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ABSTRACT

Using data from the National Longitudinal Study of Adolescent Health, this study examines the impact of high school cohort composition on the educational and labor market outcomes of individuals during their early 20s and again during their late 20s and early 30s. We find that the positive effects of having more high school classmates with a college educated mother on college attendance in the years immediately following high school fade out as students reach their later 20s and early 30s, and are not followed by comparable effects on college completion and labor market outcomes.

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I. Introduction

Existing research indicates the college enrollment decisions can be influenced by policy relevant factors. For instance, researchers have consistently found that programs that reduce the cost of college increase college enrollments (Abraham and Clark 2006; Cornwell, Mustard and Sridhar 2006; Dynarski 2000; 2003; 2004; Kane 2003; 2007). Recent evidence suggests that the composition of one's high school classmates can also influence college enrollment. Bifulco, Fletcher, and Ross (2011) find that students whose school cohorts have higher percentages of students with college educated parents are more likely to attend college, and using data from Norway, Black, Devereux, and Salvanes (2010) presents evidence that the gender composition of a school cohort can influence years of schooling.

Over the last several decades, as college going rates have increased significantly, completion rates among those who enter college have fallen (Belley and Lochner 2007). Thus, it is not clear that increasing college enrollment is sufficient for increasing degree attainment. Descriptive evidence suggests that returns to completing college are substantially higher than the return to merely attending college (Baum, Ma, & Payea 2010), and thus, effects on college completion may be more policy relevant than effects on college enrollment.

Research on whether policy relevant factors can have the same impact on college completion and degree attainment as they have on college enrollment is relatively scarce. Recent studies have examined the effect of scholarship and grant programs on college completion with somewhat mixed results. Dynarski (2008) and Scott-Clayton (2011) find that merit-based scholarship programs increase the likelihood of earning a bachelor's degree, and Castleman and Long (2012) find that a need-based grant program in Florida has increased the likelihood of earning a bachelor's degree. Sjoquist and Winters (2012), however, raise some questions about

the robustness of the findings reported in Dynaraki (2008), and in a separate study, Bruce and Carruthers (2011) find little evidence that a merit based aid program in Tennessee has had positive impacts on degree attainment. Similar studies of the impact of high school cohort composition on degree completion have not been conducted.

The lack of research examining the impact of high school composition on college completion might be explained by the difficulty of isolating causal impacts with existing data. Students are not typically assigned to schools randomly, which makes it difficult to isolate the causal effect of high school composition. Following Hoxby (2000), several recent studies have addressed this challenge by using arguably idiosyncratic variation in student composition across cohorts within the same schools to identify the effects of classmate characteristics. These studies have found that variation in the race, gender, ability, exposure to family violence, and home language of classmates can have short term effects on individual test scores (Angist and Lang 2004; Carell and Hoekstra 2010; Friesen and Krauth 2008; Hanushek, Kain, and Rivkin 2002; Hoxby 2000; Lavy, Paserman, and Schlosser 2008; Lavy and Schlosser 2007). This approach, however, requires data on multiple cohorts of students from the same schools, and data sources that have sufficient information on school context for multiple cohorts of students do not typically track students longitudinally to observe college completion outcomes.

In this study, we turn to a particular sample that is well suited to provide evidence on the effects of high school composition on college completion and other long term outcomes. The National Longitudinal Study of Adolescent Health (Add Health) is a longitudinal survey that follows multiple cohorts of students from the same schools. A previous analysis using the Add Health has demonstrated that among a representative sample of 20 to 25 year olds, having had a higher percentage of classmates with a college educated mother in high school decreases the

likelihood of being a high school dropout and increases the likelihood of having attending college (Bifulco, Fletcher, and Ross 2011). The present study uses the recently released Wave 4 of the Add Health, which measures the outcomes of respondents between the ages of 27 and 32, to examine the effect of cohort composition on college completion and other long-run outcomes.

First we examine whether the impacts of high school cohort composition on college attendance are sustained, or whether estimated effects fade as individuals make decisions to return to school during their 20s. Next, we examine whether or not the composition of one's high school cohort has any longer term effects on college completion and labor market outcomes. In addition, we extend the analysis in Bifulco, Fletcher, and Ross (2011) by estimating the effects of cohort composition separately for males and females. It is useful to examine the effect of cohort composition separately for males and females for two reasons. First, as individuals begin to form families, labor supply decisions of males and females begin to diverge (Killingworth and Heckman 1986). Second, recent studies suggest that males and females respond differently to similar peer environments (Black, Devereux, and Salvanes 2010; Kling, Liebman, and Katz 2007).

We find that the effect of the percent of classmates with a college educated mother on college attendance does fade. The estimated effect on college attendance by Wave 4 is substantially smaller than the effect on college attendance by Wave 3, and is not statistically distinguishable from zero. The separate analyses for males and females lend additional support for the fade-out hypothesis. The estimated effects of percent of classmates with a college educated mother on educational attainment during Wave 3 are driven entirely by effects on males. By Wave 4, the estimated effect on college attendance for males, while still substantively large, is one third the size of the estimated effect on college attendance in Wave 3, and is not

statistically distinguishable from zero. In addition, while the percent of black or Hispanic students in a cohort is associated with higher rates of idleness among males in Wave 3, this aspect of cohort composition shows no effect on idleness among males in Wave 4. The effects on Wave 3 and Wave 4 outcomes are estimated using the same sample and so the apparent fading of effects cannot be attributed to differential attrition between waves.

On the question of whether the effects of cohort composition on college attendance in the years immediately after high school have any lasting effects on degree attainment or labor market outcomes, the results are somewhat ambiguous. Among males, the effects of classmates with a college educated mother on degree attainment and employment are similar in magnitude to the fading college attendance results, which might be viewed as substantively large. However, the effects are imprecisely estimated and not statistically distinguishable from zero. Also, the estimates are sensitive to choice of sample. While we cannot rule out an impact of the proportion of classmates who have college educated mothers on educational attainment and employment, the estimated effects are not as large as the initial effects on college attendance. Effects of cohort composition on income and earnings are generally small and statistically insignificant.

The rest of the paper is organized as follows. Section II provides a brief discussion of why we might expect short-run effects of cohort composition on college enrollment to fade-out. Section III describes the data and sample used in the analyses. Section IV explains the within-school, across cohort identification strategy that we use and how we implemented it. It also presents the results of balancing tests that provide empirical support for this identification strategy. Section V presents evidence that the effects of cohort composition on Wave 3 outcomes fade by Wave 4. Section VI presents results on the impact of cohort composition on

degree attainment and labor market outcomes in Wave 4. Section VII discusses a potentially anomalous result from our analysis and a concluding section summarizes and discusses the implications of our findings.

II. Why Might Short-Run Effects Fade-Out

There are several reasons that we might expect the composition of one's high school cohort to influence post-secondary educational outcomes. First, attending school and classes with more educationally advantaged students, e.g. more students with college educated parents, might influence the development of academic skills, attitudes towards school, and college aspirations. Changes in skills, attitudes, and aspirations are likely to change the perceived and real benefits of a college education to an individual. Following Becker (1964), if we view the decision to attend college as an investment choice in which students choose to enroll if the perceived discounted value of the benefits exceeds the costs, increasing the real or perceived benefits of college will increase enrollments. Of course, improved skills and attitudes toward education can also be expected to increase the likelihood of persisting and succeeding in college. Increases in skills and attitudes would also be expected to translate in to improved labor market outcomes. Thus, if cohort composition influences college enrollment choices through intermediate impