection from rising fale representation in higher paying occupations to the female college boom.

WHICH SECTORS DROVE THE FEMALE COLLEGE BOOM?

Trends

Sector contributions to absorbing the net influx of workers in some group (θ_s) are defined in identity (1). A sector's total contribution to the college premium, C_s, is defined in identity (2). Time differencing (2), the sector's contribution to the shift in the premium is simply the increase in this static contribution.

(5a) $$\Delta\beta \equiv \sum_s \Delta C_s$$

This tells us how much each sector has contributed to the rise in the college premium by creating more and better opportunities for college graduates. Intuitively, the sectors that have played this role are the proximate sources of rising skill demand – they offer the jobs that make it possible for the typical worker to realize a return on their investment in college.

[Table 6 about here]

Table 6 presents the contributions of 7 industries to absorbing the net influx of male and female college graduates and to the increase in their college premiums. The combined services sector absorbed between 86% and 150% of the net influx of college graduates in each demographic group, and this figure is always higher amongst men than women and among younger than older workers.[11] Services also contributed more to the rising premium for men and younger workers. These trends reflect the progressive reduction of employment in the male-dominated agricultural and manufacturing sectors. This hit young men especially hard, releasing young male college graduates to seek employment in the services sector (note the large negative contribution of the manufacturing industry to absorbing young male college graduates).

[Table 7 about here]

Table 7 provides the analogous contributions of 17 occupations. Managerial and professional occupations stand out for being particularly supportive of the college boom. Professional occupations absorbed most of the net influx of young college graduates, and also account for most of the shift in the premium amongst the young. Managers, officials and proprietors also made large contributions to absorbing and rewarding college graduates. As might be expected, however, this occupation group generally absorbed more of the college influx in the more experienced and male groups. Also, consistent with the weakening of glass ceilings, the gender difference in the absorption of college graduates into management is smallest in the youngest experience group.

[11] A sector's contribution can exceed 100% if another sector's contribution is negative.

The importance of service industries and of managerial and professional occupations is easy to reconcile. Services industries employed 78-93% of managers and professionals in each of our four demographic groups in 2005 (table not shown).

[Table 8 about here]

Table 8 examines gendered occupational changes in further detail. It reveals clearly why these changes should have encouraged women rather than men to attend college. The first four columns depict each occupation's contribution per job to the college premium in 1981. The professional and managerial occupations (with the exception of food & fun professionals), typically offered contributions per job that were much larger than the actual college premium. The next six columns of this table show the occupational distribution of male and female workers in 1981 and 2005. The employment shares of professional and managerial occupations, increased respectively by 10 and 4 percentage points amongst women. This is in contrast to only 3 and 2 percentage point increases amongst men. Because women have shifted into these high-contribution occupations rapidly, and men have not, women have reaped the reward that college education offers through these occupations, and between-occupation shifts account for most of the rise in female premium, and less of the rise in the male premium.

The remaining columns of Table 8 show, for each occupation, the ratio of its employment share amongst women to its employment share amongst men. This ratio is analogous to the revealed comparative advantage index (RCA) in the literature on international trade (Balassa, 1965). It is greater than one when women are specialized in the occupation relative to men, and vice versa. We will not speculate on the relative importance of the many possible sources of revealed comparative advantages.[12]

The RCAs indicate that the occupations that contributed most to absorbing and rewarding college graduates (professionals, excluding food and fun, and managers) feminized rapidly. This highlights the importance of gendered employment shifts for the female college boom. Moreover, these are not simply shifts towards equal gender representation within occupations. If they were, the RCAs would converge towards 1. Some large traditionally masculine occupations became more masculine (craftsmen, operatives, farm laborers, and laborers) and two traditionally feminine occupations feminized further (teachers and other medical occupations).

Finally, tables 6-8 also reveal large gender differences in the contributions of particular service subsectors to absorbing and rewarding college graduates. To avoid overwhelming the reader, we relegate the discussion of this evidence to the appendix. There are two key findings. First, finance and business services have been more important for men, while medicine and professional services have been much more important for women. Second, one

[12] For example, they could reflect differences in relative labor productivity across occupations (Pitt et al., 2012); preferences for some types of work or work environments over others, gender differences in the importance of scheduling flexibility; risk preferences (DeLeire and Levy, 2004) or gender essentialist beliefs (Charles and Grusky, 2005).

single profession – teaching, can account completely for the fact that older women's college premiums rose almost 9 percentage points more slowly than older men's premiums; and for the fact that this gender difference is not observed amongst younger workers. This is because amongst women the college premium within the teaching professions is large, and the profession's employment share amongst older college-educated women halved.

The role of institutionally protected jobs.

There are many possible reasons for gender specialization in occupations and industries. Two such reasons have been linked to the female college boom: gender preferences of workers or employers (including discrimination); and the varying levels of flexibility offered by occupations and industries in terms of part-time work and time out of the labor force, which accommodate home production and mitigate risks associated with divorce (Bronson, 2013; Charles and Grusky, 2005).

Together, the growing importance of professional upgrading and post-graduate education for women hint at a further possible explanation for the female college boom. Some jobs offer wages that are protected against fluctuations and downwards trends, either because the wages are institutionally determined (e.g. public employees), or because the limited supply of credentials constrains the number of new entrants that are likely (e.g. lawyers). These protections may be more important for women, given that women are more likely to be single parents, and appear to be more risk averse (Bertrand, 2011). There is already evidence that risk preferences influence occupation choice (Bonin et al., 2007), and that women tend to sort into occupations that involve less risk of death (DeLeire and Levy, 2004). Charles and Luoh (2003) suggest that the female college boom occurs partly because college reduces the variance of future incomes more for women than for men – a claim that is consistent with our institutionally protected jobs hypothesis. Several commentators have pointed to problems of weakening overall labor demand due to mechanization, computerization and trade (Brynjolfsson and McAfee, 2011; Spence and Hlatshwayo, 2011), which would deepen the incentives for women to use college to reduce risks in this way.

[Table 9 about here]

To examine this hypothesis, we settle on a set of jobs (defined empirically by a worker's industry, occupation, unionization and public employment status) that are likely to pay institutionally determined wages, or require credentials whose supply is institutionally restricted. Our hypothesis suggests that more of the influx of female than male college graduates should have found work in these sectors, and also that the institutionally protected jobs would have contributed more to lifting the female college premium than to lifting the male college premium. Table 9 confirms both suggestions. Institutionally protected jobs released male college graduates (the combined contribution of these jobs to absorbing male college graduates is negative), who found employment in institutionally unprotected sectors. Meanwhile, institutionally protected jobs absorbed roughly a quarter of the much larger net influx of female college graduates. The institutionally protected jobs also contributed twice as much to lifting the college premiums for low- and medium experience women as for their male counterparts. Finally, their contribution to lifting the premium increases as we shift attention to lower experience groups, suggesting the growing importance of institutionally protected jobs to the college boom.

DISCUSSION

We have asked whether and which types of employment shifts across industries and occupations could help to explain why the US college boom has been dominated by women. We found that the feminization of good jobs could plausibly have played this role, but that structural employment trends did not favor a female college boom. We have also provided evidence ruling out the possibility that women's higher rate of occupational upgrading was driven solely by their growing educational advantage over men. Finally, we have shown that men and women have capitalized on their college educations in different ways in the labor market, with men relying more on financial activities, and women relying more on jobs in institutionally protected services, particularly in health and education.

These findings could have policy implications. If demand for college comes increasingly from women, and if women are increasingly using college to access institutionally protected jobs, then growth in the demand for college education becomes increasingly intertwined with the growth of such jobs. Rapid growth in institutionally protected jobs seems unlikely, both because of the nature of the protections themselves – credentialing and collective bargaining often restrain job creation in the process of stabilizing wages, and because many of them rely on stretched public budgets. This raises the possibility that demand for college-graduates might grow more slowly in future – a worrying prospect in the presence of rapidly growing student debt.

On the other hand, this cautionary note is countered by trends in the college premium itself, and in student interest in attending college, both of which have continued to grow in recent years. Our results imply that employment shifts can explain some, but certainly not all of this increase in the relative demand for college-educated workers. Technological change within sectors likely explains much of the rest, and technology may continue to boost demand for college graduates. At the same time, more of the increase in the college premium arises due to declining real earnings of high-school graduates than because of rising real earnings of college graduates, and it is possible that as technology advances, it will begin to substitute for both high-school and college graduates. In the face of this ambiguity on the demand side of the labor market, it will be helpful for economic analyses to keep track of what college graduates of different types do for a living, how much they are paid for doing it, and how those wages are set.

References

Autor, D.H., Katz, L.F., Krueger, A.B., 1998. Computing inequality: Have computers changed the labor market? Quarterly Journal of Economics 113, 1169-1213.

Bailey, M.J., 2006. More power to the pill: the impact of contraceptive freedom on women's life cycle labor supply. The Quarterly Journal of Economics 121, 289-320.

Balassa, B., 1965. Trade liberalisation and “revealed” comparative advantage. The Manchester School 33, 99-123.

Becker, G.S., Hubbard, W.H., Murphy, K.M., 2010. Explaining the worldwide boom in higher education of women. Journal of Human Capital 4, 203-241.

Berman, E., Bound, J., Griliches, Z., 1994. Changes in the demand for skilled labor within United-States Manufacturing: Evidence from the Annual Survey of Manufactures. Quarterly Journal of Economics 109, 367-397.

Bertrand, M., 2011. New perspectives on gender. Handbook of Labor Economics 4, 1543-1590.

Black, S.E., Spitz-Oener, A., 2010. Explaining women's success: technological change and the skill content of women's work. The Review of Economics and Statistics 92, 187-194.

Bonin, H., Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2007. Cross-sectional earnings risk and occupational sorting: The role of risk attitudes. Labour Economics 14, 926-937.

Bronson, M.A., 2013. Degrees Are Forever: Marriage, Educational Investment, and Lifecycle Labor Decisions of Men and Women, Job Market Paper.

Brynjolfsson, E., McAfee, A., 2011. Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy. Digital Frontier Press Lexington, MA.

Charles, K.K., Luoh, M.-C., 2003. Gender differences in completed schooling. Review of Economics and Statistics 85, 559-577.

Charles, M., Grusky, D.B., 2005. Occupational ghettos: The worldwide segregation of women and men. Stanford University Press.

Cho, D., 2007. The role of high school performance in explaining women's rising college enrollment. Economics of Education Review 26, 450-462.

DeLeire, T., Levy, H., 2004. Worker Sorting and the Risk of Death on the Job. J. Labor Econ. 22, 925-953.

DiPrete, T.A., Buchman, C., 2013. The Rise of Women: The Growing Gender Gap in Education and what it Means for American Schools. Russell Sage Foundation, New York, NY.

Goldin, C., Katz, L.F., Kuziemko, I., 2006. The Homecoming of American College Women: The Reversal of the College Gender Gap. The Journal of Economic Perspectives 20, 133-156.

Goldin, C.D., Katz, L.F., 2009. The race between education and technology. Harvard University Press.

Katz, L., Autor, D., 1999. Changes in the wage structure and earnings inequality, in: Ashenfelter, O., Card, D. (Eds.), Handbook of Labor Economics. Elsevier, Amsterdam, pp. 1463-1555.

Katz, L.F., Murphy, K.M., 1992. Changes in relative wages, 1963-1987: Supply and demand factors. Quarterly Journal of Economics 107, 35-78.

Kijima, Y., 2006. Why Did Wage Inequality Increase? Evidence from Urban India 1983-99. Journal of Development Economics 81, 97-117.

King, M., Ruggles, S., Alexander, J.T., Flood, S., Genadek, K., Schroeder, M.B., Trampe, B., Vick, R., 2010. Integrated Public Use Microdata Series, Current Population Survey: Version 3.0., in: University of Minnesota (Ed.), Minneapolis.

Mehta, A., Felipe, J., Quising, P., Camingue, S., 2013. Where have all the educated workers gone? Services and Wage Inequality in Three Asian Economies. Metroeconomica 64, 466-497.

Mehta, A., Mohr, B.A., 2012. Economic Liberalization and Rising College Premiums in Mexico: A Reinterpretation. World Development 40, 1908-1920.

Perkins, R., 2004. The high school transcript study: A decade of change in curricula and achievement, 1990-2000. DIANE Publishing.

Pitt, M.M., Rosenzweig, M.R., Hassan, M.N., 2012. Human capital investment and the gender division of labor in a brawn-based economy. The American Economic Review 102, 3531-3560.

Sanchez-Paramo, C., Schady, N., 2003. Off and Running? Technology, trade and the rising demand for skilled workers in Latin America, World Bank Policy Research Working Paper 3015.

Spence, M., Hlatshwayo, S., 2011. The Evolving Structure of the American Economy and the Employment Challenge. Council on Foreign Relations.

Weinberg, B.A., 2000. Computer use and the demand for female workers. Industrial and Labor Relations Review, 290-308.

APPENDIX: A DETAILED LOOK AT SOME KEY SECTORS.

Tables 6-8 capture developments in three sub-sectors. The Finance, Insurance and Business Services sustained male college attendance. Together, expansion and educational upgrading in these industries absorbed 67% of the net influx of male college graduates amongst the young (Table 6), and 105% (not shown) amongst medium experience workers. In contrast, they absorbed no more than 21% of the female influx, regardless of experience group. These industries also contributed 34% of the increase in the young male premium, and only 19% of the young female premium (Table 6). Additionally, professionals in the finance industry also became more masculine (table not shown for brevity).

The medical industry has been far more felicitous of female college graduates. It absorbed 11-19% of the influx of female college graduates (depending on the experience group), but between negative 12% and positive 7% of the net influx of male graduates (Table 6). It accounts for 7% and 18% of the rise in the college premium for younger and older women respectively, but less than 1% of its rise for younger and older men (Table 6). Similarly, our two explicitly medical occupations (Physicians and Other Medical) in combination made robust positive contributions to absorbing the influx and shifting the college premiums of low and high experience women, but made negative contributions on both accounts for men (Table 7). Moreover, both these occupations are feminizing, even though the Other Medical Professions category was already overwhelmingly feminine (Table

8). In contrast with these professional medical occupations, which deliver the medical services, managerial occupations within medicine, which handle the business end of healthcare, contributed positively to the shift in male college premium (table not shown, for brevity).

Jobs in the education sector have been pivotal in accounting for trends in college premiums, especially amongst older women. Amongst high experience workers, the education industry absorbed 8% of the net influx of female college graduates but negative 20% of the male influx (Table 6). It also accounts for around 19% of the rise in the college premium for young men and women (Table 6). As we have noted earlier, the college premium rose 32.7 percentage points for older men and only 24.3 points for older women. Roughly this entire difference can be attributed to the gender differential in the contributions to older workers' college premiums of either the teaching profession[13] (Table 7) or the education industry (Table 6). This gender differential arises because college premiums within the teaching profession are much higher than those in other occupations for women, but not for men; and because the share of older female college graduates working as teachers roughly halved between 1981 and 2005. This sharply reduced the college premium for older women. The teaching profession accounted for a much smaller share of employment amongst young workers and older men throughout our sample period, and their college

[13] Arithmetically by .6 percentage points (=0.017*32.7), and lowered the female premium by 8.3 points, a difference which is 98% of the 8.4 (=32.7-24.3) point differential to be explained.

premiums have trended similarly. Thus, a declining reliance by women on one profession – teaching – may have eliminated gender differences in trends in the college premium between cohorts.

Table 1: College attainment and college premiums

Experience Group	Sex	College Attainment (%) 1981	2005	Change	Post-College Attainment (%) 1981	2005	Change	College Premium (%) 1981	2005	Change
Low	Men	23.21	26.51	3.30	5.92	6.23	0.31	36.41	63.02	26.62
	Women	23.26	35.92	12.66	4.62	9.41	4.79	42.80	68.55	25.74
Medium	Men	28.58	31.70	3.12	10.72	10.42	-0.30	39.01	73.55	34.54
	Women	21.89	39.01	17.12	6.53	13.64	7.11	43.55	69.91	26.37
High	Men	23.88	31.77	7.89	10.71	10.50	-0.21	39.48	72.16	32.68
	Women	16.07	34.59	18.53	4.59	10.78	6.19	44.17	68.44	24.27

Note: College attainment is the percentage of the count sample that holds a college degree or higher. Post-college attainment is the share holding a post-graduate qualification or with 6 or more years of tertiary education. The college premium is calculated from the wage sample, as the difference in log-weekly-wages between workers with at least a college degree on those holding only a high-school diploma or equivalent.

Table 2: Between Sector Absorption of the Net Influx of College Graduates

	Gender-specific Emp. Shifts				Pooled Emp. Shifts			
	Low Experience		High Experience		Low Experience		High Experience	
Classification	Men	Women	Men	Women	Men	Women	Men	Women
3 Industries	2.1	0.8	1.4	0.9	1.6	0.7	1.7	1
10 Industries	1.6	1.7	1.4	1.9	2.3	1.8	2.8	1.8
17 Industries	1.5	2.7	0.5	2.5	2.9	2.1	3.6	2.2
66 Industries	2	3.3	0.5	2.9	3.2	2.5	3.5	2.2
3 Occupations	3.2	6.3	0.6	5.9	4.8	4.9	4.3	3.9
10 Occupations	3.4	6.5	0.1	6	5	4.6	4.9	3.6
17 Occupations	2.9	7	-0.3	5.6	4.9	4.5	4.8	3.4
10 Occupations, 17	2.7	6.9	-0.2	5.9	5.2	4.8	5.7	4.1
Shift to be explaine	*3.3*	*12.7*	*7.9*	*18.5*	*3.3*	*12.7*	*7.9*	*18.5*

Note: Calculations use the count sample and the definition of between-sector absorption presented in identity (1) and the text. The shifts in attainment to be explained are defined and presented in Table 1.

Table 3: Between-sector contributions to the shift in the college premium

Classification	Demographic-Specific Employment Shifts				Population Level Employment Shifts			
	Low Experience		High Experience		Low Experience		High Experience	
	Men	Women	Men	Women	Men	Women	Men	Women
3 Industries	4.4	1.8	2.2	2.5	3.4	1.6	3.0	2.8
10 Industries	3.7	4.5	2.1	6.0	2.9	3.3	4.5	6.6
17 Industries	2.6	5.3	3.8	4.4	3.5	3.5	5.8	5.0
66 Industries	5.4	6.3	3.2	5.0	3.6	4.0	3.4	7.2
3 Occupations	7.9	16.6	-0.9	14.4	6.6	6.8	6.7	7.8
10 Occupations	10.5	20.1	0.0	16.6	9.6	8.8	8.8	10.3
17 Occupations	8.3	20.6	0.2	17.1	8.3	8.6	7.0	9.8
10 Occupations, 17 Industries	10.1	21.6	5.0	17.0	9.6	9.9	11.4	13.1
Shift to be explained:	*26.6*	*25.7*	*32.7*	*24.3*	*26.6*	*25.7*	*32.7*	*24.3*

Note: All results from wage sample. Between shifts defined in identity (3) and the text. College premiums defined in Table 1 and the text.

Table 4: Supply and Demand Analysis

			%Δ Supply	%Δ Demand Between: Industries	Ind. & Occ.
(1)	Men	High-school	-8.5	-26.5	-8.2
(2)		College	2.4	6.4	4.2
(3)		*Relative (College: High School*	*10.9*	*32.8*	*12.3*
(4)	Women	High-school	-1.7	13.1	1.2
(5)		College	7.8	16.9	6.0
(6)		*Relative (College: High School*	*9.5*	*3.8*	*4.8*
(7)	Overall	High-school	-10.2	-11.4	-4.6
(8)		College	10.2	10.4	4.9
(9)		*Relative (College: High School*	*20.3*	*21.8*	*9.5*

Note: Supply and demand shifts for each cell are measured relative to the labor force. Quantities are measured in efficiency units. Calculations are explained in detail in section 4c. Between-shifts are calculated using the Katz and Murphy (1992) demand shift index.

Table 5: Feminization of high-wage occupations

	First stage sample	Second stage sample	First stage regression Controls: Years of schooling	Gender dummy	Coefficients, when second stage is weighted by: Employment shares in 1981	Employment shares in 2005	No weights
(1)	Both genders	All workers	No	No	0.192	0.187	0.157
					(0.000)	(0.000)	(0.000)
(2)	Both genders	All workers	Yes	No	0.187	0.189	0.158
					(0.000)	(0.000)	(0.002)
(3)	Both genders	All workers	Yes	Yes	0.217	0.204	0.114
					(0.000)	(0.000)	(0.082)
(4)	Men	All workers	Yes	No	0.188	0.174	0.103
					(0.000)	(0.000)	(0.019)
(5)	Women	All workers	Yes	No	0.197	0.196	0.132
					(0.000)	(0.000)	(0.007)
(6)	High school grads, both genders	High-school grads	No	Yes	0.182	0.130	0.148
					(0.000)	(0.020)	(0.021)
(7)	College grads, both genders	College grads	No	Yes	0.221	0.206	0.154
					(0.000)	(0.000)	(0.093)
(8)	Post-graduates, both genders	Post-graduates	No	Yes	0.140	0.099	0.108
					(0.001)	(0.042)	(0.121)

Note: Each coefficient is from a separate regression. P-values in parentheses. See Section 4 for details.

Table 6: Contributions of industries to absorbing college graduates and shifting the college premium								
	Contribution to absorbing the net influx of college graduates (percentage points)				Contribution to shifting the college premium (percentage points)			
	Low		High		Low		High	
Industry	Men	Women	Men	Women	Men	Women	Men	Women
Ag & Mining	-28.4	-0.3	-1.9	1.4	-6.3	0.1	-2.1	1.0
Construction	5.8	1.3	11.6	2.1	-2.0	0.5	2.4	0.2
Manufacturing	-27.5	3.5	1.0	10.7	4.8	10.1	17.4	25.1
Services, of which:	150.2	95.5	89.3	85.8	103.5	89.4	82.3	73.8
Finance & Bus. Serv.	67.1	20.1	40.5	19.5	33.7	18.7	35.2	23.9
Education	35.2	21.3	-19.9	7.8	18.7	19.0	1.7	-31.7
Medical	-11.6	10.9	7.7	18.6	1.0	7.0	0.6	18.1
Services (other)	59.5	43.1	61.0	39.8	50.1	44.7	44.8	63.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net influx or shift in college premium to be explained:	3.3	12.7	7.9	18.5	26.6	25.7	32.7	24.3

Note: Contributions to absorption calculated from the count sample and defined in identity (1). Contributions to shifting the premium calculated from the wage sample and defined in identities (2) and (5a).

Table 7: Contributions of occupations to absorbing college graduates and shifting the college premium

Occupation		Contribution to absorbing the net influx of college graduates (%)				Contribution to shifting the college premium (%)			
		Low		High		Low		High	
		Men	Women	Men	Women	Men	Women	Men	Women
Professionals, of wl		*63.1*	*63.9*	*3.4*	*47.4*	*61.4*	*63.9*	*34.4*	*22.8*
	Prof. Tech. (other)	114.2	29.6	30.1	19.1	46.3	23.9	25.8	24.7
	Prof. Physicians	-10.2	2.5	-2.8	2.4	-1.1	2.7	-1.4	4.6
	Prof. Other Medical	-4.7	5.9	2.3	12.4	1.1	6.3	0.8	13.5
	Prof. Teachers (Not	17.4	12.1	-13.2	2.5	9.2	15.8	1.5	-37
	Prof. Legal	-20.7	2.7	0.3	2	-2.5	3.4	4.7	6.8
	Prof. Finance (Accou	-7.1	6.4	0.3	5.7	0.9	8.9	3.3	7.6
	Prof. STEM	-25.3	4.4	-14.1	4.2	1.1	3.1	-1.3	6.2
	Prof. Food & Fun	-0.5	0.3	0.5	-0.9	6.4	-0.4	1	-3.7
Farmers		-6.7	-0.3	-0.4	0.2	-0.5	0	0	0.1
Managers, Officials,		25.1	19.8	45.5	22.4	15.1	20.6	39.9	47.7
Clerical and Kindred		23.9	7.1	13.2	12.5	6.6	11.3	4.1	4.5
Sales Workers		-6.7	8.4	3.6	8.1	11	6.6	8	13.1
Craftsmen		-9.3	-1.8	12.5	1.3	0.2	-0.5	2.4	2.5
Operatives		-7.2	-0.4	8.7	0.3	0	-2.7	0.3	-2.6
Service Workers		19.8	4.2	9.4	7.3	12.1	0.8	5.5	13.6
Farm Laborers		-1.4	-0.1	-0.1	0	-2.5	-0.2	0.3	-0.5
Laborers		-0.7	-0.7	4.2	0.5	-3.2	0.4	5	-1.1
Total		100	100	100	100	100	100	100	100
Net influx or shift in college prei		3.3	12.7	7.9	18.5	26.6	25.7	32.7	24.3

Note: Contributions to absorption calculated from the count sample and defined in identity (1). Contributions to shifting the premium calculated from the wage sample and defined in identities (2) and (5a).

Table 8: Occupations' contributions per job to the college premium, and their employment shares amongst men and women

	Contribution per job to the college premium in 1981				Men's Occupational Distribution		Women's Occupational Distribution		Revealed Comparative Advantage		
	Low		High								
Occupation	Men	Women	Men	Women	1981	2005	1981	2005	1981	2005	Change
Professionals, of which:					*16.51*	*19.17*	*18.24*	*28.24*	*1.11*	*1.47*	*0.37*
Prof. Tech. (other)	71.3	104.8	51.4	109.1	4.46	8.24	4.05	8.82	0.91	1.07	0.16
Prof. Physicians	133.4	279.8	353.0	432.3	0.93	0.97	0.18	0.48	0.19	0.50	0.30
Prof. Other Medical	88.8	120.9	55.7	110.7	1.09	1.37	4.65	6.55	4.26	4.79	0.53
Prof. Teachers (Not Professors)	30.8	94.5	36.1	176.1	1.86	2.05	4.97	7.26	2.67	3.54	0.88
Prof. Legal	176.5	254.5	194.4	297.6	0.94	0.84	0.19	0.49	0.20	0.58	0.38
Prof. Finance (Accountants)	134.6	88.7	121.6	38.6	1.33	0.92	1.11	1.81	0.84	1.96	1.13
Prof. STEM	114.5	122.4	93.8	94.3	4.79	3.66	1.18	1.38	0.25	0.38	0.13
Prof. Food & Fun	-36.5	62.9	6.9	93.6	1.11	1.12	1.92	1.44	1.73	1.29	-0.44
Farmers	79.5	0.0	7.9	59.9	1.97	0.86	0.31	0.28	0.16	0.32	0.16
Managers, Officials, and Proprietors	83.5	78.5	69.3	22.9	13.27	15.54	6.51	10.82	0.49	0.70	0.21
Clerical and Kindred	21.3	5.8	28.6	1.6	5.96	7.46	33.67	27.93	5.65	3.74	-1.91
Sales Workers	71.4	50.7	44.7	29.1	6.36	6.20	7.25	6.41	1.14	1.03	-0.11
Craftsmen	-5.8	16.2	-9.0	-23.7	20.57	18.23	1.85	1.32	0.09	0.07	-0.02
Operatives	-1.1	4.5	7.1	12.7	17.03	13.87	10.97	5.20	0.64	0.37	-0.27
Service Workers	33.4	47.7	29.3	33.6	9.24	11.12	19.25	18.76	2.08	1.69	-0.40
Farm Laborers	73.1	55.1	52.0	85.0	1.65	0.72	0.69	0.21	0.42	0.29	-0.12
Laborers	23.3	16.3	19.7	34.8	7.43	6.83	1.26	0.85	0.17	0.12	-0.05
Aggregate	36.4	42.8	39.5	44.2	100	100	100	100			

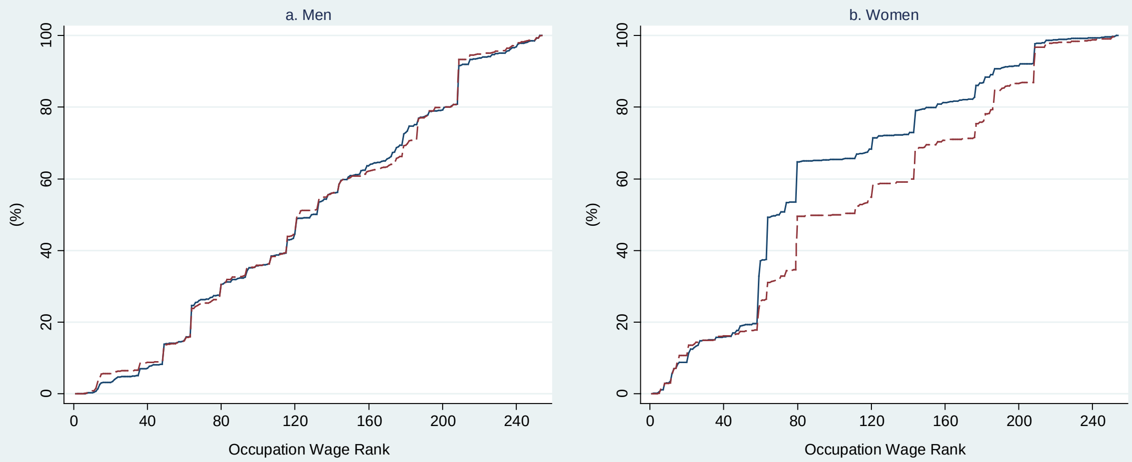
Note: The distributions are calculated for the entire count sample and represent the share of men and women in the workforce in each occupation. The revealed comparative advantage is calculated by taking ratio of women's and men's employment for each occupation.

Table 9: Contributions of institutionally protected sectors to absorbing college graduates and shifting the college premium

Occupation	Share of the net influx of college: Low Men	Low Women	High Men	High Women	Share of the shift in the college: Low Men	Low Women	High Men	High Women
Institutionally Protected Sectors, including:	*-25.1*	*25.7*	*-20.6*	*29.2*	*14.8*	*30.7*	*-1.1*	*-0.8*
Dentists	-3.5	1.0	-2.1	0.1	0.8	0.8	-2.0	0.4
Dieticians and nutritionists	0.0	0.1	0.0	0.4	0.0	-0.3	0.0	1.0
Funeral directors and embalmers	-0.4	-0.2	-0.5	0.0	-0.1	-0.3	0.0	-0.1
Lawyers and judges	-21.0	3.0	1.9	1.1	-3.4	3.7	5.8	4.1
Nurses, professional	-0.2	3.2	-0.3	7.7	0.2	4.7	0.9	13.3
Optometrists	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0
Pharmacists	-3.5	0.7	-1.0	0.5	-0.1	0.7	0.8	0.9
Physicians and surgeons	-3.1	1.1	-1.0	2.2	-0.6	0.8	0.1	6.8
Teachers (n.e.c.)	40.1	31.9	11.3	20.3	9.9	30.4	4.4	29.5
Veterinarians	-2.0	0.3	0.3	0.4	0.3	0.6	0.3	0.1
Electricians	-1.9	0.0	0.6	0.0	0.6	-0.4	1.2	0.0
Other Public Employment	-44.0	-23.5	-36.7	-8.5	4.1	-19.5	-13.7	-61.4
Other, non-public, unionized jobs	14.2	8.1	7.0	4.8	3.1	9.5	1.2	4.7
Unprotected sectors	125.1	74.3	120.6	70.8	85.2	69.3	101.1	100.8
Total:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net influx or shift in college premium to be explaine	3.3	12.7	7.9	18.5	26.6	25.7	32.7	24.3

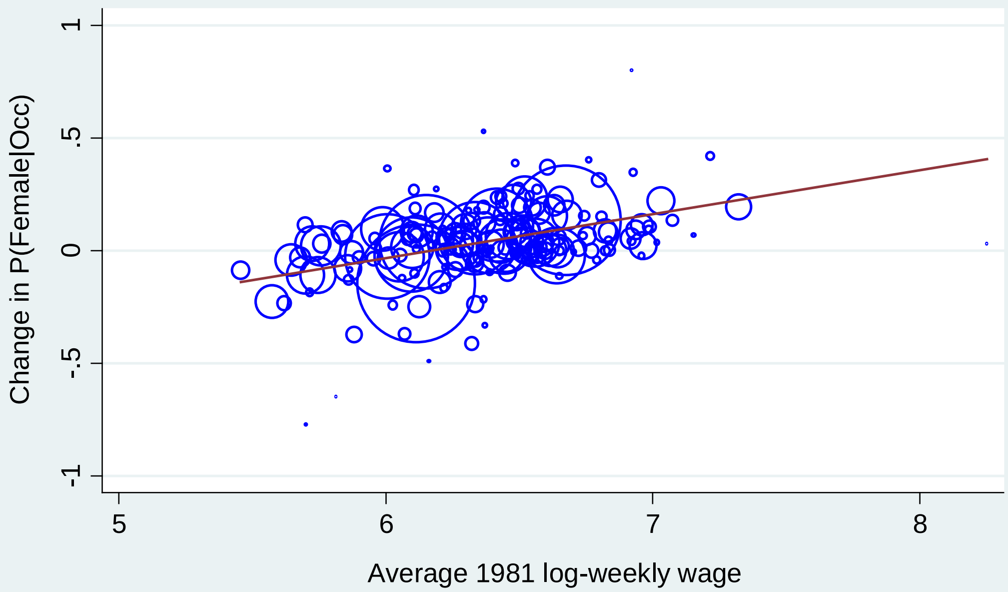
Note: Contributions to absorption calculated from the count sample and defined in identity (1). Contributions to shifting the premium calculated from the wage sample and defined in identities (2) and (5a).

Figure 1: Cumulative Distributions of Occupational Employment by Sex



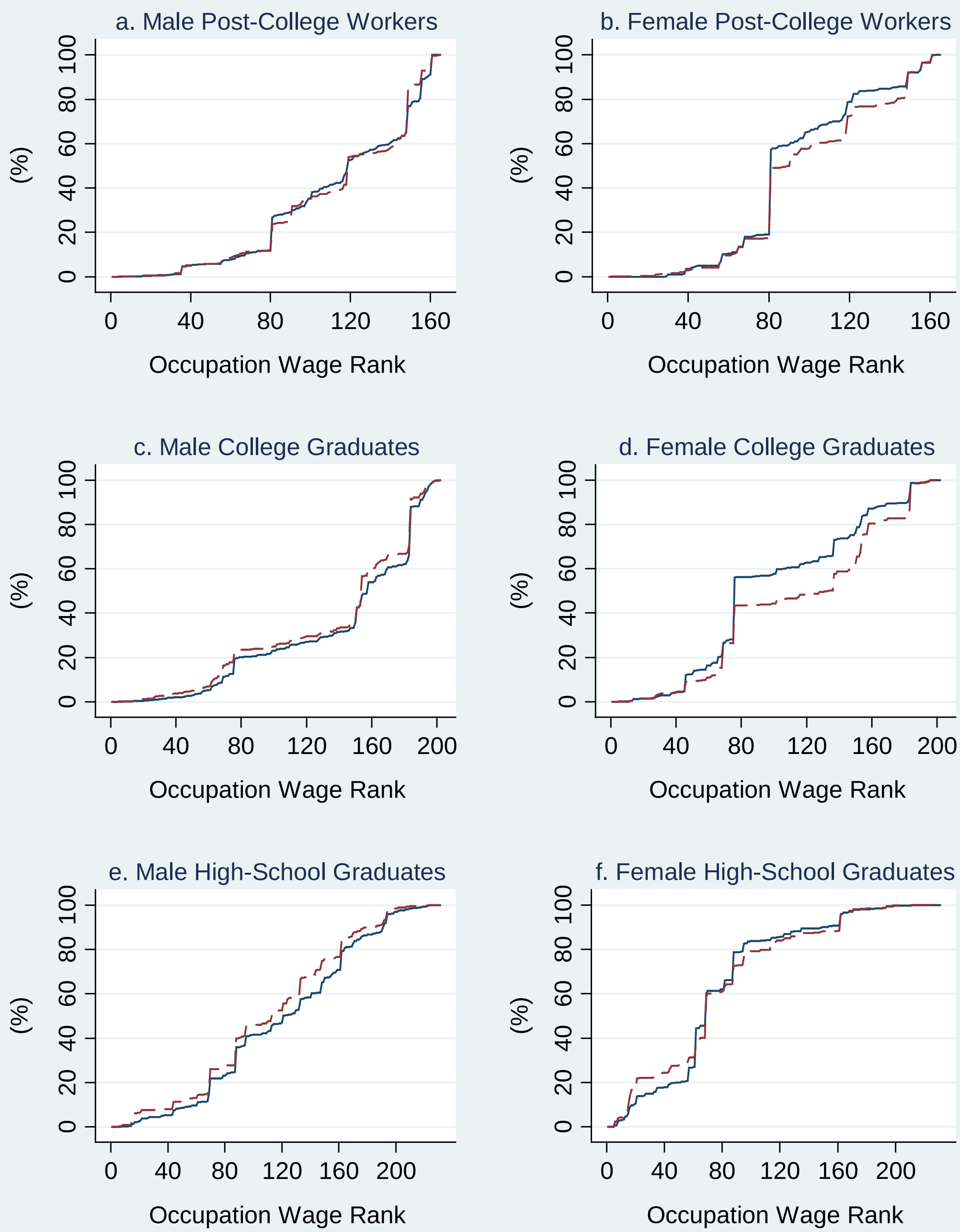
Note: Solid lines depict the distribution in 1981, dashed lines indicate 2005. Occupations are ranked by wage calculated from the pooled (male and female) wage sample. Occupations are ranked from lowest wage (0) to highest wage (254).

Figure 2: The Feminization of High Wage Occupations



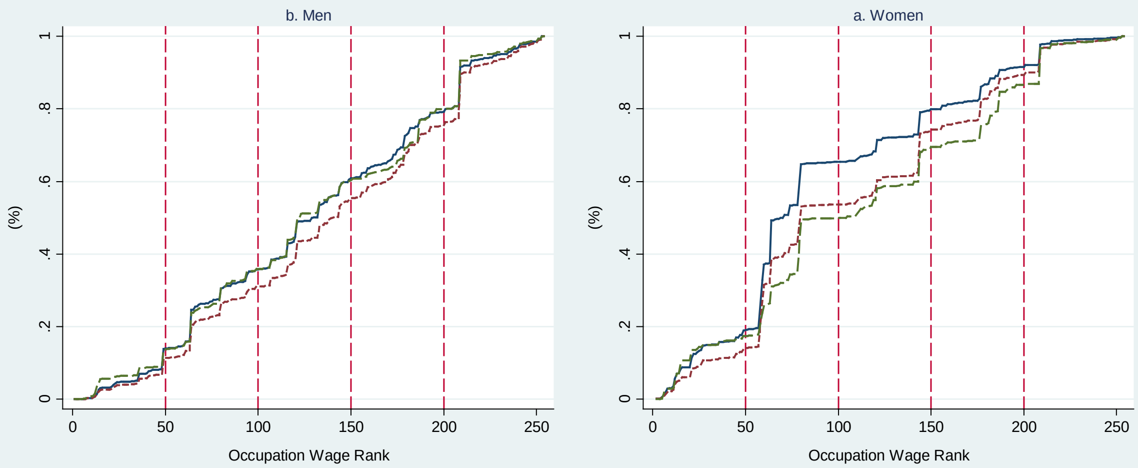
Note: Average wages were estimated using the wage sample across all employees in each occupation in 1981.

Figure 3: Cumulative Distributions of Occupational Employment by Sex and Education Class



Note: Solid lines depict the distribution in 1981, dashed lines indicate 2005. Occupations are ranked by wage within each education class for the pooled sample of men and women in that education class. Occupations are ranked from lowest wage (0) to highest wage(254).

Figure 4: Counterfactual Distributions of Occupational Employment by Sex



Note: Solid lines depict the distribution in 1981, dashed lines indicated 2005. Short dashed lines depict the the 2005 counterfactual distribution. Occupations are ranked by wage calculated from the pooled (male and female) wage sample. Occupations are ranked from lowest wage (0) to highest wage (254).

RACIAL TRENDS AND DIFFERENCES IN THE INTERGENERATIONAL TRANSMISSION OF EDUCATION

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Abstract

I estimate the intergenerational transmission of education in the United States between 1980 and 2013. I find that intergenerational persistence in education has increased substantially among blacks in recent years while remaining stable among whites and Hispanics. I observe this trend when using data from the Panel Study of Income Dynamics as well as the National Longitudinal Surveys of Youth. I demonstrate that much of the increase in educational persistence among blacks is due to decreases in upward mobility. The increase in black educational persistence is found in both two-parent and single-parent households, and I do not find similar trends and differences when estimating intergenerational income persistence.

Keywords: Education, Mobility, Race

JEL Classification: J62, I24, J15

I. Introduction

There is limited information on recent trends of the intergenerational transmission of education in the United States. While racial differences in income persistence have recently been studied (e.g. Bhattacharya and Mazumder, 2011), racial differences in educational persistence have received comparably less attention.[14] In this paper I present recent estimates of intergenerational persistence in education in the United States between 1980 and 2013 and analyze racial differences in educational persistence, highlighting a dramatic increase in educational persistence among blacks in recent decades.

Studying the intergenerational transmission of education is useful because education is positively correlated with many outcomes that contribute to socioeconomic status and wellbeing. For decades, education has been viewed as an investment in human capital which increases an individual's productivity and hourly wage (Park, 1994). It is also well known that individuals with more education suffer less unemployment and work in more prestigious occupations (Card, 1999). In addition to the labor market benefits of education, increased education also reduces

[14] The term intergenerational persistence is used less in the literature, but is useful to describe many findings in this paper. Intergenerational persistence is the opposite of intergenerational mobility.

the probability of incarceration and arrest (Lochner and Moretti, 2004), and there is evidence that increases in education improve the health of individuals (Kemptner et al., 2011). The educational attainment of an individual summarizes a great deal of information about his or her wellbeing, and many of these associations appear to be causal.

There are also advantages to using education over income as a metric of the intergenerational transmission of economic advantage. Firstly, one's educational attainment does not usually change over a person's adult lifetime or depend on his or her employment status. This is especially important when measuring the socioeconomic status of women. The labor force participation of women in the U.S. has increased greatly over time, and life events such as childbirth may impact a woman's decision to participate in the labor market. Women who don't work, whether part of a long-term trend or by personal decision are unable to report their wage rates. However, they *are* able to report their educational attainment. Misreporting of educational attainment is also likely to be low in longitudinal surveys and can be substantially mitigated by using information from all years in which an individual was interviewed as an adult. This is possible because most individuals complete their lifetime education by their mid-twenties (Black and Devereux, 2011).[15]

[15] There are many other benefits to using education over income. Unlike income, there is no such thing as negative educational attainment, and the upper bound on education is has effectively remained at the PhD level for a long time. The time-invariant bounds on educational attainment and the fact that years of schooling is a discrete measure of education provide natural cutoff points when constructing transition matrices. Finally, while there are multiple ways to obtain a certain level of income such as increased time working, capital income, or gifts, the road to additional years of schooling is single-track: one must have a high school diploma or equivalent before he or she can earn a college degree. Thus studies of the intergenerational transmission of education will likely provide clear information for policy.

My measure of educational persistence is the estimated coefficient of children's years of schooling on their parents' years of schooling. I call the estimated regression coefficient on parents' education the intergenerational transmission of education (ITE).[16] There have been numerous studies of educational persistence in the United States using the regression of parents' years of schooling on children's years of schooling (Altonji and Dunn, 1996; Couch and Dunn; 1997; Chevalier, 2003; Hertz et al., 2007; Huang, 2013). These studies estimate the coefficient on parent's years of schooling to be between .15 and .54. However, it is difficult to make comparisons between studies because researchers use different birth cohorts and estimate the ITE at different points in time. Also, many researchers have utilized surveys that are not nationally representative of the United States in an effort to study the causes of educational persistence (Black et al, 2008; Behrman and Rosenzweig, 2002; Plug, 2004). Nonetheless, estimates from these studies provide a context for this paper. A summary of studies of educational persistence in the United States and their estimates is found in Table 1. With the exception of Huang (2013), these studies do not discuss racial differences in educational persistence.[17]

[16] It is also common to use the correlation between parents' and children's years of schooling to summarize educational persistence. However, I do not discuss trends and racial differences in the correlation coefficient in the main portion of this paper because the findings from correlations are similar to the ones reached from the regression coefficients. The correlation coefficients and a brief discussion are provided in Appendix D.

[17] One notable study not mentioned in Table 1 explicitly looks at white-black differences in income and educational mobility (Bloome and Western, 2011). This study is not included in Table 1 because the authors do not use correlations or a linear regression to describe mobility.

I use the Panel Study of Income Dynamics (PSID) to analyze long-term trends in educational persistence. The PSID has been used in numerous studies of trends in income persistence (e.g. Mayer and Lopoo, 2005; Lee and Solon, 2009), but has not been utilized to study long-term trends in educational persistence. The PSID's main benefit is that it allows me to analyze educational persistence for many birth cohorts across many years. Additionally, I utilize the recently released 2013 round of the 1997 National Longitudinal Survey of Youth (NLSY97) and the 1979 National Longitudinal Survey of Youth (NLSY79) to analyze educational persistence for two recent birth cohorts.[18] The main benefit of the NLSYs is that they have a large number of observations on narrow birth cohorts, which will be helpful for constructing transition matrices by race.

I find that intergenerational persistence in education has remained unchanged in the general population in the last few decades. However, I find that educational persistence has increased substantially in recent years among blacks. To determine the nature of this increase in persistence, I use transition matrices and new directional measures of upward and downward mobility (Bhattacharya and Mazumder, 2011). These new directional measures have been designed to make racial comparisons in income mobility, but have yet to be applied to make racial comparisons in educational mobility. Using transition matrices and the directional measures of mobility, I find that upward mobility has declined for both whites and blacks, and that the declines in upward mobility are much larger among blacks. I demonstrate that the increase in black educational persistence is prevalent among both two-parent and single-parent

[18] The 2013 round of the NLSY97 was released on September 25th, 2015.

households. Finally, I show that intergenerational persistence in income does not follow the same racial pattern: it has remained stable among both whites and blacks.

II. Data

As noted, I use the Panel Study of Income Dynamics (PSID) and the 1979 and 1997 National Longitudinal Surveys (NLSY79 and NLSY97) to analyze educational mobility. The two datasets have different strengths and limitations. The PSID is useful for estimating the ITE over a longer period time than the NLSYs. The PSID has far fewer observations on young adults compared to the NLSYs. Thus my estimates of the ITE when using the PSID are less precise than my estimates from the NLSYs. Additionally, because the PSID did not make adjustments for immigration until recent years, the population it represents will be more misaligned with the actual population in the U.S. On the other hand, the NLSYs are representative of the entire population of youth in 1979 and 1997, including immigrants. Moreover, there are many more observations per birth cohort in the NLSYs compared to the PSID. This will be useful for constructing mobility transition matrices by race. Though not the focus of this paper, the NLSYs also contain much information on recent immigrants and children of immigrants in the United States including Hispanics.

Figure 1 displays the timeline for the NLSYs. Data on mothers is collected in the base year of each survey. I collect information on adult outcomes of respondents when they are 29-33 years old in 1993 for the NLSY79 and 2013 for the NLSY97 and estimate educational persistence in these years. The PSID follows a similar pattern, but I am able to estimate an intergenerational persistence coefficient for a five-year birth cohort centered on *every* survey year between 1980 and 2013. Thus, by using both datasets, I will be able to provide both a broad historical context of intergenerational persistence using the PSID, and also deeply analyze differences by race using the NLSYs.

a. National Longitudinal Surveys

I use the National Longitudinal Survey of Youth 1979 (NLSY79) and the National Longitudinal Survey of Youth 1997 (NLSY97) to estimate the ITE among respondents when they are 29-33 years old in 1993 or 2013. Individuals in the NLSY79 are a nationally representative sample of youth aged 14-22 when first surveyed in 1979, and individuals in the NLSY97 are a nationally representative sample of youth aged 12-18 when first surveyed in 1997.[19] Individuals in the NLSY79 have been surveyed annually prior to 1994 and biannually after 1994. Individuals in the NLSY97 have been surveyed annually with 2013 being the latest public release.

There are many benefits of using the NLSYs to estimate the ITE. Firstly, the surveys are nationally representative of all youth in the United States, including youth living in juvenile detention centers or other institutions and youth who are immigrants or born from immigrants. Secondly, the NLSYs have a large number of respondents which will allow me to precisely estimate the ITE and construct detailed transition matrices.[20] Finally, the NLSY97 was designed in part in order to facilitate cross-cohort research with the NLSY79, and as such, many variables

[19] It is often stated that the NLSY97 is a nationally representative survey of youth who were 12-16 years old as of December 31, 1996. When describing the age of individuals in the NLSY97 at the time of the first interview in 1997, reported ages cover a bit broader range of 12-18 years.

[20] See Appendix C for full 21x21 transition matrices by race and survey.

common to both surveys are recorded using identical schemes as documented by Altonji, Bharadwaj, and Lange (2008). Pooling both surveys will allow me to statistically detect any change in the ITE.

Because people tend to complete their lifetime education by their mid-twenties (Black and Devereux, 2011), the NLSY97 is now a practical survey for estimating the ITE. I use respondents in the NLSY79 born in 1960-64 to analyze mobility in 1993, when they are 29-33 years old.[21] Similarly, I use respondents in the NLSY97 born in 1980-84 to analyze mobility in 2013, when they are 29-33 years old. Figure 1 depicts the timeline of respondents in the NLSY79 and NLSY97 for this study. Attrition is prevalent in both surveys. Of the original NLSY79 respondents, 78.9% participated in the 1993 round. Of the original NLSY97 respondents, 78.5% participated in the 2013 round.[22]

Variables I use include years of schooling of the respondent and respondent's mother, sex of the respondent, age of the respondent, and the race of the respondent. Unfortunately, the NLSY79 has far less detail on race than the NLSY97. To keep race definitions consistent between the two surveys I use three broad races: white, black, and Hispanic. A NLS97 respondent who chooses "American Indian, Eskimo, or Aleut", "Asian or Pacific Islander", or "Something else?" as his or her race is taken to be part of the white population.[23] The main

[21] Because of the wider age range of respondents in the NLSY79, NLSY79 respondents are 29-37 years old in 1993. I exclude individuals who are aged 34-37 to match the age bracket of individuals in the 2013 round of the NLSY97.

[22] I address attrition and other sources of missing data in Appendix B and provide evidence that missing data do not seriously alter the main findings of this paper.

[23] This level of detail is not available in the baseline survey of the NLSY79.

discussion in this paper is focused on differences among the black and white subpopulations in the U.S. over time. However, I include results for Hispanics throughout for completeness.

Years of schooling for respondents and their mothers is recorded as the highest grade completed starting from 1st grade to eight or more years of college.[24] Table 2 presents descriptive statistics for both surveys.[25] Panels A and B describe the NLSY79 and NLSY97 respectively by race and variables of interest.[26] A few things are apparent. Firstly, the average of mother's years of schooling is higher among whites than among blacks. Children's average years of schooling is higher among whites than blacks in both surveys. Children's years of schooling has increased among whites and blacks, with whites experiencing a bigger increase.

b. Panel Study of Income Dynamics

I use the Panel Study of Income Dynamics (PSID) to study long-term trends of the ITE from 1980 to 2013. The PSID is a longitudinal household survey in the United States. The first survey took place in 1968 with a sample of nearly 5,000 households living in the United States and re-interviewed these respondents and household members of these respondents in subsequent years. The original survey was conducted by the Survey Research Center at the

[24] Individuals who report more than four years of college either have spent the additional years pursuing college degrees or post-secondary education. I do not distinguish between the two when presenting this paper's main results. The majority of respondents who report greater than four years of college have post-secondary degrees. Appendix A shows plots data in the NLSY79 and NLSY97 pooled and separated by race. Most of the data does not lie on the bounds of the years of schooling distribution.

[25] The average age of mothers appears to be higher in the NLSY79 than in NLSY97 when each survey was first conducted. This is because NLSY97 respondents in 1997 are younger on average than NLSY79 respondents in 1979.

[26] The main discussion in this paper is focused on differences among the black and white subpopulations in the U.S. over time. However, I include results for Hispanics throughout for completeness.

University of Michigan and includes a nationally representative sample of individuals and an oversample of individuals from low income households from the Survey of Economic Opportunity at the U.S. Census Bureau. These samples will henceforth be referred to as the SRC and SEO samples. I use survey weights from the PSID in all my analyses to adjust for sampling changes and attrition. The combined SRC and SEO samples are intended to represent all individuals in the United States except for individuals who immigrated to the United States after 1968 and their descendants.[27]

A major benefit of using the PSID is that the survey design enables me to estimate the ITE repeatedly over a long timeframe. The PSID collects information on both parents and children living in a household and tracks the characteristics of these individuals over time, even when children leave the parental household. Because of this, the PSID is often used to study intergenerational mobility in the United States (e.g. Mazumder, 2005; Lee and Solon, 2009).

Variables in the PSID that I use include years of schooling of the respondent and respondent's mother, the race of the household head, sex of the respondent and the age of the respondent. Years of schooling is recorded as 0-17 years of schooling.[28] I estimate the ITE among individuals who are 29-33 years old in any survey year. I do this in part to match the age bracket of respondents in the NLSYs used to estimate the ITE. Secondly, by choosing a narrow age bracket, the respondents used to estimate the ITE is fully replaced every five years. If there

[27] While the PSID has included an Immigrant sample since 1997, the children in this sample are not yet old enough to be included in my analysis.

[28] Individuals who have pursued some post-graduate work are recorded as having 17 years of schooling. I do not make any adjustments to the years of schooling for these individuals. Excluding these individuals does not substantially alter the main findings of this paper.

are any changes in the ITE over time by birth cohort, these changes would be realized with a narrow age bracket. The first year I estimate the ITE is in 1980 for individuals aged 29-33 born in 1947-1951. The last year I estimate the ITE is in 2013 for individuals aged 29-33, born in 1982-1986.

Unlike the NLSYs, I observe mother's education across many survey years, even if the individual and his or her mother are no longer living together. This is due to the design of the PSID, which surveys individuals who were a part of one of the original 1968 households, even if they are no longer living in that household. To mitigate misreporting of mother's years of schooling, I measure mother's education as the mode of years of schooling reported in surveys when aged 25 or older.[29]

I present descriptive statistics of the PSID in Table 3. In any given year, white mothers and respondents have a higher mean years of schooling than black mothers and respondents. These levels are similar to mean education levels from the US Census and American Community Survey. The mean years of schooling has increased for respondents and mothers with black mothers experiencing the biggest increase between 1980 and 2013.

The PSID has two major limitations. Firstly, the sample of individuals in any year aged 29-33 is much smaller when compared to other surveys such as the NLSYs. Thus my estimates of the ITE when using the PSID are less precise than when using the NLSYs. Secondly, Hispanic

[29] I use mother's rather than father's years of schooling to maximize the number of observations. The results of this paper do not change substantially when using father's years of schooling, an average of the parents, or the maximum years of schooling between the parents. Smith (2008) demonstrates that it is analytically ambiguous whether the average of parental education reduces measurement error.

and Asian immigration has been a substantial source of demographic change in the United States following the Immigration and Nationality Act of 1965. While the PSID was nationally representative of households in 1968, it has become misaligned with the United States population over time due to immigration. Though the Immigrant sample was added to address this issue, children in the immigrant sample are not yet old enough to be included in my estimates. Thus my estimates are representative of all individuals in the United States except for individuals who immigrated to the United States after 1968 and any of their descendants.

III. Empirical Findings

a. Regressions

I estimate the ITE every PSID survey year from 1980-2013 by taking the sample of individuals aged 29-33 and using the following specification:

$$Y_i = \beta_0 + \beta_1 MY_i + \varepsilon_i \qquad (1).$$

The dependent variable is the respondent's years of schooling when aged 29-33. The independent variables are a constant term, and the years of schooling of the respondent's mother (MY_i). The coefficient on mother's years of schooling (β_1) is the ITE for a particular survey year. Because I use a five-year birth cohort aged 29-33 to estimate the ITE in any year, there will be significant overlap in the sample of individuals used to estimate the ITE when moving to the next year. For example, PSID respondents who were born in 1947-1951 are used to estimate the ITE in 1980. For the 1981 estimates, I use PSID respondents who were born in 1948-1952. Thus there is significant overlap of individuals used to produce ITE estimates for adjacent years in 1980-2013. However, birth cohorts will be fully replaced every five years.

The ITE estimates for the PSID are presented in in Figures 2A-2C. Figure 1A shows the estimated coefficients and their 95% confidence intervals. For reference, the diamonds are the point estimates of the ITE from the NLSYs that I will describe below. In Figure 2A, the ITE appears to have remained stable over the past few decades and is reasonable in magnitude.

Figures 2B and 2C show estimates of the ITE separately for whites and blacks. The ITE also appears to remain stable over time among whites. However, among blacks, there has been a dramatic increase in educational persistence in recent years, particularly between 2001 and 2007.[30] In fact, when pooling estimated coefficients from 2001, 2003, 2005, and 2007 and testing for any difference between estimates pooled from 1993, 1995, 1997, and 1999, I find the difference in estimated coefficients among blacks is significant at the 99% level.[31] When I repeat this exercise for whites, I find no statistical difference. While there appears to have been an increase in the ITE among blacks, it may only be temporary: the ITE among blacks has trended downwards in recent years.

Corroborative evidence of a significant increase in the ITE among blacks comes from the NLSYs. I pool both samples and estimate the ITE using the following specification:

$$Y_i = \beta_0 + \beta_1 MY_i + \beta_2 S_i + \beta_3 MY_i * S_i + \varepsilon \quad (2).$$

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[30] Note that black mothers of children in earlier birth cohorts had considerably low levels of education, and there has been substantial increases in educational attainment of black mothers over time.

[31] The number of households in the PSID were reduced substantially in the 1997 survey due to budget constraints. Because the marked increase in persistence among blacks starts in 1997, this finding is suspect. However, when estimating equation (1) for individuals aged 25-29, the increase in persistence occurs in 1993. This is evidence against the argument that the increase in persistence is a result of the 1997 changes to the PSID.

Each variable is as defined in equation (1), and S is a sample indicator that takes a value of 0 if the individual is an NLSY79 respondent and a value of 1 if the individual is an NLSY97 respondent. I include this sample indicator to allow for educational increases over time when estimating the ITE. I include an interaction of mother's years of schooling and the sample indicator to test whether the ITE has changed over time. A positive and significant estimate of β_3 would indicate that there has been an increase in educational persistence. I estimate the ITE in 1993 using the NLSY79 cohort and in 2013 using the NLSY97 cohort. As with the PSID estimates, I first present estimates for all individuals, and then for each race separately. Results from this regression are found in Table 4.

Similar to the findings from the PSID, I find that the ITE has remained unchanged in the general population between the two cohorts. The ITE is high among whites in 1993 and exhibits no significant change in 2013. It is low among blacks, but increases profoundly between 1993 and 2013, nearly doubling in magnitude.[32]

b. Transition Probabilities

Thus far, I have presented a stark contrast in educational persistence changes over time within whites and blacks in the U.S. While tempting, it is not meaningful to make comparisons of the ITE, in the same period, between races (Mazumder, 2011). A measure of mobility for a particular group only describes the rate at which children revert to that particular group's mean,

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[32] Rising incarceration rates among black men in the 1990s may be partly driving these findings. However, these trends are still apparent when estimating the ITE separately by gender and race.

and not to society in general.[33] If a disadvantaged group experienced an increase in its mobility over time, this may initially seem like a good thing. However, if the mean education level among this group remains low compared to the rest of society, then this would not imply improved overall mobility for this group.

Transition matrices, on the other hand, *are* useful for making racial comparisons between subpopulations at a given point in time and have been used for this purpose in previous research of income mobility (e.g. Hertz, 2005). Racial comparisons are meaningful with transition matrices because comparisons are made between the educational achievements of black and white children who had mothers of a fixed education class (e.g. mothers with less than a high school degree). Additionally, transition matrices describe how upwardly or downwardly mobile individuals are. This is important for characterizing the increase in educational persistence among blacks. Clearly, higher persistence among children whose mothers have high levels of education would be preferred to higher persistence among children whose mothers have low levels of education.

I construct education transition matrices to describe upward and downward mobility by race and over time in Table 5. In each 3x3 matrix, I present three distributions of child's educational attainment conditional on the mother's educational attainment, and each column sums to one.[34]

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[33] As noted in a previous footnote, the opposite of intergenerational persistence is called intergenerational mobility. For this sub-section and the next, it will be easier to discuss findings in terms of mobility rather than persistence.

[34] Some columns do not exactly to one due to non-response by the respondent. The largest instance of nonresponse (2.85%) occurs in the distribution of black children in 2013 who had mothers with 9-12 years of schooling.

I choose categories of 0-11, 12-15, and 16-20 years of schooling, that is, less than a high school degree, at least a high school degree but not a college degree, and at least a college degree.

I will show that there has been a polarization in education towards either not finishing high school or completing college in the general population. I will also present results that demonstrate that this polarization in education is more profound among blacks than whites. Finally, the polarization in education is somewhat worrisome overall because the percentage point increases in downward mobility are bigger than the increases in upward mobility.

Panel A of Table 5 presents the education transition matrix for the entire population aged 29-33 in 1993 and 2013. Numbers along the downward-sloping diagonal are the probabilities that children obtained the same education level of their mothers. Numbers above the diagonal are the probabilities that children are downwardly mobile. Numbers below the diagonal are the probabilities that children are upwardly mobile.

I will discuss aggregate trends by closely examining Panel A. The leftmost columns of Panel A's matrices are the probabilities of children reaching a particular educational class if their mothers had 0-11 years of schooling in 1993 and 2013. The percentage of these children who remain at 0-11 years of schooling was 22.5% and increased to 35.1%. The percentage of children who obtain 12-15 years of schooling was 71.1% and decreased to 49.6%. Finally, the change in the percentage of children who obtained 16-20 years of schooling was 6.4% and more than doubled to 13.4%. Nonetheless, when analyzing the differences between 2013 and 1993, the large decrease in the percentage of children with 12-15 years of schooling was marked by a bigger increase in the percentage of children who obtained 0-11 years of schooling (12.6%) than those who obtained 16-20 years (7.0%). By comparison of the figures in the left-most columns of Panel A alone, there has been an overall decrease in upward mobility between 1993 and 2013 for children of mothers who have 0-11 years of schooling.[35]

Moving to the middle columns of the matrices for 1993 and 2013 in Panel A represents distributions of educational attainment of children whose mothers had 12-15 years of schooling. In this category, 6.3% of individuals declined in educational attainment relative to their mothers, only obtained 0-11 years of schooling in 1993. This figure has unfortunately increased to 14.8% in 2013. There has also been an increase in the percentage of respondents in this category who improved to 16-20 years of schooling, moving from 27.4% to 32.6%. The decrease in immobile children, those who obtained 12-15 years of schooling, declined from 66.4% to 51.7%. However, this decrease was a result of a bigger difference in the percentage of children who downwardly mobile (8.6%) than the difference in the percentage of children who are upwardly mobile (5.2%). Thus there has been an overall reduction in upward mobility among children of mothers with 12-15 years of schooling.

Moving to the rightmost columns of the 1993 and 2013 matrices in Panel A represents distributions of educational attainment for children whose mothers had 16-20 years of schooling. In this category there has been a subtle increase in downward mobility. Only 1.1% of children in this category obtained 0-11 years of schooling in 1993, and this increased to 3.0%

[35] Of course, the type of individuals who remain in the 0-11 years of schooling category has likely changed as well. However, the findings from the 12-15 years of schooling category reinforce the findings from the 0-11 years of schooling category. Because of this, I am less concerned that the entirety of my results are being driven by selection.

in 2013. There has been a decrease in the percentage of children who obtained 12-15 years of schooling (71.1% to 49.6%), and an increase in those remaining obtaining 16-20 years of schooling (6.4% to 13.4%). However, these differences over time are not statistically significant. In summary of Panel A, there has been a decrease in upward mobility in the general population.[36]

I will now discuss racial trends in mobility. In general, the trends by race are similar to the trends in the general population. For both races, there has been a decrease in upward mobility for children whose mothers who have 0-11 years of schooling. For children of mothers with 12-15 years of schooling, the gains in upward mobility were more than offset by gains in downward mobility, implying a reduction in upward mobility overall. Finally, for children of mothers with 16-20 years of schooling, there has been a small increase in downward mobility. These trends for blacks are much bigger in magnitude than for whites. Most of the racial differences at a given point in time as well as the racial differences in the differences over time are statistically significant at the 99% level.[37]

Panel B displays mobility matrices in 1993 and 2013 for whites. The magnitude and changes in mobility for whites largely reflect aggregate trends described above. Panel C displays mobility matrices in 1993 and 2013 for blacks. Comparing the left-most columns of Panel B and Panel C shows that for children of mothers with 0-11 years of schooling, blacks used to be more upwardly mobile than whites. An easy way to see this is to note that 23% of whites in the

[36] These findings, and the findings by race are still realized when accounting for the number of individuals who are a part of each cell. That is, in percentage of individuals, these findings also hold.

[37] Table available on request.

mothers with 0-11 years of schooling category were immobile in 1993 compared to 18.0% of blacks. Moving to 2013, this has reversed, with whites now being more upwardly mobile than blacks in this group. In 2013, 36.5% of whites in this category are immobile, but blacks are faring worse with 43.5% in this category being immobile.

For children of mothers with 12-15 years of schooling in 1993, whites are less immobile than blacks (50% vs. 55.9%). Whites also have greater upward mobility (29.1%) than downward mobility (5.8%). In this category, blacks also have more upward mobility than downward mobility in 1993, but blacks are more downwardly mobile than whites (8.3% vs 5.8%). Moreover, the percentage of blacks who are upwardly mobile (15.7%) is less than for whites (29.1%). While immobility in this category has declined for both whites and blacks, the figures from 2013 still show whites having more upward mobility and less downward mobility than blacks. When examining the net change over time for children of mothers with 12-15 years of schooling, blacks have experienced a greater increase in downward mobility than whites.

Finally, for children of mothers with 16-20 years of schooling there are no substantial changes over time. One thing to note is that whites have had and continue to have greater immobility in this category. In 1993, 66.9% of whites in this category obtained 16-20 years of schooling. Only 49.4% of blacks were able to do the same. While there has been improvement over time, blacks are still less immobile in this category than whites.[38]

[38] Children of mothers who have 16-20 years of schooling and obtained either 12-15 years of schooling or 16-20 years of schooling do not show any statistically significant change over time among whites or blacks. However, the racial differences for these children in a given point in time are significant at the 99% level and the racial differences in the changes over time are also significant at the 99% level.

In summary of racial trends, blacks have experienced an increase in downward mobility in the mothers with 0-11 years of schooling category. For the 12-15 years of schooling category, black have and continue to face more downward mobility than whites and less upward mobility than whites. For the 16-20 years of category, there has not been substantial change over time; however, whites continue to have greater immobility in this category than blacks. These trends illustrate a story of greater polarization in education. This is most clearly seen when calculating the stationary distributions of the transition matrices. These stationary distributions are presented in Figure 3.[39] For the entire population and for every race, the percentage of individuals having 12-15 years of schooling is less using 2013 transition probabilities than the transition probabilities from 1993. Moreover, the percentage of individuals having 0-11 years of schooling or 16-20 years of schooling is greater when using the 2013 transition probabilities than the transition probabilities from 1993. The stationary distributions also show a trend towards stronger polarization among blacks than whites.

c. Directional Mobility

Based on previous work by Formby, Smith and Zheng (2004), Bhattacharya and Mazumder (2011), I develop upward and downward educational mobility measures that are arguably more insightful than transition matrices. These measures are not as sensitive to cut off points because they track upward and downward movement of at least a certain amount and not whether or not an individual exited a particular education class. These measures are also useful because they are

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[39] The stationary distribution, π, of a transition matrix P is simply the solution to $\pi = \pi P$.

directional, either upward or downward, and can often be easier to interpret than net changes in transition probabilities.

As Bhattacharya and Mazumder (2011) explain, their measures of mobility, named directional rank mobility, may be more appropriate when making racial comparisons in mobility. In the context of education with discrete, time-invariant cutoff points, I call these measures *directional educational mobility*. Directional educational mobility can be defined for both upward and downward mobility. Upward educational mobility is defined as:

$$UEM_{\tau,s_1,s_2} = \Pr(Y_1 - Y_0 \geq \tau | s_1 \leq Y_0 \leq s_2) \quad (3).$$

Where Y_1 is the child's level of education, Y_0 is the mother's level of education, τ is an arbitrary amount of education needed to qualify an individual as moving up, and s_1 and s_2 are the cutoffs of education class considered, in this study, 0 and 11, 12 and 15, or 16 and 20 years of schooling. The simplest case is when $\tau = 1$, which simply makes UEM mean the probability that a child has more education than his mother.

Upward education mobility measures the probability of moving up in the distribution by a specific amount and does not depend on which cutoffs are used for the transition matrix. For example, consider the group of mothers with 0-11 years of schooling. Suppose there is a mother in this group who had 10 years of schooling whose child managed to obtain 12 years of schooling. Suppose also, that there is a mother in this group with 0 years of schooling whose child managed to obtain 9 years of schooling. The transition matrices as I constructed them in Table 5, would label the first child as being upwardly mobile while labeling the second child as being immobile despite the second child obtaining more education than his mother in absolute terms. This occurs because of the choice to use 11 years of schooling as a cutoff point of my transition matrix. Upward education mobility would, however, count both children as being upwardly mobile if $\tau = 1$, and only the second child as being upwardly mobile if $\tau = 3$ regardless of which cutoffs I choose.

Setting $\tau = 1$ may not be the most appropriate given rising average education levels of individuals as documented in Tables 2 and 3. Therefore I also consider values of $\tau = 2$ and$\tau = 3$. For upward education mobility, one should be aware that for the group of individuals whose mothers have 16-20 years of schooling, the upper bound of 20 years will limit the amount of upward education mobility by construction, especially when τ is big.

Table 6 displays measures of upward rank mobility by race and education level of respondents' mothers in the NLSY79 and NLSY97. Mechanically, as τ is increased, fewer individuals will be upwardly mobile. A clear contrast is illustrated between the two cohorts. Blacks whose mothers have 0-11 years of schooling are either more upwardly mobile or as mobile as whites in the NLSY79 cohort depending on the level of τ used. However, between cohorts, upward mobility declined for blacks relative to whites in this category so much that they are much less upwardly mobile than whites in the NLSY97 cohort. For the other categories, whites have been more upwardly mobile than blacks, and while the white-black difference in upward mobility may have declined, whites continue to be more upwardly mobile than blacks in the NLSY97 cohort. The only significant change between cohorts in the white-black difference between cohorts are among children of mothers with 0-11 years of schooling.

Similar to equation (3), one can construct downward education mobility:

$$DEM_{\tau,s} = \Pr(Y_0 - Y_1 \geq \tau | s_1 \leq Y_0 \leq s_2) \quad (4).$$

A bounding issue is also present when tracking downward education mobility for the group of individuals whose mothers have 0-11 years of schooling. The lower bound of 0 years of schooling may limit the amount of downward education mobility by construction, especially when τ is big.

Table 7 displays measures of downward rank mobility by race and cohort. In the NLSY79 cohort, there is little downward mobility in the category of mothers with 0-11 years of schooling for both whites and blacks. There is also no significant white-black difference. For children of mothers with 12-15 or 16-20 years of schooling in the NLSY79 cohort, blacks are more downwardly mobile than whites. Moving to the NLSY97 cohort, downward mobility for children of mothers with 0-11 and 12-15 years of schooling has grown over time for both whites and blacks. In any category, blacks are more downwardly mobile than whites. The only significant change over time in the white-black difference occurs among children of mothers with 0-11 years of schooling.

The main conclusion drawn from the transition probabilities in Table 5 and the directional mobility measures in Tables 6 and 7 is that the documented increase in persistence among blacks in recent decades is a worrisome trend. Upward educational mobility has decreased among blacks whose mothers have less than a high school education. For blacks with mothers who have at least a high school degree, they remain less upwardly mobile than whites. Additionally, there continues to be greater downward mobility among blacks than among whites.

IV. Changes in Family Structure

A possible explanation for increased educational persistence among blacks could lie in the change in family structure among blacks. Table 2 lists the percentage of households by the type of parentage respondents in the NLSY79 and NLSY97 grew up in. In the general population and in each race, there has been a decline in the percentage of two-parent households. Among blacks, the decline in two-parent households is the largest.

Because I use mother's years of schooling as the key explanatory variable when estimating the ITE, it could be that black mothers have a greater ability to transmit their educational attainment to their children because there is no father in the household. To explore whether my findings are being driven by the change in household composition I estimate the ITE as I do in Table 4, but separately by household type. Results from this exercise are presented in Table 8.

Educational persistence in education increases among blacks in both two-parent and single-parent households. This is evidence against the role of changing household structure being a factor that has contributed to rising educational persistence among blacks. To more formally show this, I pool all household types and control for whether a respondent was part of a two-parent household. Results from this regression are presented in the last four columns of Table 8. The importance of growing up in a two-parent households is important for one's educational attainment and has grown in importance between the two cohorts. This is indicated by the positive and significant estimated coefficients on the two-parent indicator and the interaction term of the two-parent indicator and NLSY97 sample indicator. Nonetheless, the increase in educational persistence among blacks above and beyond this still remains.

V. Racial Trends in Income Mobility

Though income and education are usually positively correlated, the big increase in educational persistence among blacks is not matched by a big increase in income persistence. To demonstrate this, I build on work by Lee and Solon (2009).[40] The authors use the PSID to estimate the intergenerational elasticity of income for sons and daughters aged 25-48 between 1977 and 2000. I replicate their methodology and extend their analysis to 2012. Estimates for this exercise are presented in Figure 2A.[41]

Clearly, there has been no large increase or decrease in income mobility, even throughout the 2008 financial crisis. I then take the sample used to estimate the figures presented in Figure 2 and estimate the intergenerational elasticity of income over time by race. These estimates and their 95% confidence intervals are presented in Figure 2B and Figure 2C. There has been relatively little change in income mobility among blacks when compared to the change in educational mobility among blacks.

Figure 2 describes mobility for a large birth cohort bracket, individuals aged 25-48. Lee and Solon (2009) use this large bracket to provide more precise estimates of the intergenerational

[40] Please refer to Lee and Solon (2009) for a description of their sample and econometric specification.

[41] Lee and Solon (2009) estimate the intergenerational elasticity of income separately by sex and only using the SEO sample. However, the bulk of my paper is concerned with racial trends and differences and not gender. Because of this, the replication of their estimates and my extension of estimates for 2002-2012 are presented in Appendix E.

elasticity of income. As stated previously, changes in any mobility measure are likely to be more pronounced when using narrower birth cohorts. However, a major reason Lee and Solon used a large age bracket was to estimate the intergenerational elasticity of income precisely. Indeed, when I attempt to restrict the bracket of individuals used to generate estimates to 29-33 years old as I do when estimating the ITE, many of the standard errors are so large that the estimates are not statistically different from zero.

Thus, I turn to the larger samples of the NLSYs to demonstrate the stability of income mobility over time and among blacks when using narrower age bracket. I estimate the intergenerational elasticity of income using the following specification:[42]

$$CRI_i = \beta_0 + \beta_1 PRI_i + \beta_2 S_i + \beta_3 PRI_i * S_i + \beta_4 Age_i + \beta_5 Age_i^2 + \beta_6 AgeM_i + \beta_7 AgeM\hat{}2_i + \varepsilon \quad (5)$$

where CRI is the natural log of the child respondent's real total family income reported in 1993 or 2013. PRI is the natural log of parent's real total family income when surveyed in 1979 or 1997, S_i is an indicator for whether the child was part of the NLSY97 survey, and $AgeM_i$ is the age of the child's mother when surveyed in 1979 or 1997. Results for this regression are found in Table 9. Similar to the findings from the PSID, the intergenerational elasticity of income has not significantly changed between 1993 and 2013.

Finally, I demonstrate that the increase in educational persistence among blacks may not be associated with changing income levels. If family income is important for a child's educational attainment and has become more important over time and family income is positively correlated with a mother's educational attainment, the growing importance of mother's educational

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42 This specification is similar to the one used by Lee and Solon (2009).

attainment may merely be capturing the growing importance of family income. Thus, I present the estimates of the ITE while controlling for real family income in Table 10. Unsurprisingly, real family income is positively associated with the educational attainment of respondents. Additionally, it is true that the importance of real family income has risen for the NLSY97 cohort in general and among whites. However, controlling for the level of family income does not alter this paper's main finding: educational persistence has risen greatly among blacks, albeit less so than when not controlling for family income.

VI. Conclusion

The mechanism determining what level of education an individual is able to obtain is multi-faceted but strongly associated with his or her parent's level of education. In this study, I analyze this association, the intergenerational transmission of education, in the United States in a number of different ways through the lens of race. It is especially important to consider this view of educational mobility in the United States given the racial history of education and education policy in the United States. My estimates of the intergenerational transmission of education in the United States are, to my knowledge, the most recent to date.

I first highlight the different histories of educational mobility within races, uncovering a large increase in educational persistence among blacks. This increase is not observed among whites. Through transition matrices and new directional measures of mobility, I am able to characterize changes in education mobility over time. Black children whose mothers have less than a high school education today have a lower probability of getting at least a high school degree than they did 20 years ago. For children whose mothers had at least a high school degree, whites have had and continue to have a higher probability of being upwardly mobile than blacks. Thus the marked increase in educational persistence is largely a worrisome trend.

Changing family structure does not appear to be the cause behind the increase in black educational persistence and the racial trends educational mobility are not apparent in racial trends in income mobility. Given that educational and income inequality are not very correlated across countries (Morrisson and Murtin, 2013), this discrepancy must not necessarily be reconciled. Moreover, research on the effects of desegregation policy on education and income mobility have shown that income and educational mobility do not necessarily follow the same trends (Bloome and Western, 2011). Identifying the cause of the increase in black educational persistence is an important area for future research, especially if it is rooted in public policy. The findings of this paper suggest that programs directed at improving the educational outcomes for children who have parents with low education should be evaluated on their efficacy and if effective, increased in scale.[43]

[43] The Advancement Via Individual Determination is a non-profit organization that directs support to students in high school wishing to pursue college given that they will be the first generation in their family to attend college. In light of this paper's findings, such a program may mitigate the decline in upward mobility experienced among children whose parents do not have a high school degree, especially among blacks.

References

Altonji, Joseph G., and Thomas A. Dunn. "The effects of family characteristics on the return to education." *The Review of Economics and Statistics* (1996): 692-704.

Altonji, Joseph G., Prashant Bharadwaj, and Fabian Lange. *Changes in the characteristics of american youth: Implications for adult outcomes*. No. w13883. National Bureau of Economic Research, 2008.

Bauer, Philipp, and Regina T. Riphahn. "Timing of school tracking as a determinant of intergenerational transmission of education." *Economics Letters*91, no. 1 (2006): 90-97.

Behrman, Jere R., and Mark R. Rosenzweig. "Does increasing women's schooling raise the schooling of the next generation?." *American Economic Review* (2002): 323-334.

Bhattacharya, Debopam, and Bhashkar Mazumder. "A nonparametric analysis of black–white differences in intergenerational income mobility in the United States." *Quantitative Economics* 2, no. 3 (2011): 335-379.

Black, Sandra E., and Paul J. Devereux. "Recent developments in intergenerational mobility." *Handbook of labor economics* 4 (2011): 1487-1541.

Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes. "Staying in the Classroom and out of the maternity ward? The effect of compulsory schooling laws on teenage births*." *The Economic Journal* 118, no. 530 (2008): 1025-1054.

Bloome, Deirdre, and Bruce Western. "Cohort change and racial differences in educational and income mobility." *Social Forces* 90, no. 2 (2011): 375-395.

Card, David. "The causal effect of education on earnings." *Handbook of labor economics* 3 (1999): 1801-1863.

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez. *Where is the land of opportunity? the geography of intergenerational mobility in the united states*. No. w19843. National Bureau of Economic Research, 2014.

Chevalier, Arnaud, Kevin Denny, and Dorren McMahon. "A multi-country study of inter-generational educational mobility." (2003).

Couch, Kenneth A., and Thomas A. Dunn. "Intergenerational correlations in labor market status: A comparison of the United States and Germany." *Journal of Human Resources* (1997): 210-232.

Formby, John P., W. James Smith, and Buhong Zheng. "Mobility measurement, transition matrices and statistical inference." *Journal of Econometrics* 120, no. 1 (2004): 181-205.

Ganzeboom, Harry BG, Ruud Luijkx, and Donald J. Treiman. "Intergenerational class mobility in comparative perspective." *Research in social Stratification and Mobility* 8 (1989): 3-79.

Haider, Steven, and Gary Solon. "Life-cycle variation in the association between current and lifetime earnings." *The American economic review* 96, no. 4 (2006): 1308-1320.

Heineck, Guido, and Regina T. Riphahn. *Intergenerational transmission of educational attainment in Germany: The last five decades*. No. 738. Discussion papers//German Institute for Economic Research, 2007.

Hertz, Tom. "Rags, riches and race: The intergenerational economic mobility of black and white families in the United States." *Unequal chances: Family background and economic success* 2005 (2005): 165-91.

Hertz, Tom, Tamara Jayasundera, Patrizio Piraino, Sibel Selcuk, Nicole Smith, and Alina Verashchagina. "The inheritance of educational inequality: International comparisons and fifty-year trends." *The BE Journal of Economic Analysis & Policy* 7, no. 2 (2007).

Huang, Jin. "Intergenerational transmission of educational attainment: The role of household assets." *Economics of Education Review* 33 (2013): 112-123.

Kemptner, Daniel, Hendrik Jürges, and Steffen Reinhold. "Changes in compulsory schooling and the causal effect of education on health: Evidence from Germany." *Journal of Health Economics* 30, no. 2 (2011): 340-354.

Kornrich, Sabino, and Frank Furstenberg. "Investing in Children: Changes in Parental Spending on Children, 1972–2007." *Demography* 50, no. 1 (2013): 1-23.

Lee, Chul-In, and Gary Solon. "Trends in intergenerational income mobility."*The Review of Economics and Statistics* 91, no. 4 (2009): 766-772.

Lochner, Lance. "Education, Work, and Crime: A Human Capital Approach*."*International Economic Review* 45, no. 3 (2004): 811-843.

Machin, Stephen, and Anna Vignoles. "Educational inequality: the widening socio-economic gap." *Fiscal Studies* 25, no. 2 (2004): 107-128.

Mayer, Susan E., and Leonard M. Lopoo. "Has the intergenerational transmission of economic status changed?." *Journal of Human Resources* 40, no. 1 (2005): 169-185.

Mazumder, Bhash. "Black-White Differences in Intergenerational Economic Mobility in the US." (2011).

Mazumder, Bhashkar. "Fortunate sons: New estimates of intergenerational mobility in the United States using social security earnings data." *Review of Economics and Statistics* 87, no. 2 (2005): 235-255.

Morrisson, Christian, and Fabrice Murtin. "The Kuznets curve of human capital inequality: 1870–2010." *The Journal of Economic Inequality* 11, no. 3 (2013): 283-301.

Pascual, Marta, and David Cantarero. "Intergenerational health mobility: an empirical approach based on the ECHP." *Applied Economics* 41, no. 4 (2009): 451-458.

Park, Jin Huem. "Returns to schooling: A peculiar deviation from linearity." (1994).

Plug, Erik. "Estimating the effect of mother's schooling on children's schooling using a sample of adoptees." *American Economic Review* (2004): 358-368.

Solon, Gary. "Intergenerational income mobility in the United States." *The American Economic Review* (1992): 393-408.

Winter, Mildred, and Joy Rouse. "Fostering intergenerational literacy: The Missouri parents as teachers program." *The Reading Teacher* (1990): 382-386.

Table 1 - Selected U.S. Studies of the Intergenerational Transmission of Education

Author(s)	Year	Data	Birth Cohort(s)	Year(s) Estimated	Regression Point Estimate	Correlation
Huang	2013	Panel Study of Income Dynamics	1964-71, 1974-81	1996, 2007	.15-.42	.43-50
Behrman & Rosenzwig	2002	Minnesota Twin Registry	1936-55	1994	0.332-.466	-
Plug	2004	Wisconsin Longitudinal Survey	1956-79 (Approximately)	1992	.267-.538	-
Altonji & Dunn	1996	Panel Study of Income Dynamics, NLS Young Men, NLS Young	1913-65, 1942-52, 1944-54	1968-89, 1966-81, 1968-88 (Pooled)	-	.33-.58
Couch and Dunn	2007	Panel Study of Income Dynamics	1948-68 (Approximately)		.255-.368	.402-.431
Hertz	2007	International Social Survey Programme	1929-80	1932, 1937,…,1977	.4-.5	.35-.5
Pena	2011	Health & Retirement Study, Wisconsin Longitudinal Study	1967-, 1979-	1992, 2004	.275-.499	-
Olneck	1977	Kalamazoo Sample	1917-39	1973	-	.383-.423

Note: This table lists major studies of the intergenerational transmission of education in the United States by author and year of publication. In some studies authors present regression estimates of the coefficient on parental education when regressing child's education on parental education. Other studies present correlation coefficients between child and parental education.

Table 2 - Descriptive Statistics from the NLSY79 and NLSY97													
Panel A: NLSY79		All Races			Whites			Blacks			Hispanics		
		n	Mean	Std. Dev.	n	Mean	Std. Dev.	n	Mean	Std. Dev.	n	Mean	Std. Dev.
	Individual's Years of Schooling	6,008	12.92	2.39	2,997	13.4	2.5	1,828	12.7	2.0	1,183	12.22	2.42
	Mother's Years of Schooling	5,646	10.8	3.21	2,872	11.9	2.4	1,673	10.8	2.5	1,101	7.90	4.07
	Mother's Age	5,834	42.92	6.82	2,924	43.2	6.5	1,761	42.5	7.2	1,149	42.74	7.00
	Two Parent Household Indicator	6,009	0.77	0.42	2,997	0.88	0.3	1,828	0.58	0.5	1,184	0.76	0.43
Panel B: NLSY97													
	Individual's Years of Schooling	7,048	13.67	2.99	3,607	14.3	3.0	1,934	13.1	2.0	1,507	13.05	2.79
	Mother's Years of Schooling	6,353	12.53	2.96	3,335	13.5	2.5	1,687	12.5	2.5	1,331	10.28	3.66
	Mother's Age	6,325	39.94	5.65	3,281	40.6	5.3	1,671	39.0	7.2	1,373	39.58	5.68
	Two Parent Household Indicator	7,141	0.61	0.49	3,637	0.73	0.4	1,973	0.38	0.5	1,531	0.63	0.48

Note: This table lists the number of observations and means and standard deviations for individual years of schooling, mother's years of schooling, and mother's age in the the NLSY79 and NLSY97. The first three columns display figures for each survey when combining all races. The remaining columns display these figures by race. The number of observations is differs depending on which variable is being described. For example, in the NLSY79 among all races, more mothers report their age than their years of schooling.

Table 3 - Descriptive Statistics from the PSID 1978-2013

	Whites					Blacks				
Year	n	Mean Yrs. Schooling	Std. Deviation	Mean Mother's Yrs. Schooling	Std. Deviation	n	Mean Yrs. Schooling	Std. Deviation	Mean Mother's Yrs. Schooling	Std. Deviation
1980	1,047	13.32	2.16	11.54	2.93	591	11.91	1.98	9.07	2.71
1981	1,057	13.28	2.09	11.45	2.71	653	11.94	1.91	9.07	2.73
1982	1,115	13.19	2.05	11.51	2.75	717	12.01	1.89	9.29	2.62
1983	1,173	13.12	2.11	11.53	2.66	794	12.09	1.92	9.36	2.76
1984	1,274	13.11	2.10	11.53	2.66	813	12.10	1.86	9.47	2.71
1985	1,318	13.35	2.15	11.48	2.63	813	12.39	1.91	9.62	2.77
1986	1,323	13.32	2.15	11.61	2.65	832	12.43	1.90	9.81	2.75
1987	1,248	13.24	2.14	11.58	2.59	840	12.40	1.97	9.86	2.78
1988	1,235	13.24	2.14	11.65	2.58	855	12.41	1.86	9.90	2.70
1989	1,206	13.29	2.08	11.76	2.57	845	12.47	1.84	10.04	2.82
1990	1,574	12.76	2.63	11.84	2.52	804	12.41	1.85	10.06	2.78
1991	1,483	12.77	2.53	11.81	2.58	783	12.37	1.67	10.17	2.70
1992	1,520	12.80	2.53	11.98	2.55	764	12.35	1.65	10.25	2.68
1993	1,467	12.83	2.51	12.04	2.52	755	12.35	1.63	10.46	2.53
1994	1,424	13.04	2.43	12.11	2.43	716	12.37	1.63	10.60	2.31
1995	1,283	13.02	2.33	12.10	2.40	677	12.35	1.81	10.70	2.25
1996	1,011	13.28	2.10	12.17	2.33	603	12.51	1.80	10.83	2.25
1997	712	13.41	2.22	12.42	2.18	393	12.65	1.93	10.79	2.17
1999	709	13.54	2.18	12.67	2.02	363	12.84	1.84	10.92	2.30
2001	778	13.62	2.09	12.77	2.06	346	12.71	1.77	11.28	2.05
2003	831	13.70	2.02	12.78	2.22	407	12.80	1.86	11.70	1.87
2005	924	13.56	2.29	12.87	2.19	466	12.83	1.81	11.95	1.71
2007	995	13.65	2.17	13.00	2.14	507	12.96	1.87	12.03	1.74
2009	1,155	14.08	2.17	13.16	2.27	655	13.27	1.99	12.07	1.92
2011	1,183	14.22	2.05	13.24	2.41	705	13.21	1.98	12.22	1.89
2013	1,145	14.30	2.16	13.20	2.74	750	13.33	2.05	12.42	1.91

Note: Mean years of schooling is the average years of schooling of PSID respondents aged 27-31 in each survey year. Mean mother's years of schooling is the average years of schooling of mothers of these respondents. Figures are from the combined SRC, SEO, Latino, and Immigrant samples.

Table 4 - ITE Estimates from the NLSYs, Individuals Aged 29-33

Variable	All	Whites	Blacks	Hispanics
Mother's Years of Schooling	0.392***	0.475***	0.263***	0.185***
	(0.012)	(0.019)	(0.02)	(0.023)
NLSY97 Sample Indicator	-0.026	0.436	-3.067***	0.142
	(0.238)	(0.375)	(0.518)	(0.305)
Mother's Years of Schooling * Indicator	0.02	-0.017	0.247***	0.029
	(0.019)	(0.028)	(0.043)	(0.031)
Constant	8.747***	7.766***	9.902***	10.814***
	(0.144)	(0.225)	(0.223)	(0.204)
n	11,923	6,180	3,329	2,414

Note: This table presents estimates of the ITE in 1993 and 2013 by pooling the NLSY79 and NLSY97 samples. The dependent variable is the respondent's years of schooling as reported in 1993 or 2013 when respondents are 29-33 years old. Robust standard errors are reported below each estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 - Education Transition Matrices by Race in 1993 and 2013, individuals aged 29-33

		1993				2013				Difference		
		Mother's Years of Schooling										
Panel A: All Races												
		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs
Child's Yrs Schl.	0-11 Yrs	22.5	6.3	1.1		35.1	14.8	3.0		12.6***	8.6***	1.8***
	12-15 Yrs	71.1	66.4	33.5		49.6	51.7	29.0		-21.5***	-14.7***	-4.4
	16-20 Yrs	6.4	27.4	65.4		13.4	32.6	67.3		7.0***	5.2***	1.9
Panel B: Whites												
		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs
Child's Yrs Schl.	0-11 Yrs	23.0	5.8	0.9		36.5	13.7	2.6		13.4***	7.9***	1.8***
	12-15 Yrs	70.7	65.1	32.2		47.0	50.0	27.9		-23.7***	-15.1***	-4.3
	16-20 Yrs	6.3	29.1	66.9		15.5	35.5	68.8		9.2***	6.4***	1.9
Panel C: Blacks												
		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs
Child's Yrs Schl.	0-11 Yrs	18.0	8.3	3.8		43.5	19.6	6.1		25.5***	11.3***	2.2***
	12-15 Yrs	75.0	76.0	46.8		43.0	55.9	35.8		-32.0***	-20.1***	-10.9
	16-20 Yrs	7.0	15.7	49.4		9.1	23.3	57.1		2.2	7.6***	7.8
Panel D: Hispanics												
		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs		0-11 Yrs	12-15 Yrs	16-20 Yrs
Child's Yrs Schl.	0-11 Yrs	27.2	13.5	3.1		28.2	15.8	4.1		1.1	2.2	1
	12-15 Yrs	66.7	69.6	40.4		57.4	57.2	39.2		-9.2***	-12.4***	-1.2
	16-20 Yrs	6.0	16.8	56.6		12.6	26.3	56.7		6.5***	9.5***	0.2

Note: Figures come from the NSLY79 and NLSY97 for individuals aged 29-33 in 1993 and 2013. Mother's education is measured in each survey's base year, 1979 or 1997. Each column in any 3x3 matrix is a conditional education distribution of respondents given their mother's education.

Table 6 - Upward Class Mobility

	τ=1 year				τ=2 years		
Panel A: NLSY79	Whites	Blacks	W-B		Whites	Blacks	W-B
Mothers with 0-11 Yrs. of Schooling	87.3***	90.3***	-3.0*		67.9***	68.7***	-0.9
Mothers with 12-15 Yrs. of Schooling	49.4***	41.1***	8.3***		39.3***	31.0***	8.2***
Mothers with 16-20 Yrs. of Schooling	27.9***	16.1***	11.8**		20.0***	10.8***	9.2**
Mothers with any Yrs. of Schooling	57.0***	65.1***	-8.1***		44.7***	49.4***	-4.7***
Panel B: NLSY97							
Mothers with 0-11 Yrs. of Schooling	74.7***	62.6***	12.1***		58.5***	45.6***	12.9***
Mothers with 12-15 Yrs. of Schooling	55.2***	49.4***	5.8***		45.3***	36.6***	8.7***
Mothers with 16-20 Yrs. Of Schooling	32.8***	27.7***	5.2		21.8***	19.7***	2.1
Mothers with any Yrs. of Schooling	51.7***	49.6***	2.1		40.8***	36.6***	4.2***
Change (NLSY97 - NLSY79)							
Mothers with 0-11 Yrs. of Schooling	-12.6***	-27.7***	15.0***		-9.4***	-23.1***	**13.8*** **
Mothers with 12-15 Yrs. of Schooling	5.8***	8.3***	-2.6		6.0***	5.6**	0.4
Mothers with 16-20 Yrs. Of Schooling	4.9	11.6**	-6.6		1.8	8.9*	-7.1
Mothers with any Yrs. of Schooling	-5.3***	-15.5***	10.2***		-3.9***	-12.8***	8.9***

Note: These figures are probabilities of individuals increased their educational attainment by at least τ more than their mothers. Probabilities are presented for NLSY79 and NLSY97 respondents by educational attainment of their mothers and race. Two values of τ are considered. For each value of τ, the last column shows the white-black difference in probabilities. For mothers with 16-20 years of schooling, the upper bound of 20 years of schooling may reduce the probability by construction, especially for larger values of τ.

Table 7 - Downward Class Mobility

	τ=1 year				τ=2 years				τ=3 years		
Panel A: NLSY79	Whites	Blacks	W-B		Whites	Blacks	W-B		Whites	Blacks	W-B
Mothers with 0-11 Yrs. of Schooling	6.6***	4.7***	1.9		3.0***	2.2***	0.8		0.9***	1.2***	-0.3
Mothers with 12-15 Yrs. of Schooling	11.5***	18.6***	-7.1***		6.5***	10.2***	-3.7***		2.8***	2.8***	0
Mothers with 16-20 Yrs. Of Schooling	43.3***	64.1***	-20.9***		34.9***	47.4***	-12.5*		22.3***	28.9***	-6.6
Panel B: NLSY97											
Mothers with 0-11 Yrs. of Schooling	18.2***	26.9***	-8.7***		7.2***	16.1***	-9.0***		2.1***	4.1***	-2.0
Mothers with 12-15 Yrs. of Schooling	25.0***	29.6***	-4.6***		16.5***	19.7***	-3.2**		9.1***	10.7***	-1.6
Mothers with 16-20 Yrs. Of Schooling	45.9***	56.7***	-10.8**		37.4***	44.6***	-7.2		23.3***	32.1***	-8.8**
Change (NLSY97-NLSY79)											
Mothers with 0-11 Yrs. of Schooling	11.6***	22.2***	-10.6***		4.2***	13.9***	-9.8***		1.2	2.9***	-1.7
Mothers with 12-15 Yrs. of Schooling	13.5***	11.0***	2.5		10.0***	9.6***	.4		6.3***	7.9***	-1.6
Mothers with 16-20 Yrs. Of Schooling	2.6	-7.4	10.1		2.5	-2.8	5.3		1.0	3.2	-2.2

Note: These figures are probabilities of individuals increased their educational attainment by at least τ more than their mothers. Probabilities are presented for NLSY79 and NLSY97 respondents by educational attainment of their mothers and race. Two values of τ are considered. For each value of τ, the last column shows the white-black difference in probabilities. . For mothers with 0-11 years of schooling, the lower bound of 0 years of schooling may reduce the probability, especially for larger values of τ.

Table 8 - The Intergenerational Transmission of Education Among Two-Parent and Single-Parent Households

	Two-Parent Households				Single-Parent Households				All Households			
	All	Whites	Blacks	Hispanics	All	Whites	Blacks	Hispanics	All	Whites	Blacks	Hispanics
Mother's Years of Schooling	0.404***	0.484***	0.267***	0.187***	0.33***	0.416***	0.241***	0.194***	0.387***	0.473***	0.26***	0.184***
	(0.014)	(0.021)	(0.027)	(0.027)	(0.026)	(0.045)	(0.032)	(0.042)	(0.013)	(0.019)	(0.02)	(0.023)
NLSY97 Sample Indicator	0.352	0.678	-2.705***	0.224	-0.994**	-0.89	-3.585***	0.034	-0.377	-0.008	-2.949***	-0.122
	(0.281)	(0.423)	(0.739)	(0.351)	(0.446)	(0.806)	(0.693)	(0.633)	(0.24)	(0.388)	(0.504)	(0.348)
Mother's Yrs of Schl. * NLSY97 Ind.	0.008	-0.022	0.244***	0.034	0.069*	0.048	0.289***	0.016	0.014	-0.018	0.224***	0.032
	(0.022)	(0.032)	(0.058)	(0.036)	(0.039)	(0.064)	(0.059)	(0.064)	(0.019)	(0.028)	(0.042)	(0.031)
Two Parent Household Indicator									0.433***	0.463***	0.315***	0.326*
									(0.09)	(0.139)	(0.099)	(0.177)
Two Parent Ind. * NLSY97 Ind.									0.665***	0.65***	0.526***	0.376
									(0.123)	(0.183)	(0.176)	(0.242)
Constant	8.671***	7.713***	9.976***	10.871***	9.104***	8.147***	9.87***	10.474***	8.437***	7.378***	9.746***	10.575***
	(0.169)	(0.251)	(0.297)	(0.244)	(0.276)	(0.525)	(0.342)	(0.363)	(0.151)	(0.247)	(0.225)	(0.236)
n	8,549	5,109	1,705	1,735	3,051	961	1,472	618	11,923	6,180	3,329	2,414

Note: This table presents estimates of the ITE among respondents who grew up in two-parent or single-parent households separately by race. The final four columns includes the entire pooled NLSY79 and NLSY97 samples with an indicator for respondents who grew up in two-parent households.

Table 9 - Estimates of the Intergenerational Elasticity of Income, individuals aged 29-33 in 1991 and 2011

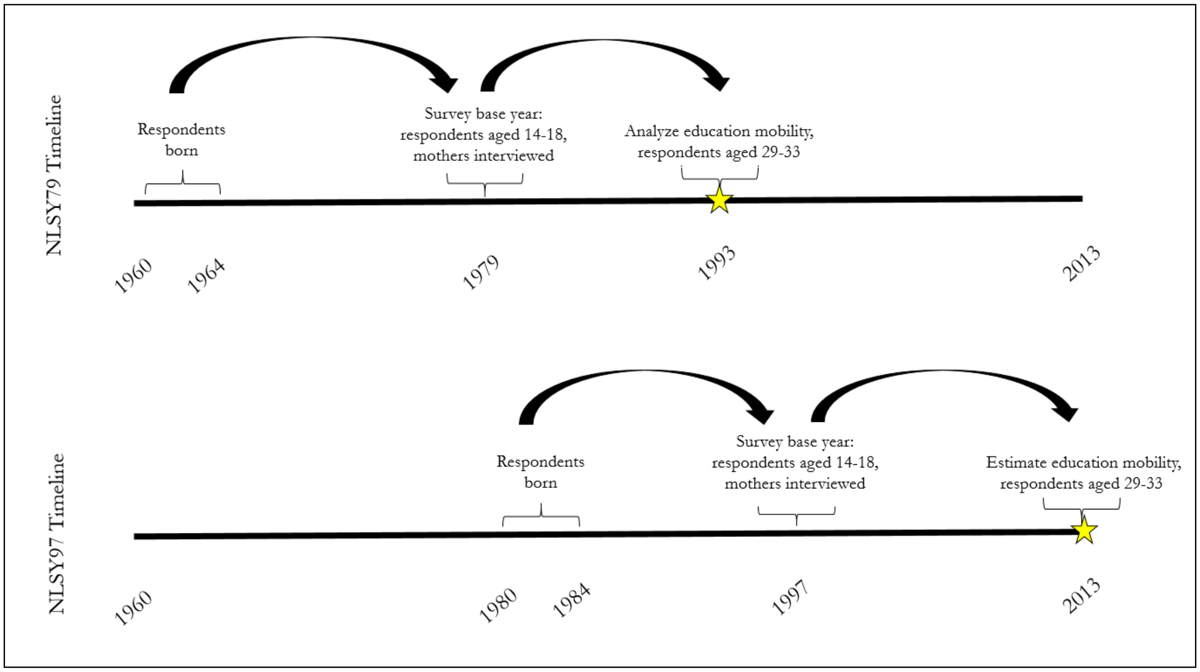
	All	Whites	Blacks	Hispanics
Log Real Family Income	0.447***	0.313***	0.538***	0.311**
	(0.038)	(0.045)	(0.097)	(0.125)
NLSY97 Sample Indicator	0.393	-0.352	-0.63	1.996
	(0.631)	(0.848)	(1.597)	(1.462)
Log Real Family Income * Sample Indicator	-0.038	0.026	0.026	-0.153
	(0.053)	(0.071)	(0.14)	(0.13)
Mother's Age	0.118***	0.11**	0.018	0.127
	(0.036)	(0.044)	(0.071)	(0.103)
Mother's Age^2	-0.001***	-0.001**	0.000	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Age	-2.185***	-1.728**	-4.855**	-1.261
	(0.7)	(0.781)	(2.218)	(1.811)
Age^2	0.036***	0.028**	0.079**	0.021
	(0.011)	(0.013)	(0.036)	(0.029)
Constant	36.901***	31.706***	78.252**	24.136
	(10.823)	(12.076)	(34.197)	(28.265)
n	7,933	4,296	2,050	1,587

Note: This table presents estimates of the intergenerational elasticity of income by regressing the natural log of real income of NLSY79 and NLSY97 respondents when aged 29-33 on the natural log of their household income in the survey base year when living with their parents.

Table 10 - ITE Estimates from the NLSYs Controlling for Income, Individuals Aged 29-33				
	All	Whites	Blacks	Hispanics
Mother's Years of Schooling	0.299***	0.377***	0.218***	0.143***
	(0.014)	(0.021)	(0.022)	(0.024)
NLSY97 Sample Indicator	-1.576*	-2.964**	-3.269***	3.151**
	(0.824)	(1.297)	(1.152)	(1.551)
Mother's Yrs of Schl.* Sample Indicator	0.016	-0.028	0.173***	0.043
	(0.023)	(0.034)	(0.052)	(0.036)
Log Real Family Income	0.584***	0.659***	0.404***	0.605***
	(0.056)	(0.081)	(0.069)	(0.122)
Log Real Family Income*Sample Indicator	0.15*	0.313***	0.109	-0.28*
	(0.078)	(0.118)	(0.112)	(0.141)
Constant	2.983	1.128	5.922***	4.424***
	(0.601)	(0.896)	(0.737)	(1.347)
n				

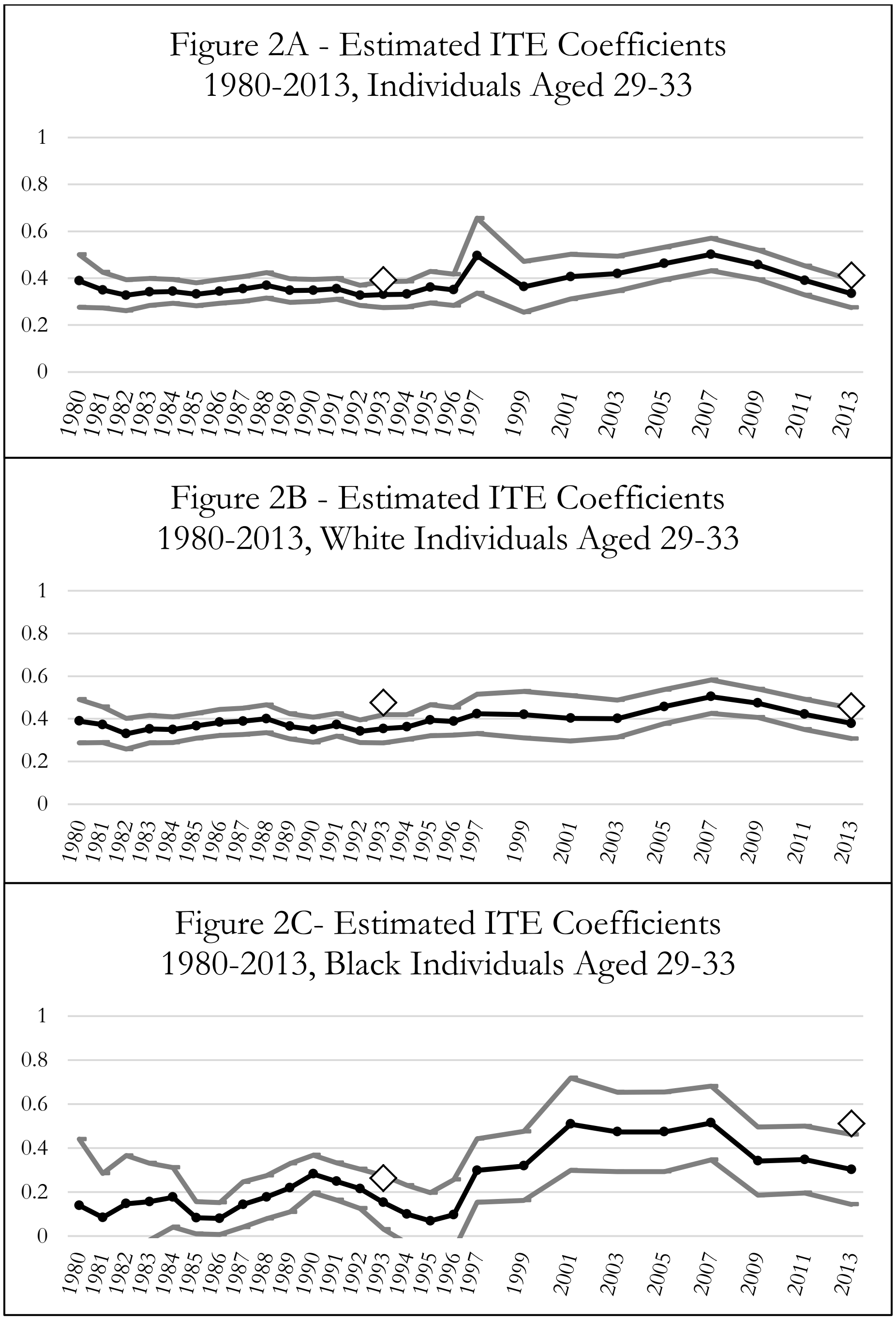
Note: This table presents estimates of the ITE in 1993 and 2013 by pooling the NLSY79 and NLSY97 samples and controlling for the natural log of real family income in both periods. The dependent variable is the respondent's years of schooling as reported in 1993 or 2013 when respondents are 29-33 years old. Robust standard errors are reported below each estimate.

Figure 1 – Timeline for the NLSY79 and NLSY97



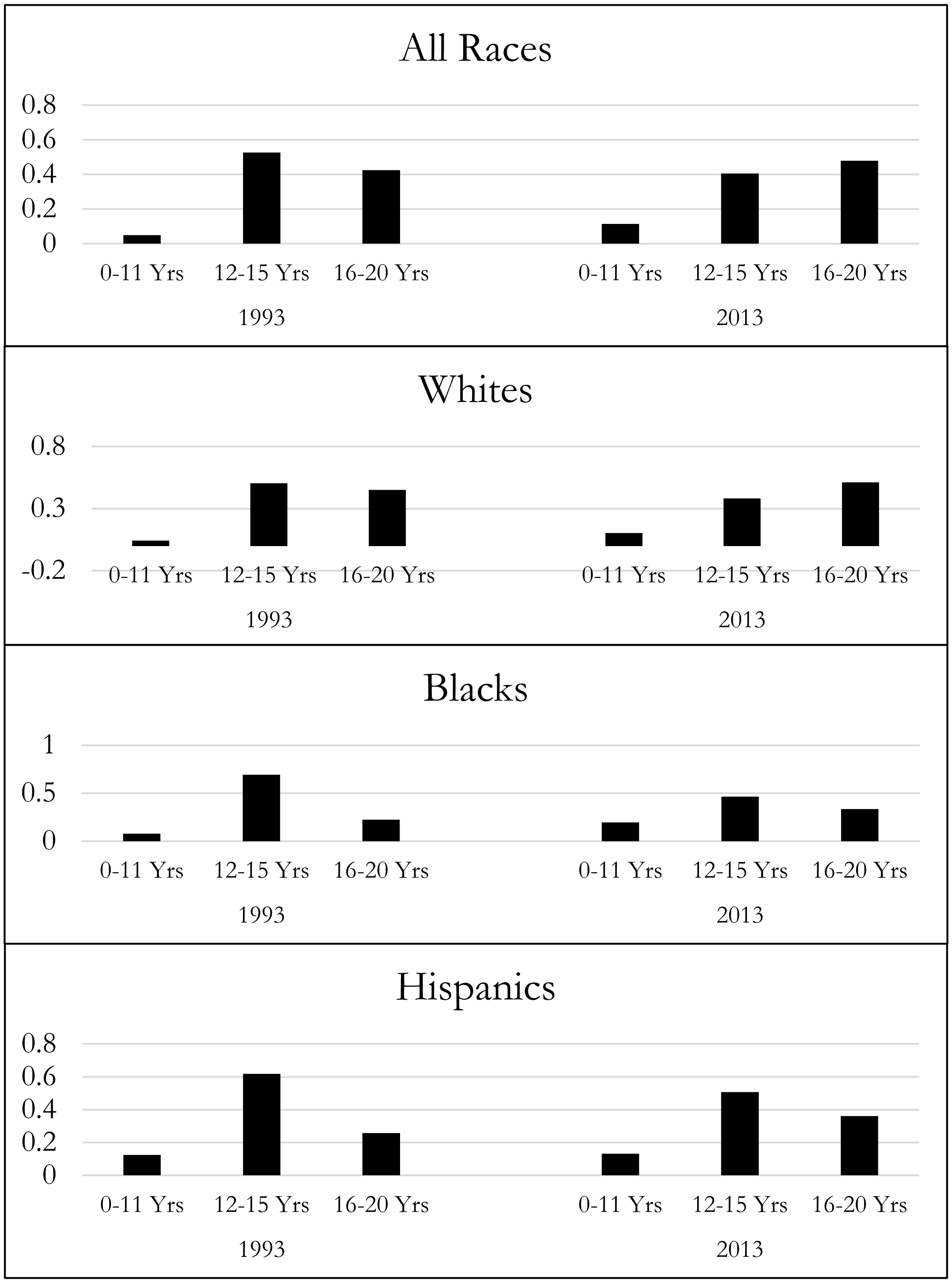
Note: This figure depicts the timeline in years for the NLSY79 and NLSY97. For the NLSY79, respondents are born in 1960-64 and are first interviewed in 1979 when aged 14-18. Information on mothers, including their educational attainment, is obtained in this first interview. Information on respondents' educational attainment is collected in 1993 when aged 29-33 and is also the year when intergenerational educational persistence is estimated. The NLSY97 follows a similar timeline.

Figure 2 – Estimates of Intergenerational Educational Persistence



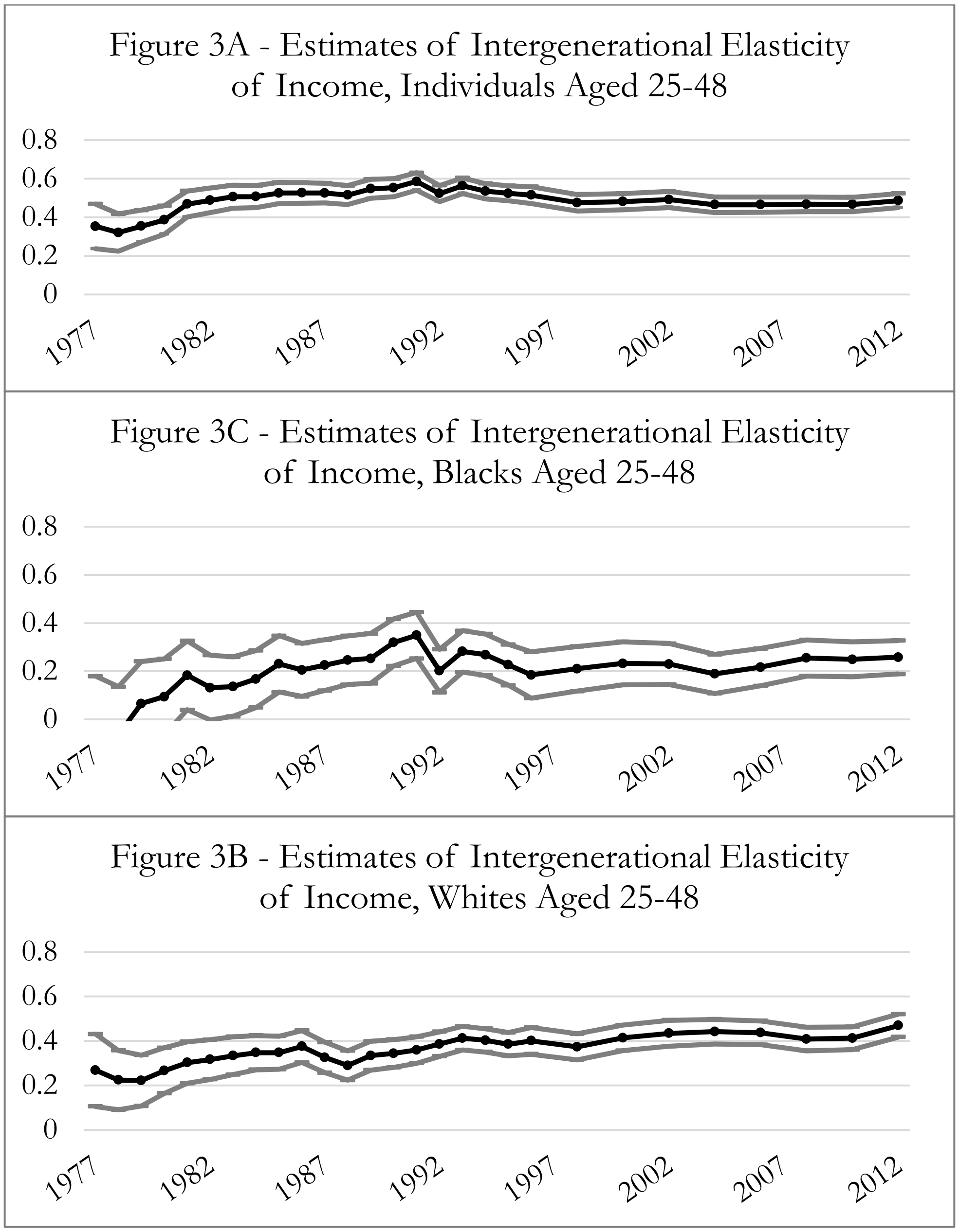
Note: These figures present point estimates and 95% confidence intervals of the intergenerational transmission of education using specification (1). Starting in 1997, the PSID occurred on a biannual basis. Diamonds show point estimates of the ITE in 1993 and 2013 from the NLSYs as detailed in Table 4.

Figure 3 – Stationary Distributions of Education in 1993 and 2013



Note: These figures depict the stationary distributions for the transition matrices

Figure 4 – Estimates of the Intergenerational Elasticity of Income



Note: These figures present point estimates and 95% confidence intervals of the intergenerational income Elasticity of income using the baseline specification from Lee and Solon (2009). Starting in 1997, the PSID occurred on a biannual basis. Households reported 2012 income in the 2013 round of the PSID and as such, 2012 is the last year possible to estimate intergenerational income persistence.

Appendix A – Correlations

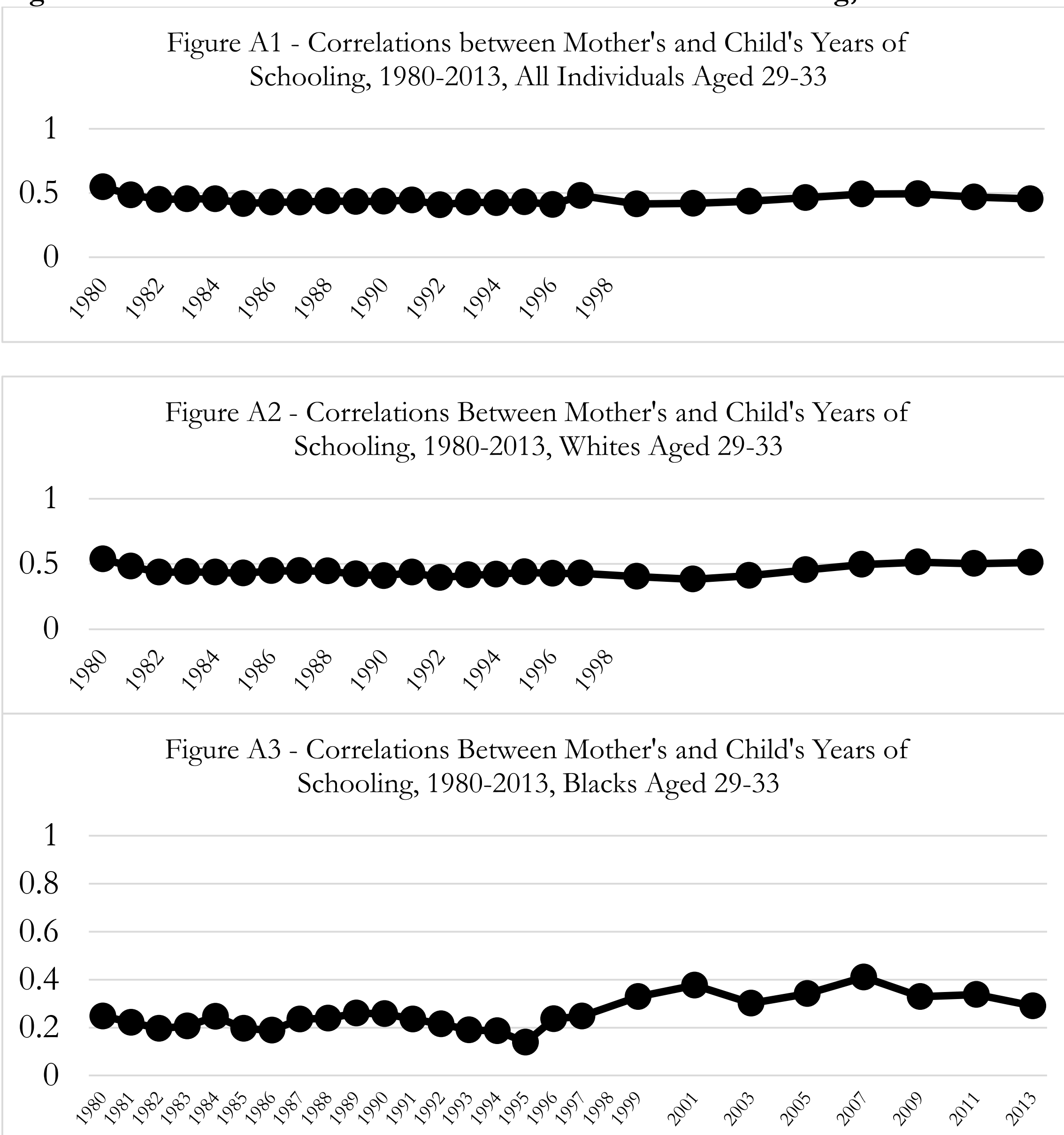
In this appendix, I present calculations of correlations between mother's and child's years of schooling for the PSID and the NLSYs. In both datasets, these findings point to a similar conclusion from estimating the ITE using a regression. Blacks have experienced a big increase in the correlation compared to the general population and whites. In the NLSYs, blacks are the only group to have experienced an increase while whites and Hispanics have experienced a decrease. In the PSID there appears to be a slight increase in the correlation among whites, but the increase in the correlation among blacks is bigger in magnitude.

Table A - Correlations of Mother's and Child's Years of Schooling in 1993 and 2013

	1993	2013	Difference
All	0.399	0.367	-0.032
Whites	0.459	0.385	-0.074
Blacks	0.322	0.374	0.052
Hispanics	0.278	0.247	-0.030

Note: This table lists spearman correlation coefficients between mother's years of schooling and child's years of schooling when aged 29-33 for the NLSY79 (1993) and NLSY97 (2013) for the entire sample and separately by race. Blacks are the only group who have seen an increase in the correlation.

Figure A – Correlations of Mother's and Child's Years of Schooling, 1980-2013



Note: These figures present spearman correlation coefficients between mother's and child's years of schooling when the child is aged 29-33. Blacks have exhibited a bigger increase in the correlation than whites.

Appendix B – 21x21 Transition Matrices

For completeness, I present 21x21 transition matrices for the NLSY79 and NLSY97 for the entire samples and then by race.

Table B1 - Education Transition Matrices for Respondents in the NLSY79 and NLSY97, Individuals Aged 29-33

Panel A: NLSY79

	Respondent's Years of Schooling																				
Mother's Years of Schooling	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.9	0.0	3.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	3.3	0.6	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	3.8	0.0	6.6	5.0	2.6	0.0	0.8	0.0	0.5	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.8	0.0	8.5	1.7	5.5	0.5	0.3	12.2	3.0	0.6	0.6	1.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	4.8	0.0	6.6	2.5	3.6	4.5	4.2	8.1	4.4	4.7	4.4	1.2	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
9	4.3	3.8	3.1	11.2	7.0	4.4	11.4	8.4	2.3	9.8	3.5	2.4	1.9	0.8	0.7	0.3	0.6	0.0	0.0	0.0	0.0
10	3.2	25.3	3.3	2.8	11.1	6.9	9.1	3.7	5.2	9.0	6.2	4.2	1.9	2.4	2.4	0.0	0.2	0.0	0.0	0.0	0.0
11	12.4	7.4	4.0	8.1	4.7	10.0	9.8	3.8	7.3	4.0	6.6	5.8	2.8	2.3	0.8	0.0	1.0	0.0	0.0	0.0	0.0
12	49.5	44.9	45.6	39.6	55.6	50.6	39.8	51.9	55.6	49.0	56.0	59.7	46.6	31.9	25.0	18.0	12.3	11.3	18.0	0.0	11.8
13	3.0	13.1	3.9	10.0	3.4	12.7	7.9	2.3	8.1	7.7	7.1	8.2	9.8	11.5	7.6	8.8	5.1	0.8	3.6	0.0	0.0
14	3.7	2.5	9.7	5.9	1.2	5.3	7.1	5.4	3.4	7.3	6.3	6.2	9.0	11.5	10.8	14.6	12.0	10.2	9.5	0.0	0.0
15	5.5	3.0	0.0	1.6	2.6	0.5	1.5	2.4	2.2	2.0	3.6	2.5	4.5	6.6	5.6	13.9	6.3	12.0	6.0	0.0	13.1
16	3.0	0.0	1.3	4.5	0.4	3.8	4.9	1.5	5.9	2.3	4.1	6.4	16.2	21.1	29.1	31.0	34.7	27.8	37.2	72.8	22.3
17	0.7	0.0	1.4	1.6	0.8	0.0	1.0	0.3	0.8	1.2	0.9	0.7	2.9	5.9	10.0	6.4	8.9	16.6	9.3	13.6	10.0
18	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.3	0.4	0.6	2.4	4.9	1.5	2.5	9.5	9.4	9.4	13.6	34.2
19	0.9	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.1	0.6	0.3	0.1	0.5	0.2	4.3	3.8	6.3	8.2	4.2	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	0.2	0.0	0.8	0.6	1.8	0.6	3.0	3.8	2.8	0.0	8.6

Panel B: NLSY97

	Respondent's Years of Schooling																				
Mother's Years of Schooling	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	1.6	0.4	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	7.3	0.0	0.0	1.3	0.0	0.0	1.8	1.8	0.3	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	3.2	2.3	3.2	1.9	3.7	3.3	12.4	8.6	7.1	5.4	2.5	1.5	1.7	3.9	0.3	0.3	1.5	0.0	0.0
9	0.0	0.0	0.0	4.8	4.2	10.3	5.1	10.6	7.3	8.8	9.9	8.6	4.3	2.2	3.2	2.8	0.8	1.6	0.0	0.0	0.0
10	0.0	0.0	13.0	10.1	7.3	14.2	7.0	20.8	7.7	9.8	9.3	13.1	4.6	3.0	4.3	0.6	1.2	0.7	1.2	0.0	0.5
11	0.0	40.7	5.7	7.2	4.3	18.4	8.1	3.3	9.1	11.0	9.4	9.6	6.1	5.4	3.6	2.8	0.5	1.8	1.0	3.2	1.0
12	0.0	0.0	25.6	23.9	25.1	20.7	32.3	33.1	26.6	24.4	30.2	30.1	29.3	21.4	19.1	20.1	10.3	6.3	8.2	3.2	7.9
13	0.0	0.0	17.0	11.9	6.1	6.1	15.1	4.2	8.1	10.2	5.8	6.4	10.3	10.5	8.4	11.2	6.0	3.8	5.2	10.1	3.1
14	0.0	0.0	5.9	4.4	15.8	15.1	10.6	7.1	7.8	9.5	10.1	8.5	12.2	13.5	9.2	11.7	11.4	5.1	10.5	3.8	10.6
15	0.0	0.0	10.2	5.1	1.3	7.5	3.0	1.2	3.1	4.7	4.0	3.6	4.6	4.9	8.1	6.2	5.4	8.0	5.8	3.2	4.6
16	0.0	0.0	8.9	15.6	14.6	3.0	5.0	8.9	4.3	4.8	5.0	5.9	12.4	19.7	20.4	22.9	27.0	24.4	28.2	28.5	24.4
17	0.0	0.0	0.0	10.2	6.1	0.0	3.3	0.0	3.3	0.9	2.8	2.6	4.9	7.9	8.3	8.1	11.6	18.3	7.8	3.3	12.1
18	0.0	0.0	0.0	4.6	6.3	0.0	1.3	3.1	1.5	1.3	2.9	1.0	4.0	5.4	7.9	2.5	13.1	12.9	13.7	14.5	11.5
19	0.0	59.3	0.0	0.0	4.0	0.0	3.1	0.0	2.7	1.4	1.0	1.6	1.6	2.2	2.3	2.8	5.2	9.0	10.8	8.5	11.6
20	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	2.6	1.0	0.0	1.1	1.7	1.9	2.8	2.0	6.8	7.7	6.0	21.8	12.7

Note: This table displays education transition matrices for the NLSY79 and NLSY97 cohorts. Mother's years of schooling is listed across the top. Each column is a distribution of survey respondents given mothers of a particular education level. Columns may not always sum to 100 because of survey non-response.

Table B1 - Education Transition Matrices for Respondents in the NLSY79 and NLSY97, Individuals Aged 29-33

Panel A: NLSY79

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.9	0.0	3.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	3.3	0.6	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	3.8	0.0	6.6	5.0	2.6	0.0	0.8	0.0	0.5	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.8	0.0	8.5	1.7	5.5	0.5	0.3	12.2	3.0	0.6	0.6	1.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	4.8	0.0	6.6	2.5	3.6	4.5	4.2	8.1	4.4	4.7	4.4	1.2	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
9	4.3	3.8	3.1	11.2	7.0	4.4	11.4	8.4	2.3	9.8	3.5	2.4	1.9	0.8	0.7	0.3	0.6	0.0	0.0	0.0	0.0
10	3.2	25.3	3.3	2.8	11.1	6.9	9.1	3.7	5.2	9.0	6.2	4.2	1.9	2.4	2.4	0.0	0.2	0.0	0.0	0.0	0.0
11	12.4	7.4	4.0	8.1	4.7	10.0	9.8	3.8	7.3	4.0	6.6	5.8	2.8	2.3	0.8	0.0	1.0	0.0	0.0	0.0	0.0
12	49.5	44.9	45.6	39.6	55.6	50.6	39.8	51.9	55.6	49.0	56.0	59.7	46.6	31.9	25.0	18.0	12.3	11.3	18.0	0.0	11.8
13	3.0	13.1	3.9	10.0	3.4	12.7	7.9	2.3	8.1	7.7	7.1	8.2	9.8	11.5	7.6	8.8	5.1	0.8	3.6	0.0	0.0
14	3.7	2.5	9.7	5.9	1.2	5.3	7.1	5.4	3.4	7.3	6.3	6.2	9.0	11.5	10.8	14.6	12.0	10.2	9.5	0.0	0.0
15	5.5	3.0	0.0	1.6	2.6	0.5	1.5	2.4	2.2	2.0	3.6	2.5	4.5	6.6	5.6	13.9	6.3	12.0	6.0	0.0	13.1
16	3.0	0.0	1.3	4.5	0.4	3.8	4.9	1.5	5.9	2.3	4.1	6.4	16.2	21.1	29.1	31.0	34.7	27.8	37.2	72.8	22.3
17	0.7	0.0	1.4	1.6	0.8	0.0	1.0	0.3	0.8	1.2	0.9	0.7	2.9	5.9	10.0	6.4	8.9	16.6	9.3	13.6	10.0
18	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.3	0.4	0.6	2.4	4.9	1.5	2.5	9.5	9.4	9.4	13.6	34.2
19	0.9	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.1	0.6	0.3	0.1	0.5	0.2	4.3	3.8	6.3	8.2	4.2	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	0.2	0.0	0.8	0.6	1.8	0.6	3.0	3.8	2.8	0.0	8.6

Panel B: NLSY97

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	1.6	0.4	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	7.3	0.0	0.0	1.3	0.0	0.0	1.8	1.8	0.3	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	3.2	2.3	3.2	1.9	3.7	3.3	12.4	8.6	7.1	5.4	2.5	1.5	1.7	3.9	0.3	0.3	1.5	0.0	0.0
9	0.0	0.0	0.0	4.8	4.2	10.3	5.1	10.6	7.3	8.8	9.9	8.6	4.3	2.2	3.2	2.8	0.8	1.6	0.0	0.0	0.0
10	0.0	0.0	13.0	10.1	7.3	14.2	7.0	20.8	7.7	9.8	9.3	13.1	4.6	3.0	4.3	0.6	1.2	0.7	1.2	0.0	0.5
11	0.0	40.7	5.7	7.2	4.3	18.4	8.1	3.3	9.1	11.0	9.4	9.6	6.1	5.4	3.6	2.8	0.5	1.8	1.0	3.2	1.0
12	0.0	0.0	25.6	23.9	25.1	20.7	32.3	33.1	26.6	24.4	30.2	30.1	29.3	21.4	19.1	20.1	10.3	6.3	8.2	3.2	7.9
13	0.0	0.0	17.0	11.9	6.1	6.1	15.1	4.2	8.1	10.2	5.8	6.4	10.3	10.5	8.4	11.2	6.0	3.8	5.2	10.1	3.1
14	0.0	0.0	5.9	4.4	15.8	15.1	10.6	7.1	7.8	9.5	10.1	8.5	12.2	13.5	9.2	11.7	11.4	5.1	10.5	3.8	10.6
15	0.0	0.0	10.2	5.1	1.3	7.5	3.0	1.2	3.1	4.7	4.0	3.6	4.6	4.9	8.1	6.2	5.4	8.0	5.8	3.2	4.6
16	0.0	0.0	8.9	15.6	14.6	3.0	5.0	8.9	4.3	4.8	5.0	5.9	12.4	19.7	20.4	22.9	27.0	24.4	28.2	28.5	24.4
17	0.0	0.0	0.0	10.2	6.1	0.0	3.3	0.0	3.3	0.9	2.8	2.6	4.9	7.9	8.3	8.1	11.6	18.3	7.8	3.3	12.1
18	0.0	0.0	0.0	4.6	6.3	0.0	1.3	3.1	1.5	1.3	2.9	1.0	4.0	5.4	7.9	2.5	13.1	12.9	13.7	14.5	11.5
19	0.0	59.3	0.0	0.0	4.0	0.0	3.1	0.0	2.7	1.4	1.0	1.6	1.6	2.2	2.3	2.8	5.2	9.0	10.8	8.5	11.6
20	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	2.6	1.0	0.0	1.1	1.7	1.9	2.8	2.0	6.8	7.7	6.0	21.8	12.7

Note: This table displays education transition matrices for the NLSY79 and NLSY97 cohorts. Mother's years of schooling is listed across the top. Each column is a distribution of survey respondents given mothers of a particular education level. Columns may not always sum to 100 because of survey non-response.

Table B2 - Education Transition Matrices for White Respondents in the NLSY79 and NLSY97 Aged 29-33

Panel A: NLSY79

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	100.0	0.0	15.5	0.0	0.0	15.3	3.5	0.6	0.5	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	4.2	10.8	5.2	5.4	5.3	0.8	0.5	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	34.4	0.0	0.0	22.1	8.4	1.8	10.7	3.8	2.8	1.7	0.9	0.8	0.0	0.7	0.0	0.0	0.0	0.0
10	0.0	47.7	0.0	0.0	24.7	10.6	9.0	4.2	5.0	9.6	6.1	3.8	1.7	2.3	2.4	0.0	0.0	0.0	0.0	0.0	0.0
11	24.0	0.0	0.0	0.0	0.0	7.1	10.3	2.0	6.7	3.8	6.4	5.1	2.5	2.4	0.6	0.0	0.8	0.0	0.0	0.0	0.0
12	76.0	52.3	0.0	65.6	59.9	54.1	41.2	48.5	56.5	48.9	55.0	63.1	46.7	30.8	21.9	16.2	11.9	9.9	20.6	0.0	12.1
13	0.0	0.0	0.0	0.0	0.0	16.5	0.0	2.6	8.2	7.4	7.1	7.7	9.4	11.1	6.4	7.3	4.5	0.0	3.8	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	6.5	3.6	6.2	2.4	7.3	5.7	5.1	8.9	12.2	10.5	15.7	11.8	11.8	10.1	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	2.2	1.2	3.3	1.0	4.1	5.5	5.8	14.0	5.7	10.7	4.1	0.0	13.5
16	0.0	0.0	0.0	0.0	0.0	5.2	5.0	0.0	6.0	1.4	4.7	6.9	17.2	22.3	32.1	33.6	36.2	27.0	34.8	70.7	20.1
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.1	1.1	0.6	3.0	6.4	10.6	7.1	9.0	18.6	8.2	14.6	10.2
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.5	0.8	2.5	5.3	1.4	2.0	9.6	10.0	9.7	14.6	35.2
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.4	0.0	0.5	0.0	5.1	4.2	6.5	8.4	5.2	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.9	0.7	1.9	0.0	3.3	3.6	3.5	0.0	8.8

Panel B: NLSY97

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	1.6	0.4	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	7.3	0.0	0.0	1.3	0.0	0.0	1.8	1.8	0.3	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	3.2	2.3	3.2	1.9	3.7	3.3	12.4	8.6	7.1	5.4	2.5	1.5	1.7	3.9	0.3	0.3	1.5	0.0	0.0
9	0.0	0.0	0.0	4.8	4.2	10.3	5.1	10.6	7.3	8.8	9.9	8.6	4.3	2.2	3.2	2.8	0.8	1.6	0.0	0.0	0.0
10	0.0	0.0	13.0	10.1	7.3	14.2	7.0	20.8	7.7	9.8	9.3	13.1	4.6	3.0	4.3	0.6	1.2	0.7	1.2	0.0	0.5
11	0.0	40.7	5.7	7.2	4.3	18.4	8.1	3.3	9.1	11.0	9.4	9.6	6.1	5.4	3.6	2.8	0.5	1.8	1.0	3.2	1.0
12	0.0	0.0	25.6	23.9	25.1	20.7	32.3	33.1	26.6	24.4	30.2	30.1	29.3	21.4	19.1	20.1	10.3	6.3	8.2	3.2	7.9
13	0.0	0.0	17.0	11.9	6.1	6.1	15.1	4.2	8.1	10.2	5.8	6.4	10.3	10.5	8.4	11.2	6.0	3.8	5.2	10.1	3.1
14	0.0	0.0	5.9	4.4	15.8	15.1	10.6	7.1	7.8	9.5	10.1	8.5	12.2	13.5	9.2	11.7	11.4	5.1	10.5	3.8	10.6
15	0.0	0.0	10.2	5.1	1.3	7.5	3.0	1.2	3.1	4.7	4.0	3.6	4.6	4.9	8.1	6.2	5.4	8.0	5.8	3.2	4.6
16	0.0	0.0	8.9	15.6	14.6	3.0	5.0	8.9	4.3	4.8	5.0	5.9	12.4	19.7	20.4	22.9	27.0	24.4	28.2	28.5	24.4
17	0.0	0.0	0.0	10.2	6.1	0.0	3.3	0.0	3.3	0.9	2.8	2.6	4.9	7.9	8.3	8.1	11.6	18.3	7.8	3.3	12.1
18	0.0	0.0	0.0	4.6	6.3	0.0	1.3	3.1	1.5	1.3	2.9	1.0	4.0	5.4	7.9	2.5	13.1	12.9	13.7	14.5	11.5
19	0.0	59.3	0.0	0.0	4.0	0.0	3.1	0.0	2.7	1.4	1.0	1.6	1.6	2.2	2.3	2.8	5.2	9.0	10.8	8.5	11.6
20	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	2.6	1.0	0.0	1.1	1.7	1.9	2.8	2.0	6.8	7.7	6.0	21.8	12.7

Note: This table displays education transition matrices for white respondents in the NLSY79 and NLSY97 cohorts. Mother's years of schooling is listed across the top. Each column is a distribution of survey respondents given mothers of a particular education level. Columns may not always sum to 100 because of survey non-response.

Table B3 - Education Transition Matrices for Black Respondents in the NLSY79 and NLSY97 Aged 29-33

Panel A: NLSY79

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	1.7	0.8	1.0	0.5	0.1	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	5.9	11.8	4.3	2.5	2.8	4.0	1.3	1.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	23.5	0.0	0.0	8.8	3.2	6.8	1.6	10.2	3.1	6.4	0.9	1.5	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	13.1	0.0	7.4	3.9	3.4	7.4	5.4	4.4	3.0	4.4	0.7	0.0	1.6	0.0	0.0	0.0	0.0
11	0.0	0.0	27.0	9.2	3.0	17.4	9.4	7.1	7.2	6.0	6.7	7.0	4.4	1.7	0.0	0.0	4.0	0.0	0.0	0.0	0.0
12	76.5	0.0	73.0	26.4	74.7	48.7	47.4	56.2	58.0	47.2	61.7	53.4	46.6	45.5	44.3	42.1	12.7	22.3	0.0	0.0	0.0
13	0.0	0.0	0.0	28.2	0.0	4.3	10.2	1.4	7.4	7.0	7.9	9.2	11.5	13.4	11.9	23.6	9.3	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	15.2	0.0	11.0	6.8	1.5	5.0	8.6	6.6	8.8	9.6	4.8	14.6	5.9	15.8	0.0	9.8	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	3.9	4.0	2.8	4.4	5.0	5.3	7.8	14.0	5.6	15.4	14.7	30.4	17.8	0.0	0.0
16	0.0	0.0	0.0	12.3	0.0	0.0	9.1	6.8	6.2	4.6	2.6	6.3	10.1	9.0	13.3	8.1	25.8	29.1	54.3	100.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.3	0.7	2.3	1.4	6.1	0.0	4.2	0.0	9.7	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.4	0.0	0.2	1.5	0.0	2.3	4.9	7.8	7.6	8.4	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	2.9	0.0	0.0	4.3	10.7	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.7	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0

Panel B: NLSY97

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	3.7	0.8	0.4	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.3	1.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1	7.7	6.6	3.9	3.7	0.6	2.6	1.6	0.0	3.1	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	20.8	28.4	13.9	7.5	12.4	16.0	4.2	7.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	40.1	8.5	11.4	3.5	11.7	13.5	7.4	3.3	6.3	1.4	2.7	8.2	0.0	0.0	6.7
11	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	15.7	7.2	11.2	11.2	8.0	7.4	2.7	3.4	0.6	3.6	0.0	0.0	14.0
12	0.0	0.0	0.0	0.0	0.0	0.0	19.5	37.1	22.9	37.8	21.6	26.6	27.7	20.0	18.1	19.7	16.7	3.0	9.7	0.0	15.8
13	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	0.0	5.8	7.5	4.9	11.3	11.1	10.7	16.7	9.0	9.6	6.7	60.3	0.0
14	0.0	0.0	0.0	0.0	0.0	100.0	0.0	12.8	6.1	8.7	11.8	6.4	13.3	11.7	14.8	15.2	11.3	2.7	0.0	0.0	8.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	3.9	3.0	5.0	8.7	10.7	11.0	7.5	21.3	9.2	0.0	6.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.1	6.2	2.1	4.2	4.0	7.4	14.9	14.1	21.1	20.6	28.7	29.0	21.8	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	3.5	2.7	3.9	5.2	4.9	1.3	11.0	3.3	16.2	0.0	16.9
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.0	1.0	0.4	3.4	4.3	5.4	5.5	6.9	2.9	3.3	17.9	15.5
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	3.4	1.1	1.5	8.3	10.5	16.4	0.0	6.3
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	1.0	0.7	1.8	2.8	0.0	5.3	3.2	9.5	0.0	10.7

Note: This table displays education transition matrices for black respondents in the NLSY79 and NLSY97 cohorts. Mother's years of schooling is listed across the top. Each column is a distribution of survey respondents given mothers of a particular education level. Columns may not always sum to 100 because of survey non-response.

Table B4 - Education Transition Matrices for Hispanic Respondents in the NLSY79 and NLSY97 Aged 29-33

Panel A: NLSY79

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1.4	0.0	3.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	4.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	6.0	0.0	7.8	6.6	4.8	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	2.8	0.0	0.0	2.3	3.1	1.3	0.8	3.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	7.7	0.0	7.7	3.3	4.5	6.5	4.2	3.1	1.5	0.0	4.2	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	5.0	7.1	3.7	7.4	11.9	8.7	8.4	4.3	3.8	8.4	8.0	2.8	5.7	0.0	0.0	19.5	0.0	0.0	0.0	0.0	0.0
10	5.1	5.8	3.9	3.7	3.8	5.6	10.4	0.0	8.9	8.0	9.2	8.6	3.6	0.0	8.4	0.0	2.0	0.0	0.0	0.0	0.0
11	7.3	13.9	2.7	9.4	7.5	9.9	9.6	8.1	11.1	1.7	7.5	8.9	6.1	0.0	10.4	0.0	1.9	0.0	0.0	0.0	0.0
12	33.7	38.3	48.2	36.7	46.0	47.2	33.3	64.9	47.4	53.8	47.5	54.6	40.7	25.8	28.6	0.0	25.2	16.7	32.9	0.0	0.0
13	4.7	24.7	4.6	9.3	6.4	12.1	13.6	2.0	8.1	11.3	5.5	7.6	16.0	17.1	21.8	21.5	17.2	18.0	11.2	0.0	0.0
14	5.8	4.8	11.5	5.7	2.2	1.0	10.5	8.4	7.9	4.6	12.5	4.7	11.7	10.2	4.7	0.0	9.7	0.0	0.0	0.0	0.0
15	8.8	5.5	0.0	2.1	4.9	1.3	1.1	2.6	1.6	3.6	2.3	4.5	3.1	15.9	2.8	0.0	6.9	0.0	0.0	0.0	0.0
16	4.8	0.0	1.5	4.2	0.8	4.0	1.9	0.0	5.0	5.6	2.3	0.0	7.5	20.1	13.1	0.0	4.5	42.1	22.9	0.0	100.0
17	1.2	0.0	1.6	2.1	1.5	0.0	2.6	2.6	1.9	0.0	0.0	2.3	2.0	3.9	10.2	0.0	18.5	8.2	24.9	0.0	0.0
18	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.9	1.0	0.0	1.3	7.0	0.0	18.1	10.9	0.0	8.0	0.0	0.0
19	1.4	0.0	0.0	0.0	1.6	2.3	0.0	0.0	0.8	0.0	0.0	1.5	0.4	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	40.9	0.0	15.0	0.0	0.0	0.0

Panel B: NLSY97

Mother's Years of Schooling	Respondent's Years of Schooling: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.5	2.2	0.0	0.0	0.9	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	7.3	0.0	0.0	1.8	0.0	0.0	1.8	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	3.2	2.4	4.4	2.6	4.5	7.5	8.9	2.2	6.1	5.0	0.9	2.8	0.7	4.5	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	5.2	5.7	14.6	5.1	5.2	7.3	10.4	4.8	5.0	4.4	2.7	1.7	2.1	1.0	0.0	0.0	0.0	0.0	0.0
10	0.0	13.0	11.0	10.0	5.4	4.4	19.9	6.6	10.8	14.3	10.2	4.4	4.7	1.9	4.0	3.5	0.0	3.9	0.0	0.0	0.5
11	0.0	5.7	7.9	5.8	19.0	7.7	7.5	9.3	11.2	10.1	3.3	8.7	5.2	1.7	4.2	1.3	0.0	0.0	0.0	0.0	1.0
12	0.0	25.6	26.0	28.0	22.5	38.0	27.2	27.9	26.2	31.0	31.9	29.1	29.0	27.1	22.1	12.3	0.0	8.6	0.0	15.9	7.9
13	0.0	17.0	12.9	8.4	8.6	16.3	9.5	14.4	6.3	7.9	7.8	13.8	14.4	4.6	9.4	3.6	15.9	0.0	0.0	39.8	3.1
14	0.0	5.9	4.7	15.3	16.8	9.6	4.4	12.0	15.4	11.1	17.5	12.2	10.2	9.9	24.2	20.0	0.0	5.0	0.0	11.0	10.6
15	0.0	10.2	5.5	1.8	2.5	3.6	2.8	1.8	8.3	2.6	2.9	6.0	3.7	10.8	8.1	11.2	21.1	15.9	0.0	17.0	4.6
16	0.0	8.9	17.0	14.0	4.2	4.1	7.1	2.4	6.6	6.9	5.6	10.2	13.6	15.7	9.4	23.6	22.8	10.0	52.4	16.3	24.4
17	0.0	0.0	2.3	2.3	0.0	2.5	0.0	0.9	0.8	2.5	4.5	3.3	6.2	6.4	7.6	5.4	8.1	0.0	0.0	0.0	12.1
18	0.0	0.0	5.0	2.2	0.0	1.6	6.8	3.0	0.0	1.9	3.3	2.4	2.8	11.3	0.0	9.0	17.8	31.7	0.0	0.0	11.5
19	100.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	1.1	4.6	2.9	0.0	5.9	7.5	9.1	47.6	0.0	11.6
20	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	2.2	0.0	3.7	0.0	3.2	6.8	15.9	0.0	0.0	12.7

Note: This table displays education transition matrices for Hispanic respondents in the NLSY79 and NLSY97 cohorts. Mother's years of schooling is listed across the top. Each column is a distribution of survey respondents given mothers of a particular education level. Columns may not always sum to 100 because of survey non-response.

Appendix C – Missing Data

Missing data is prevalent in both the NLSY79 and the NLSY97. There are three general reasons for having missing data. The first is the attrition of respondents in the NLSYs. About 80% of respondents in both surveys remain and participate in the survey year in which I conduct my analyses (1993 for the NLSY79 and 2013 for the NLSY97). Secondly, respondents who do participate in 1993 or 2013 may not report years of schooling. This is not a major source of missing data. Years of schooling is reported by over 99% of respondents who participate in the 1993 round of the NLSY79 and over 98.5% of respondents who participate in the 2013 round of the NLSY97. I will not address this source of missing data due to how infrequent it is. Finally, mother's years of schooling may not be recorded in the base year for many reasons including a refusal to answer or being deceased. Table B1 displays the number of observations in the base year of each survey and the number of observations that are available in the analysis year due to the three circumstances just described.

Survey weights are included in the NLSYs to construct nationally representative samples despite attrition. I examine several variables including the respondent's age, sex, race, mother's years of schooling, real family income, an indicator for being in two-parent household, an urban indicator, and geography indicators. I calculate the means of these variables for respondents in the base year of the NLSYs using the base year weights. I then take the sample of respondents who participated in the 1993 round of the NLSY79 or the 2013 round of the NLSY97, and calculate means of the same variables using the 1993 or 2013 weights. I then perform a weighted t-test to ascertain whether there are any significant differences in means between the baseline and the non-attritted samples. Table B2 clearly demonstrates the efficacy of the NLSY weights. While slight differences exist, no difference is close to being statistically significant.

I now examine whether this paper's main findings are being driven by an absence of information on mothers. To address this, I estimate the probability of a respondent having a missing mother on a set of baseline variables available on all respondents in the base year. These variables include race indicators, indicators for household parental type, sex of the individual, and age of the individual. Under a probit specification, I predict the probability an individual will have missing years of schooling for his or her mother. I then weight each observation by (1/1-p) to give more weight to individuals who are likely to have mothers with missing years of schooling, with p being the probability of having a mother with missing years of schooling.

I predict probabilities with another specification, this time including also base year variables of real family income, geography indicators, and an urban indicator. Because some individuals do not have information recorded for these variables, I am unable to predict the probability for having a missing mom for the entire sample. Nonetheless, for the observations I do have, I weight them again by (1/1-p). I then repeat the regression from Table 4 using these different weighting schemes. Results from this exercise are found in Table B3. From this exercise, I demonstrate that even when giving more weight to individuals who are likely to have mothers with missing years of schooling, this paper's main results hold: intergenerational persistence has increased significantly and substantially among blacks, but not among other races.

A final check on missing years of schooling is to transform the data on mother's years of schooling to an indicator of whether an individual's mother had above or below the median level of education. The median years of schooling for observed mothers is 12 years of schooling. I first naively assume that mothers who do not report years of schooling are below the median. I then randomly select a proportion of mothers reporting 12 years of schooling to also be included in the subset of mothers who have below median education to force exactly half of the sample to have a median indicator variable equal to zero (below the median) and the other half of the sample to have the indicator variable equal to 1. I then run the regression from Equation (2), this time using the median indicator instead of mother's years of schooling. Results from this regression are found in Table B4. Again, the main conclusion from this paper hold: intergenerational persistence has increased significantly and substantially among blacks, but not among other races.

Table C1 - Prevalence of Missing Data in the NLSYs

	Observations in base year (1979 or 1997)	Observations in analysis year (1993 or 2013)	Observations in analysis year with non-missing respondent's years of schooling	Observations in analysis year with non-missing mother's years of schooling
NLSY79	7,607	6,009	6,008	5,646
NLSY97	8,984	7,141	7,048	6,353

Note: This table lists the number of observations available in the NLSY79 and NLSY97 base years and the number of observations available in the analysis year (1993 or 2013). It also lists the number of observations with non-missing respondent's years of schooling or non-missing mother's years of schooling.

Table C2 - Baseline Characteristics of Attritted and Non-Attritted Respondents in the NLSY79 and NLSY97

	NLSY79			NLSY79		
	Full Sample	Non-Attritted	Difference	Full Sample	Non-Attritted	Difference
Age in 1993 or 2013	32.55	32.55	0.00	31	31	0.00
	(0.03)	(0.03)		(0.02)	(0.02)	
% Female	0.49	0.49	0.00	0.49	0.49	0.00
	(0.01)	(0.01)		(0.01)	(0.01)	
% Black	0.14	0.14	0.00	0.15	0.15	0.00
	(0)	(0)		(0)	(0)	
% Hispanic	0.06	0.07	0.00	0.13	0.13	0.00
	(0)	(0)		(0)	(0)	
Mother's Years of Schooling	11.6	11.58	-0.02	12.96	12.98	0.03
	(0.03)	(0.03)		(0.03)	(0.04)	
Real Family Income	70,741.17	70,947.9	206.73	78,888.78	77,856.08	-1,032.71
	(680.32)	(733.16)		(923.07)	(1027.49)	
% Two Parents in HH	0.84	0.84	0.00	0.67	0	0.00
	(0)	(0)		(0.01)	(0.01)	
% Urban	0.79	0.78	-0.01	0.72	0.72	-0.01
	(0)	(0.01)		(0.01)	(0.01)	
% Northeast	0.21	0.2	-0.01	0.18	0.18	-0.01
	(0)	(0.01)		(0)	(0.01)	
% North Central	0.29	0.3	0.00	0.26	0.27	0.01
	(0.01)	(0.01)		(0.01)	(0.01)	
% South	0.31	0.32	0.00	0.34	0.34	0.00
	(0.01)	(0.01)		(0.01)	(0.01)	
% West	0.16	0.17	0	0.21	0.21	0.00
	(0)	(0)		(0)	(0.01)	
n	7,607	6,009		8,984	7,141	

Note: A large proportion of NLSY79 respondents attritted by the 1993 round. Similarly, a large proportion of NLSY97 respondents attritted by the 2013. The NLSYs contain survey weights for each survey year to create nationally representative samples. To demonstrate the efficacy of these weights, this table displays means and standard deviations of variables collected from respondents in the base year using base year weights. It also displays means of the same variables from respondents who did not attrit using weights from 1993 and 2013. Differences in means between these two groups in the NLSY79 and NLSY97 are very small and are not statistically significant.

Table C3 - ITE Estimates from the NLSYs, Individuals Aged 29-33

	Weighting Scheme 1				Weighting Scheme 2			
Variable	All	Whites	Blacks	Hispanics	All	Whites	Blacks	Hispanics
Mother's Years of Schooling	0.296***	0.478***	0.268***	0.162***	0.284***	0.454***	0.269***	0.165***
	(0.011)	(0.018)	(0.023)	(0.021)	(0.012)	(0.02)	(0.026)	(0.022)
NLSY97 Sample Indicator	-0.47**	0.672*	-2.769***	0.288	-0.775***	0.303	-2.535***	-0.004
	(0.208)	(0.372)	(0.518)	(0.289)	(0.239)	(0.422)	(0.616)	(0.331)
Mother's Years of Schooling * Indicator	0.06***	-0.034	0.218***	0.02	0.084***	-0.006	0.2***	0.036
	(0.017)	(0.028)	(0.043)	(0.029)	(0.019)	(0.032)	(0.051)	(0.033)
Constant	9.759***	7.678***	9.845***	10.95***	9.917***	7.976***	9.859***	11.008***
	(0.124)	(0.218)	(0.246)	(0.187)	(0.131)	(0.239)	(0.276)	(0.19)
n	11,923	6,180	3,329	2,414	9,102	4,794	2,489	1,819

Note: This table presents estimates of the ITE in 1993 and 2013 by pooling the NLSY79 and NLSY97 samples. The dependent variable is the respondent's years of schooling as reported in 1993 or 2013 when respondents are 29-33 years old. Robust standard errors are reported below each estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C4 - ITE Estimates from the NLSYs, Individuals Aged 29-33

Variable	All	Whites	Blacks	Hispanics
Mother's Years of Schooling	1.846***	1.94***	1.103***	1.498***
	(0.069)	(0.087)	(0.099)	(0.185)
NLSY97 Sample Indicator	0.818***	1.066***	0.139	0.76***
	(0.073)	(0.105)	(0.107)	(0.12)
Mother's Years of Schooling * Indicator	-0.004	-0.156	0.462***	0.082
	(0.102)	(0.133)	(0.169)	(0.247)
Constant	12.098***	12.09***	12.251***	11.887***
	(0.048)	(0.067)	(0.061)	(0.085)
n	13,056	6,604	3,762	,2690

Note: This table presents estimates of the ITE in 1993 and 2013 by pooling the NLSY79 and NLSY97 samples. The dependent variable is the respondent's years of schooling as reported in 1993 or 2013 when respondents are 29-33 years old. Robust standard errors are reported below each estimate.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix D – Data Outliers

Figures A1-A8 plot mother's years of schooling vs. child's years of schooling using cross-sectional weights. The size a bubble reflects the number of respondents represented. Figures A1 and A2 are plots of the entire NLSY79 and NLSY97 samples, respectively. Figures A3-A8 are plots of the data for the NLSY79 and NLSY97 by race.

Recall that for the NLSYs, years of schooling is measured as 0 to 20 years of schooling. These figures show that there aren't many individuals who have 0 or 20 years of schooling nor individuals with mothers who have 0 or 20 years of schooling. The group with the highest proportion of data lying on the bounds are whites in the NLSY97. In this group, 6.45% have child's education reported as 0 or 20 years of schooling or mother's education reported as 0 or 20 years of schooling (or both). This paper's conclusions are not changed when removing these observations from the main analyses.

Figure D1 - Mother's vs. Respondent's Years of Schooling, 1993

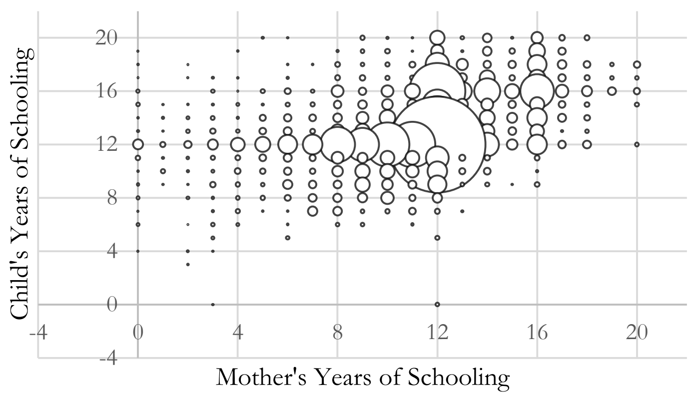


Figure D2 - Mother's vs. Respondent's Years of Schooling, 2013

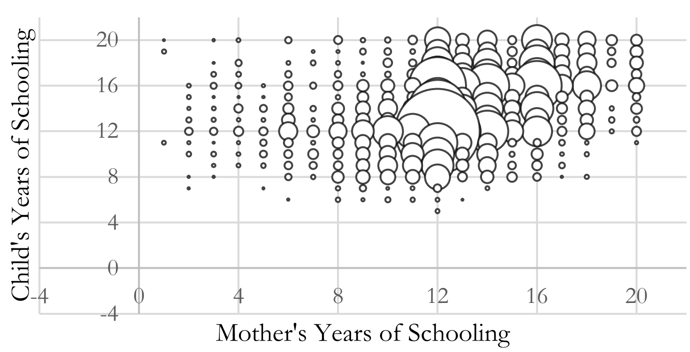


Figure D3 - Mother's vs. Respondent's Years of Schooling, White Population in 1993

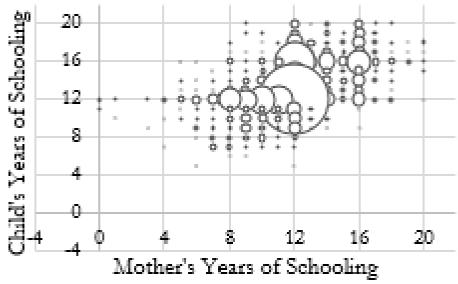


Figure D4 - Mother's vs. Respondent's Years of Schooling, White Population in 2013

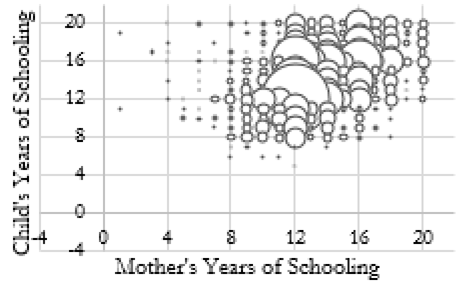


Figure D5 - Mother's vs. Respondent's Years of Schooling, Black Population in 1993

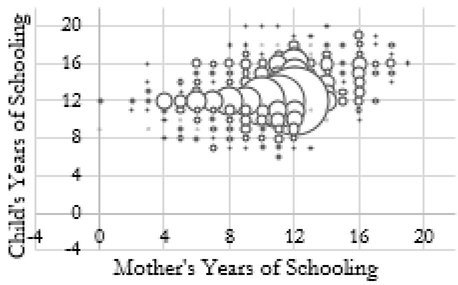


Figure D6 - Mother's vs. Respondent's Years of Schooling, Black Population in 2013

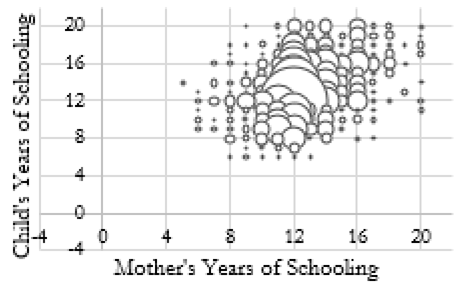


Figure D7 - Mother's vs. Respondent's Years of Schooling, Hispanic Population 1993

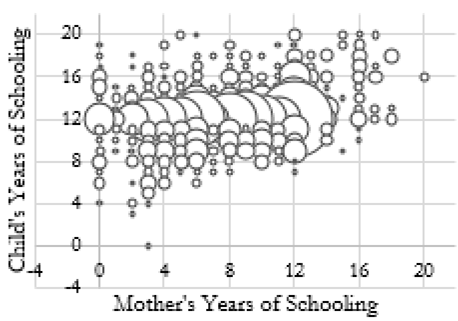
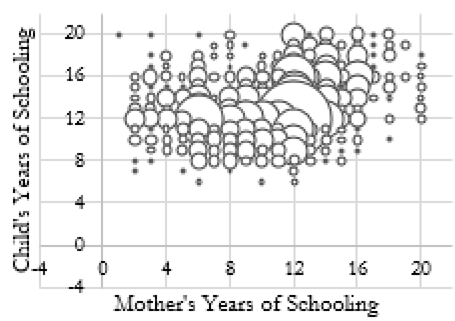


Figure D8 - Mother's vs. Respondent's Years of Schooling, Hispanic Population 2013



Appendix E – Replication of Lee and Solon (2009)

In this paper, I presented estimates of the intergenerational elasticity of income by race using the specification and data from Lee and Solon (2009). The original paper estimated the intergenerational elasticity of income by gender using only the SEO sample. I replicate the findings of their paper and extend their analysis to 2012. Results are presented in the figures below.

Figure E1 - Estimates of Intergenerational Income Mobility, Men Aged 25-48

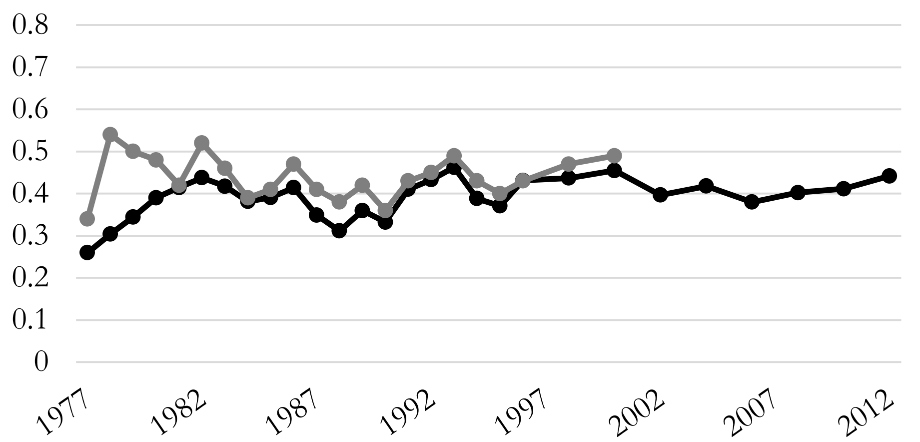
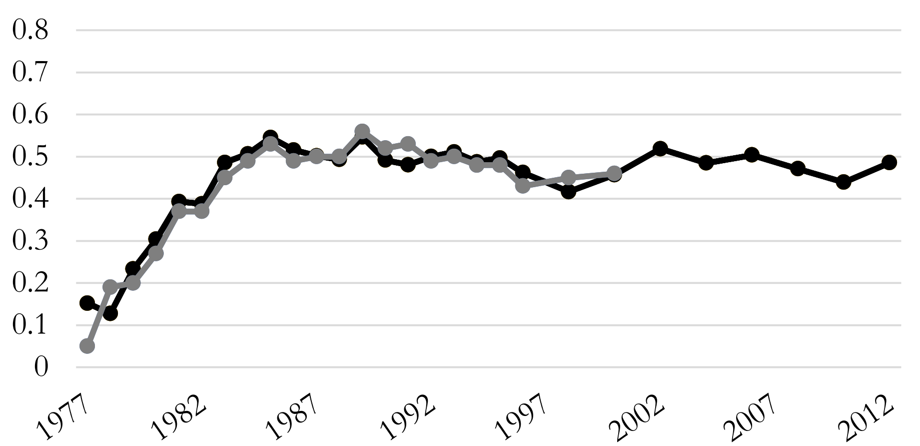


Figure E2 - Estimates of Intergenerational Income Mobility, Women Aged 25-48



Note: These figures present estimates of the intergenerational elasticity of income by gender following the procedure

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Figure E1 - Estimates of Intergenerational Income Mobility, Men Aged 25-48

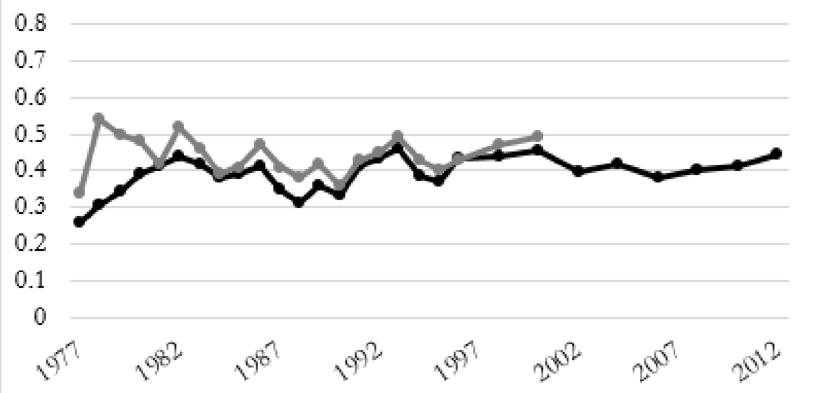
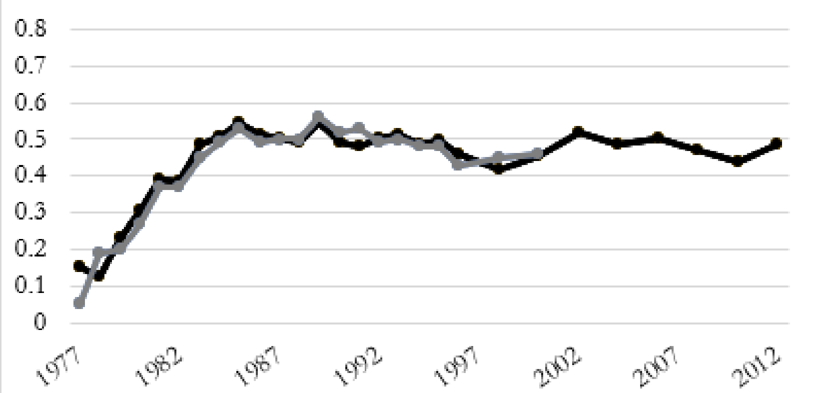


Figure E2 - Estimates of Intergenerational Income Mobility, Women Aged 25-48



Note: These figures present estimates of the intergenerational elasticity of income by gender following the procedure and specification of Lee and Solon (2009). Estimates from their paper are presented in grey, and this paper's replication is presented in black. As seen from the two figures, recent trends in the intergenerational elasticity of income show continued stability in income mobility.

OVEREDUCATION IN THE U.S. DURING THE GREAT RECESSION

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Abstract

I use the method introduced by Gottschalk and Hansen (2003) to analyze the rate of overeducation among workers with exactly a college degree between 2006 and 2013. To my knowledge, this is the first study to use this method to analyze trends in overeducation during the great recession in the U.S. I find that the proportion of workers with exactly a college degree working in occupations offering low college premiums increased during great recession and fell afterwards. An increase in the rate in overeducation could be due to more college-educated workers working in noncollege occupations that were noncollege in the past or because there was an increase in the number of noncollege occupations. I show that changes in the rate of overeducation are mostly due mostly to the latter. When shutting the down the flexibility for occupations to change from college to noncollege (and vice versa), the rate of overeducation increases only slightly between 2006 and 2013. Regardless, these findings run contrary to the secular decline of the rate of overeducation during the end of 20th century documented by previous research.

Keywords: Overeducation, College, Premium, Recession

JEL Classification: J24, I26

I. Background and Summary

Traditionally, a worker is said to be overeducated (or underemployed) when he or she has more education than what is required for his or her job. Knowing the prevalence of overeducation is important for policy because overeducation may represent misallocated resources in an economy (McGuinness, 2008). Such inefficiency could arise due to job search and labor market frictions (Leuven and Oosterbeek, 2011). Under these scenarios, overeducated workers may not as easily recoup the cost of their educational investments if their surplus educational investments do not bring commensurate productivity and wage gains. There are numerous methods that have been employed to determine whether a worker is overeducated (Duncan and Hoffman, 1981; Rumberger, 1987; Verdugo and Verdugo, 1989; Kiker et al., 1997). The general finding from these studies is that overeducated workers usually earn more than workers in the same job who are not overeducated. Also, overeducated workers earn less than similarly educated workers who work in jobs that require higher levels of education.

Three popular approaches have been used to measure the rate of overeducation in a country. The first approach relies on surveys that asked respondents what level of education was required for their jobs, and an individual is determined to be overeducated if he or she reports having more education than what they say is required for his or her job (Duncan and Hoffman, 1981; Hartog and Oosterbeek, 1988; Hartog, 1986; Sicherman, 1991; Alba-Ramirez, 1993). This worker self-assessment method, while insightful, is subject to biases. For example, workers may easily overstate the level of education actually required or they may simply mirror requirements as stated by their employer than what is actually required for a job (Hartog, 2000). A second approach has relied on the work of professional job analysts, instead of survey respondents, to determine the required level of education is for specific occupations (Rumberger, 1987; Kiker and Santos, 1991). However, the reliability of professional job analysts, especially over long time-frames, has been called into question (Verdugo and Verdugo, 1992). The third approach relies on statistical methods to determine whether a worker is overeducated. In these methods, workers who have above the mode or mean plus one standard deviation of the educational level in their occupation are determined to be overeducated. While these methods may be more agnostic than using the worker self-assessment or professional job analyst methods, they are not rooted in economic theory and are problematic if distributional changes in education levels in an occupation are not reflective of the changing educational requirements of that occupation.

An alternative approach proposed by Gottschalk and Hansen (2003) relies on classifying occupations by the earnings premiums they offer to college graduates. An occupation is said to be noncollege if it offers a college earnings premium below an arbitrarily low threshold to college-educated workers. Then the rate of overeducation among college-educated workers is the proportion of these college-educated workers who are employed in noncollege occupations. Rather than focus on the prevalence of excess skills among workers, this approach focuses on the prevalence of workers who on average are not able to easily recoup the cost of their educational investments through college earnings premiums. Consistent with skill-biased technological change (SBTC), he finds that there was a secular decline in the rate of overeducation between 1983 and 1994. Cardoso (2007) finds a similar trend using this method in Portugal from 1986-1999.

In this paper, I use the method of Gottschalk and Hansen (2003) to analyze overeducation in 2006-2013. To my knowledge, this study is the first that provides calculations of the rate of overeducation using this method during the great recession in the U.S.[44] I use the American Community Survey (ACS) for my analysis. One clear benefit of the ACS is the sheer number of observations available in every year. Because of this, I am able to more narrowly define occupations than Gottschalk and Hansen (2003). This should lead to a clearer delineation of college and noncollege occupations.

The trend in what one should expect in overeducation during the great recession may not be immediately obvious. On one hand, people could be competing for a dwindling number of jobs leading some to unemployment and others to secure employment in jobs where they are overeducated (Modestino et al., 2015). On the other hand, there has been evidence of rapid SBTC in some occupations during recessions in the past 25 years including the great recession (Hershbein and Kahn, 2016). Such rapid SBTC might have propped up college premiums for some occupations during the great recession.

I find that the rate of overeducation increased during the great recession and fell afterwards when designating workers earning less than 25% of the aggregate college premium as being overeducated. A key feature of this method is that an increase in the rate of overeducation could be due to an increase in the number of college-educated workers employed in noncollege

[44] O'Leary and Sloane (2014) use the same method to study overeducation during the great recession in the UK and find similar results to this paper. Fogg and Harrington (2011) use the American Community Survey to analyze overeducation during the great recession using a mixture of the job analyst and statistical approaches and find an increase in the rate of overeducation.

occupations that were noncollege in the past or an increase in the number of noncollege occupations themselves (or both). When decomposing shifts in the rate of overeducation into these two types of shifts, I show that the year-to-year changes in the rate of overeducation are mostly due to changes in the number of occupations being reclassified as noncollege. When holding the classification of occupations constant, I find that there is only a slight increase in the rate of overeducation in my time period. These results run contrary to the secular decline in the rate of overeducation in the late 20th century found by Gottschalk and Hansen (2003) and Cardoso (2007). However, they are concordant with findings of O'Leary and Sloane (2014) who use the same method to study overeducation during the great recession in the UK.

II. Data

I use the American Community Survey (ACS) to estimate the rate of overeducation in the United States. I use the 2005-2014 ACS samples to estimate the aggregate college premium and within-occupation college premiums in every year from 2006 to 2013. Thus my time frame will cover the period before, during, and after the great recession in the United States. Though the ACS started in 2000, it was not fully implemented until 2005. I choose to exclude the ACS samples from 2000-2004 because of substantially smaller number of survey participants in these samples compared to the number of survey participants in the 2005-2014 samples.[45] Having a large number of observations in every survey year is important for me to precisely estimate

[45] The number of observations in each ACS sample from 2000-2004 is less than 1.2 million while the number of observations in each ACS sample from 2005-2014 is greater than 3 million.

within-occupation college premiums for a large number of narrowly defined occupations. I use the Integrated Public Use Microdata Series (IPUMS) occupation classification which provides a time-invariant occupation classification system for all ACS survey years. The IPUMS occupations are more narrowly defined than the 3-digit Standard Occupational Classification (SOC) system used by Gottschalk and Hansen (2003) and can easily be aggregated to the 3-digit 2010 SOC system.[46]

I use a comparable sample to the one used by Gottschalk and Hansen (2003). My sample includes nonstudent male and female workers with at least a high school degree and 10 years or less of (potential) labor market experience.[47] This experience restriction is imposed to track the rate of overeducation among recent college graduates. I focus on the premium paid to those with exactly a college degree (college workers) over those with at least a high school degree, but no college degree (noncollege workers).[48] Both part-time and part-year workers are included in the sample.[49] I exclude workers who reported working zero weeks in the past 12 months, workers who reported working more than 98 hours per week, self-employed workers, and unpaid family workers.

[46] In particular, I use the variable named occ2010. For more information, please refer to IPUMS-USA: https://usa.ipums.org.

[47] Potential labor market experience=min(age-yrsschool-7,age-17).

[48] By this definition, I estimate the college premium using workers who may have earned associate's degrees or entered and attended college, but never earned college degrees.

[49] I control for full-time status when estimating premiums.

My earnings measure is the log real average weekly wage in 2013 dollars.[50] Reported yearly wage incomes that fall in the 99.5th percentile in every state each year are topcoded. I multiply any topcoded wage incomes by 1.45 following Katz and Murphy (1992). Starting in 2008, weeks worked was reported in brackets. I impute weeks worked in the 2008-2014 samples as the average of weeks worked in each bracket by sex in 2005-2007.[51]

The means and standard deviations of variables I use to estimate the college premium on the sample I have constructed are presented in Table 1. Overall, there has been little change between years. There appears to be a slight decrease in real wages and the percentage of full-time workers starting in 2008. Between 2006 and 2013 there has been a very slight increase in the proportion of workers with a college degree and a slight decrease in the percentage of full-time workers. Although small, most of the differences in means between any two adjacent years of the variables listed in Table 1 are statistically significant at the 95% level.[52]

I estimate the college premium for my sample using the following specification in every year:

$$Y = \beta_0 + \beta_1 College + \beta_2 Female + \beta_3 Black + \beta_4 Hisp + \beta_5 Fulltime + \beta_6 Exp + \beta_7 Exp^2 + \varepsilon$$

(1),

where Y is the natural log of real average weekly earnings (in 2013 dollars). I regress this variable on indicators for whether an individual has college degree, is female, is black, is Hispanic (non-black), is a full-time worker, and on a quadratic of potential work experience. The college premium in a given year is determined by the estimate of β_1. Estimates and 95%

50 I use the chain-weighted Personal Consumption Expenditures deflator (PCE).
51 This approach is also used in Katz and Murphy (1992).
52 Results of this exercise are available on request.

confidence intervals of the college premium are depicted in Figure 1. The figure shows the college premium reaching exceeding .51 in 2005-2007, declining to .49 in 2008, and stagnating after 2009. My findings are concordant with findings from the literature. Namely, Gottschalk and Hansen (2003) find a premium of roughly .45 in 1995 and James (2012) shows that, the college premium for workers with only a bachelor's degree (no advanced degree) has stagnated between 2000 and 2010.

III. Methods

a. Using Premiums in Every Year to Measure the Rate of Overeducation

I follow the methodology of Gottschalk and Hansen (2003) to define whether an occupation is a noncollege or college occupation based on the magnitude of the college premium estimated for that occupation. A college degree is one that pays college-educated workers a substantial premium while a noncollege degree is one that does not. The threshold for determining whether a college premium is substantial is arbitrary. Gottschalk and Hansen (2003) define a noncollege occupation to be one that pays below a .1 college premium. In this paper, I consider multiple thresholds.

Estimating a college premium for workers with exactly a college degree may not make sense for certain occupations (lawyers, e.g.). Following Gottschalk and Hansen (2003), I first determine the occupations that fall into this category by calculating the percent of workers in every occupation with at least a college degree. For this step, I include workers with at least a high school degree, workers with exactly a college degree, and also workers with an advanced degree. Any occupation that has an average of more than 90% workers with a college degree or higher is determined to be a college occupation.[53] These occupations include physicians, pharmacists, dentists, veterinarians, psychologists, aerospace engineers, chemists, special education teachers, lawyers.

For the remaining occupations, I estimate the college premium paid to college workers with exactly a college degree. In any year, I pool workers of any particular occupation with workers in that occupation from the previous year and one year ahead to avoid college premiums from fluctuating greatly between years but also to allow premiums to change over time. Thus an estimate for a within-occupation college premium from 2007 would include workers in that occupation from 2006 and 2008. I regress log real average weekly wage by year and occupation with dummy variables for females, full-time workers, whether the observation was from the previous year, whether the observation was from the year ahead, and a quadratic in potential experience.

Some occupations using the IPUMS classification system are much smaller by employment (and observations) than others. In order to generate precise estimates, I require each occupation for which I estimate a premium to have at least 50 college and 50 noncollege workers in every year.[54] If an occupation does not meet this requirement in at least one year between 2006 and 2013, I aggregate this occupation with similarly problematic occupations to the 3-digit 2010 SOC

[53] I take the average percentage of workers with at least a college degree in an occupation across the 2005-2014 ACS samples.

[54] That is, 50 college workers and 50 noncollege workers after pooling observations from the year before and the year after in every year from 2006 to 2013.

level. Doing so allows me to retain and estimate premiums for the narrowly defined occupations using the IPUMS classification system. Many occupations that were aggregated to the 3-digit 2010 SOC level still did not have 50 college and 50 noncollege workers observed in every year between 2006 and 2013. I aggregate these to the 2-digit 2010 SOC level. Any occupations aggregated to the 2-digit 2010 SOC level that still did not meet my observation count requirement, were all pooled together into a miscellaneous category. The observations in this miscellaneous category represent 1.1% of the entire sample. This aggregation procedure provides me with 276 distinct occupations. Of these, 49 are occupations that I define to be college ones based on employment (i.e., occupations that are made up of greater than 90% college graduates). The remaining 227 occupations are ones for which I will estimate the college premium in in every year in 2006-2013.

I calculate the rate of overeducation among workers with only a bachelor's degree in each year in 2006-2013 by taking the number of these workers in occupations paying a low premium over the total number of workers in that year. Gottschalk and Hansen (2003) consider occupations that pay a premium of less than .1 in log real weekly earnings to be noncollege occupations. Occupations that pay a premium of less than .1 in 2006 include food processing workers, motor vehicle operators, massage therapists, postal service mail carriers, painters, and construction and maintenance workers. I also consider premium thresholds of .15, .2, and .25 for determining whether an occupation is noncollege. The rates of overeducation in 2006-2013 using these four thresholds are depicted in Figure 2.

The rate of overeducation using a .1 premium threshold in 2006 is quite small but harmonious with previous findings.[55] When increasing the cutoff for defining an occupation as noncollege, the proportion of overeducated workers increases mechanically. The findings from the .1, .15, thresholds are similar: there is an increase in the proportion of overeducated workers during the great recession peaking in 2009, and declining after. This is different to the findings of Gottschalk and Hansen (2003) who find a secular decrease in the proportion of overeducated college workers between 1983 and 1994. When setting the threshold to .2, the rate of overeducation is shown to decrease over time, while a setting a threshold of .25 indicates a slight increase.[56] The components of these changes and the disparate results from the .2 and .25 thresholds will be explored and reconciled in the following subsection.

b. Between and Within Components of Changes in the Rate of Overeducation

As illustrated in Figure 1, there was a statistically significant decline in the aggregate college premium between 2007 and 2008. It could be that using a fixed threshold may detect an increase in the rate of overeducation because all occupations suffered a decline in the college premium. If this is the case, the number of occupations classified as being noncollege may be greater in 2009 than in 2006. A close examination of occupations and their yearly premiums

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[55] Gottschalk and Hansen (2003) finds a decline in the proportion of overeducated workers from roughly .09 to .03 between 1983 and 1994. Because the aggregate college premium among workers with only a bachelor's degree still increased after 1994, the rate of overeducation using a threshold of .1 in my time period may not be appropriately comparable and would likely understate the rate of overeducation compared to his findings.

[56] These findings are similar when also considering unemployment to be an occupation that pays no premium to workers with a college degree.

shows that the number of noncollege occupations increased between 2006 and 2009. There were 8 noncollege occupations in 2006 and 13 noncollege occupations in 2009 when using a premium threshold of .1.

While many occupations changed from college to noncollege between these years, there were others that did the reverse. Following the aggregate trend in the college premium, there were 12 occupations that paid a premium of greater than .1 in 2006 but less than .1 in 2009.[57] However, there were also 7 occupations that did the opposite, paying a premium of less than .1 in 2006 but greater than .1 in 2009.[58] Thus, the results presented in Figure 2 depends on the number of noncollege occupations in each year and the proportion of college workers working in those occupations.

Gottschalk and Hansen (2003) justify the flexibility for an occupation to offer a different premium in every year and possibly change from noncollege to college over time because of SBTC. This line of reasoning may be appropriate for the length of time period in their study (1983-1994). However, the growth in noncollege occupations I have documented between 2006 and 2009 may not be due to a reverse of SBTC. In fact, Hershbein and Kahn (2016) present evidence that SBTC was actually exacerbated during the financial crisis. I thus explore how

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[57] The following are these occupations: life, physical, and social science occupations; surveying and mapping technicians; respiratory therapists; physical therapist assistants and aides; dental assistants; combined food preparation and serving workers, including fast food; food preparation and serving related workers (not elsewhere classified); maids and housekeeping cleaners; construction laborers; telecommunications line installers and repairers; hand packers and packagers.

[58] The following are these occupations: food processing workers; purchasing agents, except wholesale retail, and farm products; agricultural and food science technicians; healthcare practitioners and technical occupations (not elsewhere classified); massage therapists; food preparation workers; bookbinders, printing machine operators, and job printers.

much the results in Figure 2 are driven by occupations fluctuating between being college or noncollege vs. the changes in the size of noncollege occupations by employment size.[59]

In Figure 3, I show that changes in the rate of overeducation are largely due to the yearly reclassification of occupations as being college or noncollege. Figure 3A plots the change in the share of overeducated workers using .1 as the premium threshold. These are the year-to-year changes in the rate of overeducation of the line in Figure 2A. The change in the share of overeducated workers between two adjacent years is due to what I define as changes of within and between shares, which I define below.

Let O be the set of all occupations. In year t, let the set of college occupations be $O_{t,C}$ and the set of noncollege occupations be $O_{t,N}$, and the employment share of college workers in an occupation be γ_i.[60] The rate of overeducation in a given year is defined as:

$$OE_t \equiv \frac{\sum_i \gamma_{t,i} O_{t,N}}{\sum_i \gamma_{t,i} O_t} \qquad (2).$$

For two years $t = 0$ and $t = 1$, some occupations that are noncollege in year 0 are also noncollege in year 1. Let the set of these shared noncollege occupations be O_{0,N_s} and the remaining noncollege occupations unique to year 0 be O_{0,N_u}. Thus $O_{0,N} = O_{0,N_s} \cup O_{0,N_u}$, and $O_{0,N_s} \cap O_{0,N_u} = \emptyset$. Also, let the set of noncollege occupations in year 1 that were college in year

[59] To address this issue, Gottshalk and Hansen (2013) calculate the probability that each occupation pays a premium lower than .1. College workers are then assigned these probabilities. The aggregate probability that a worker with exactly a college degree receives a premium of less than .1 in a year is simply the (weighted) average of these probabilities. Findings from this exercise are similar to the ones from Figure 2 and are presented in Appendix A.

[60]

0 be O_{1,N_u}. Similarly, $O_{1,N} = O_{1,N_s} \cup O_{1,N_u}$, and $O_{1,N_s} \cap O_{1,N_u} = \emptyset$. The rate of overeducation in either year can then be decomposed as:

$$OE_t = \frac{\sum_i \gamma_{t,i} o_{t,N_s}}{\sum_i \gamma_{t,i} o_t} + \frac{\sum_i \gamma_{t,i} o_{t,N_u}}{\sum_i \gamma_{t,i} o_t} = (Within\ Share)_t + (Between\ Share)_t \quad (3)$$

The change in the rate of overeducation between years 0 and 1 can then be calculated as the change in these components:

$$\Delta OE_{0,1} = OE_1 - OE_0 =$$

$$[(Within\ Share)_1 - (Within\ Share)_0] + [(Between\ Share)_1 - (Between\ Share)_0] =$$

$$\Delta(Within\ Share) + \Delta(Between\ Share) \quad (3).$$

Thus the change in the within share is the portion of the change in the rate of overeducation due to employment changes in noncollege occupations that are defined as noncollege in both years. The between change represents the change in the number of overeducated workers as a result of occupations being classified as noncollege in the first year and college in the next and vice versa. Figure 3B plots within and between changes, and clearly demonstrates that much of the change in the share of overeducated workers is due to between changes.[61]

The changes documented in Figure 2 may be from labor market shocks to within-occupation college premiums during the great recession. Because the nature and function of many occupations are likely similar between 2006 and 2013, I use premiums calculated for 2006 only (using data from 2005-2007) to determine whether an occupation is college or noncollege for the

[61] For each year, I use the preceding year as year 0.

entire period.[62] This method shuts down between changes and will only highlight employment changes in noncollege occupations as defined by the premiums calculated for 2006. I present findings using this method in Figure 4. Relative to the rates illustrated in Figure 2, there has been substantially less movement in the rate of overeducation when shutting down between changes. Depending on the threshold considered, the rate of overeducation has either remained stable or increased slightly between 2006-2013.

IV. Conclusion

In this paper, I have studied overeducation in the U.S. between 2006 and 2013. This time-frame is particularly interesting because it covers the period before, during, and after the great recession. I employ a methodology introduced by Gottschalk and Hansen (2003) that is less commonly utilized in the literature. When replicating their method, I find that among workers with exactly a college degree, the proportion of workers with exactly a college degree working in occupations that paid very low college premiums increased during the great recession and decreased after. Changes in the rate of overeducation could be due to an increase in the number of college-educated workers employed in noncollege occupations that were noncollege in the past or could be due to an increase in the number of noncollege occupations themselves. I decompose shifts in the rate of overeducation to changes of within shares and between shares to show that much of the movement documented is due to changes in the between shares. When I keep the classification of an occupation as college or noncollege constant over time, the rate of

[62] I also consider estimating within-occupation premiums by pooling across all years, and the findings do not differ substantially from using within-occupations from 2006 only.

overeducation only exhibits a slight increase in this time period. Either way, these findings run contrary to findings from previous research that show a general decrease in the rate of overeducation during the late 20th century. They are, however, concordant with findings from O'Leary and Sloane (2014) who use the same methodology to document an increase in the rate of overeducation in the U.K. during the great recession.

The findings of this paper, while puzzling, may not be problematic. There has been some evidence of SBTC occurring rapidly in some occupations during recessions in the past 25 years, even during the great recession (Hershbein and Kahn, 2016). Thus one might expect within-occupation premiums for college-educated workers to rise on average during the recession. However, I show that within-occupation premiums fell on average, and for some occupations so much that they would be classified as a noncollege occupation. It could be that SBTC was not pervasive enough to increase within-occupation premiums overall. Also, my narrowly defined occupations may still be broad enough to contain jobs requiring skilled and unskilled tasks, and the share of employment in jobs requiring unskilled tasks increased in this period. My main suspicion, however, is that wage premiums estimated during the recession may simply not be well correlated with the actual productivity of college-educated workers. A suggestion for future research would be to obtain better measures of worker productivity during the great recession.

References

Alba-Ramirez, Alfonso. "Mismatch in the Spanish labor market: overeducation?." *Journal of Human Resources* (1993): 259-278.

Cardoso, Ana Rute. "Jobs for young university graduates." *Economics Letters* 94, no. 2 (2007): 271-277.

Duncan, Greg J., and Saul D. Hoffman. "The incidence and wage effects of overeducation." *Economics of Education Review* 1, no. 1 (1981): 75-86.

Gottschalk, Peter, and Michael Hansen. "Is the proportion of college workers in noncollege jobs increasing?." *Journal of Labor Economics* 21, no. 2 (2003): 449-471.

Hartog, Joop. "Allocation and the earnings function." *Empirical Economics*11, no. 2 (1986): 97-110.

Hartog, Joop, and Hessel Oosterbeek. "Education, allocation and earnings in the Netherlands: Overschooling?." *Economics of Education Review* 7, no. 2 (1988): 185-194.

Hartog, Joop. "Over-education and earnings: where are we, where should we go?." *Economics of Education Review* 19, no. 2 (2000): 131-147.

Hershbein, Brad, and Lisa B. Kahn. "Do Recessions Accelerate Routine-Biased Technological Change?." (2016).

James, Jonathan. "The College Wage Premium." *Federal Reserve Bank of Cleveland Economic Commentary* 2012-10 (2012): 2012-10.

Katz, L.F. and Murphy, K.M., 1991. *Changes in relative wages, 1963-1987: Supply and Demand Factors* (No. w3927). National Bureau of Economic Research.

Kiker, B. F., and Maria C. Santos. "Human capital and earnings in Portugal."*Economics of Education Review* 10, no. 3 (1991): 187-203.

Kiker, Billy Frazier, Maria C. Santos, and M. Mendes De Oliveira. "Overeducation and undereducation: Evidence for Portugal." *Economics of Education Review* 16, no. 2 (1997): 111-125.

Leuven, Edwin, and Hessel Oosterbeek. "Overeducation and mismatch in the labor market." *Handbook of the Economics of Education* 4 (2011): 283-326.

McGuinness, Seamus. "How biased are the estimated wage impacts of overeducation? A propensity score matching approach." *Applied Economics Letters* 15, no. 2 (2008): 145-149.

Modestino, Alicia Sasser, Daniel Shoag, and Joshua Ballance. *Upskilling: Do Employers Demand Greater Skill When Workers Are Plentiful?*. No. rwp15-013. 2015.

O'Leary, Nigel C., and Peter J. Sloane. "Too Many Graduates? An Application of the Gottschalk-Hansen Model to Young British Graduates between 2001-2010." (2014).

Steven Ruggles, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. *Integrated Public Use Microdata Series: Version 6.0* **[Machine-readable database]. Minneapolis: University of Minnesota, 2015.**

Rumberger, Russell W. "The impact of surplus schooling on productivity and earnings." *Journal of Human Resources* (1987): 24-50.

Sicherman, Nachum. "" Overeducation" in the Labor Market." *Journal of Labor Economics* (1991): 101-122.

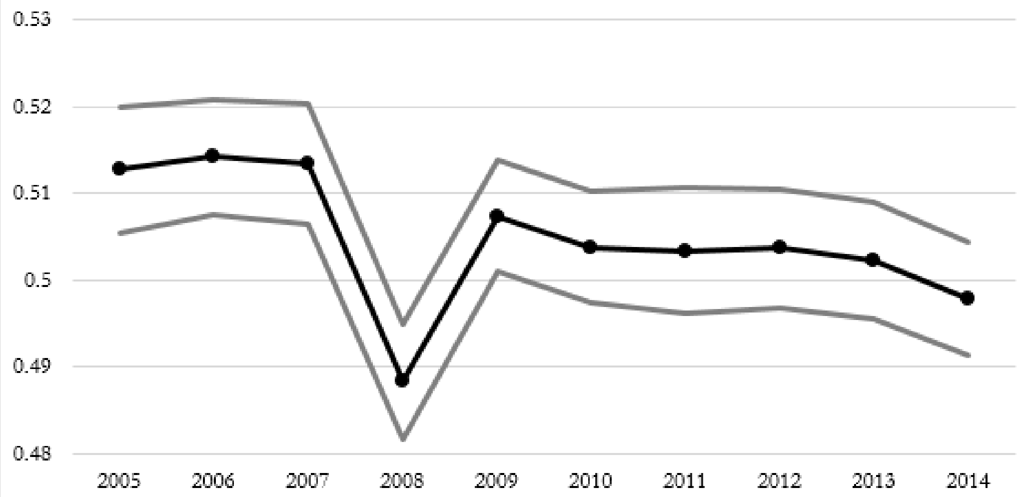
Verdugo, Richard R., and Naomi Turner Verdugo. "The impact of surplus schooling on earnings: Some additional findings." *Journal of Human Resources* (1989): 629-643.

Table 1 - Descriptive Statistics

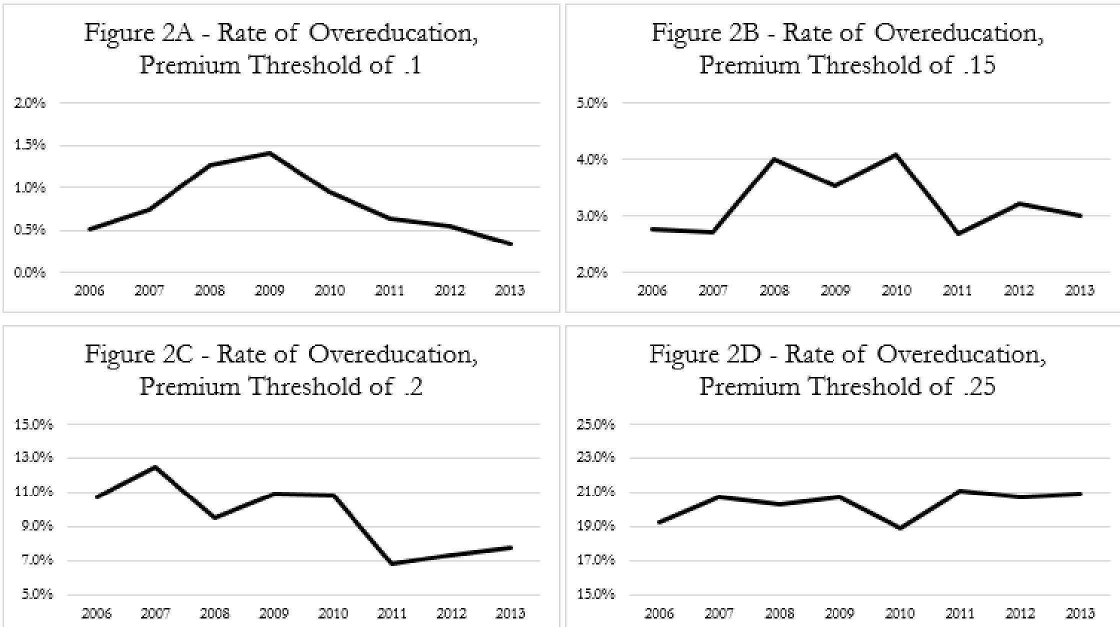
Year	n	Log Real Avg Weekly Wage	% College	% Female	% Black	% Hisp.	Potential Exp.	% Full-time
2005	172,148	6.42	0.33	0.46	0.09	0.13	5.15	0.87
		(0.65)	(0.47)	(0.5)	(0.28)	(0.33)	(3.15)	(0.34)
2006	181,288	6.41	0.32	0.46	0.09	0.14	5.10	0.87
		(0.65)	(0.47)	(0.5)	(0.29)	(0.34)	(3.14)	(0.33)
2007	182,773	6.43	0.33	0.46	0.09	0.14	5.07	0.87
		(0.65)	(0.47)	(0.5)	(0.29)	(0.35)	(3.14)	(0.33)
2008	185,884	6.40	0.34	0.46	0.09	0.14	5.12	0.86
		(0.64)	(0.47)	(0.5)	(0.29)	(0.35)	(3.14)	(0.34)
2009	182,898	6.37	0.35	0.47	0.09	0.14	5.18	0.84
		(0.64)	(0.48)	(0.5)	(0.28)	(0.35)	(3.12)	(0.37)
2010	179,172	6.35	0.35	0.47	0.09	0.15	5.22	0.83
		(0.65)	(0.48)	(0.5)	(0.28)	(0.36)	(3.11)	(0.38)
2011	175,491	6.32	0.35	0.46	0.09	0.15	5.18	0.82
		(0.65)	(0.48)	(0.5)	(0.29)	(0.36)	(3.13)	(0.38)
2012	178,782	6.31	0.36	0.46	0.09	0.15	5.15	0.82
		(0.64)	(0.48)	(0.5)	(0.29)	(0.36)	(3.12)	(0.38)
2013	186,689	6.31	0.37	0.46	0.09	0.15	5.16	0.83
		(0.65)	(0.48)	(0.5)	(0.29)	(0.36)	(3.12)	(0.38)
2014	191,519	6.31	0.37	0.46	0.10	0.15	5.15	0.83
		(0.65)	(0.48)	(0.5)	(0.29)	(0.36)	(3.12)	(0.38)

Note: Figures above are the unweighted variable means of the sample of workers described in section III for 2005-2014. Standard deviations for each variable are provided in parentheses.

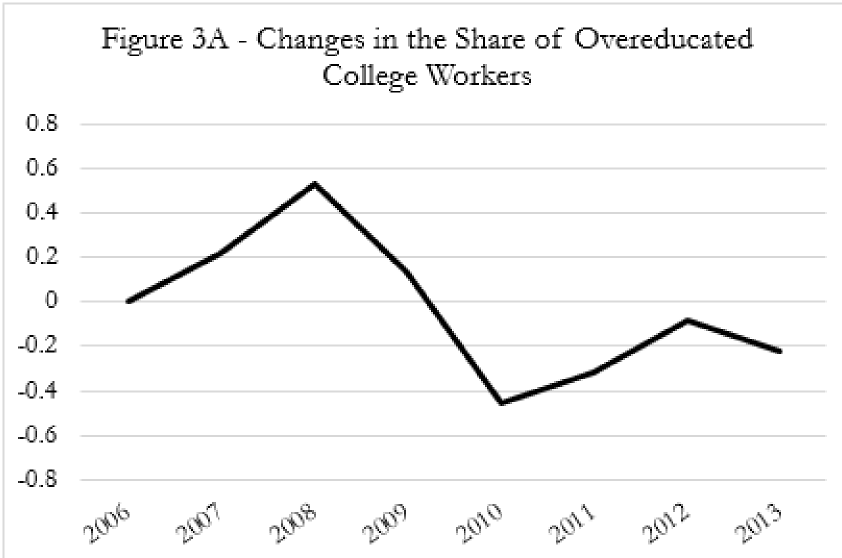
Figure 1
The College Premium, 2005-2014

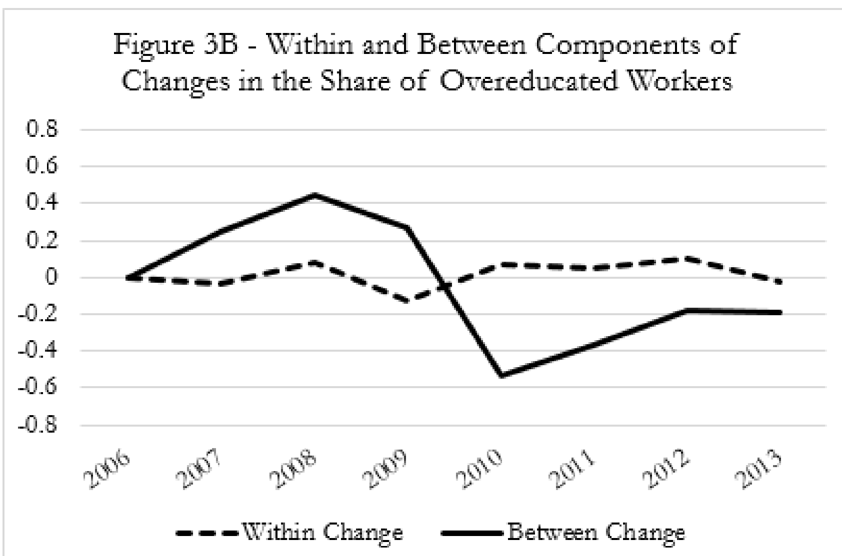


Note: This figure presents the estimates of the college premium in every year from 2005-2014 (black line) and 95% confidence intervals constructed using robust standard errors (grey lines). The college premium is calculated by estimated coefficient on having a college degree in a log real weekly earnings regressions estimated separately in each year from the American Community Survey. The sample used to estimate the premium is described in section III.



Note: This figure presents the rate of overeducation in 2006-2013 using different college premium thresholds to determine whether an occupation is college or noncollege. There will be more noncollege occupations as the threshold is raised and the rate of overeducation will be higher, mechanically. Figures 2A and 2B show an increase in the rate of overeducation during the financial crisis, while Figure 2C shows a decline. Finally, figure 2D shows a slight increase in the rate of overeducation over time.





Note: Figure 3A presents the year-to-year changes in the rate of overeducation when using a college premium threshold of .1. That is, Figure 3A presents the year-to-year changes in the rate of overeducation shown in Figure 2A. Figure 3B shows how much of the change in the rate of overeducation is due to within share changes and between share changes. The within share change in a given year is any change in the rate of overeducation due to changes in employment in occupations that are noncollege in that year and the year before. The between share change is any change in the rate of overeducation that occurs due to occupations shifting from college to noncollege or vice versa.

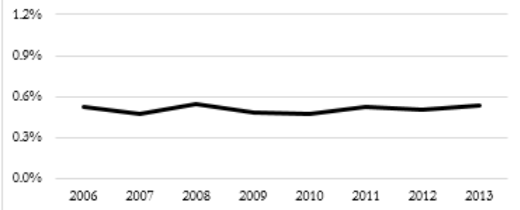


Figure 4A - Rate of Overeducation, Premium Threshold of .1

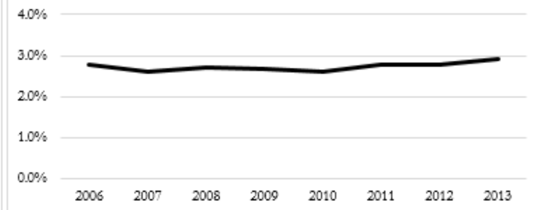


Figure 4B - Rate of Overeducation, Premium Threshold of .15

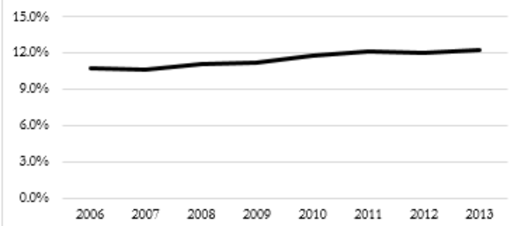


Figure 4C - Rate of Overeducation, Premium Threshold of .2

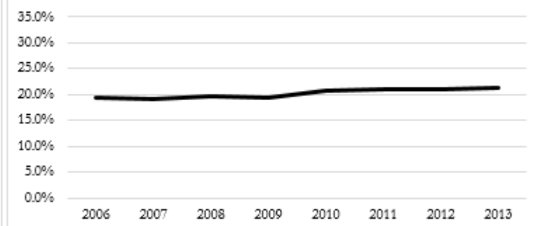


Figure 4D - Rate of Overeducation, Premium Threshold of .25

Note: This figure presents the rate of overeducation in 2006-2013 using different college premium thresholds to determine whether an occupation is college or noncollege. In contrast to Figure 2, occupations are determined to be college or noncollege based on their 2006 premium only. In general, there has been only a slight increase in the rate of overeducation when using this approach.

Appendix A

The measure of overeducation I use to produce Figure 2 relies on classifying an occupation as either being a noncollege occupation or not. Thus the number of occupations classified as being noncollege could vary substantially from year to year simply due to noisy estimates of within-occupation premiums. Gottschalk and Hansen (2003) address this by calculating the probability an occupation pays less than a given threshold. Then an individual's probability of being in a noncollege job is taken to be the probability that his or her occupation pays a premium less than that given threshold. The aggregate probability of being in a noncollege occupation in a given year is simply the (weighted) average probability across individuals of being in a noncollege job. The outcomes of this exercise are presented below. The findings are similar to Figure 2. Namely, the trends from Figure A1, Figure A3, and Figure A4 match their Figure 2 counterparts. The only exception is Figure A2 which unlike Figure 2B, shows no big increase during the great recession.

Figure A1 - Probability of Overeducation, Premium Threshold of .1

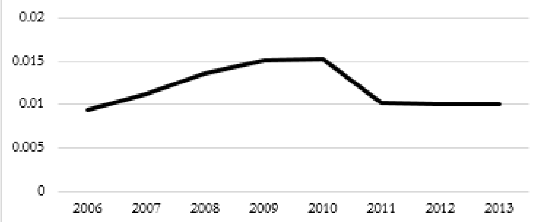


Figure A2 - Probability of Overeducation, Premium Threshold of .15

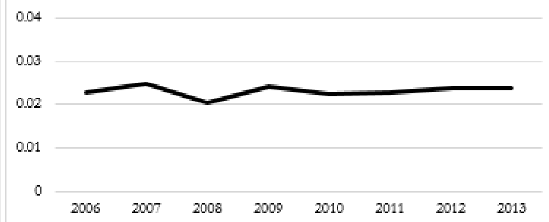


Figure A3 - Probability of Overeducation, Premium Threshold of .2

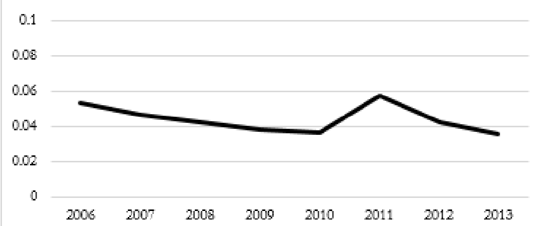


Figure A4 - Probability of Overeducation, Premium Threshold of .25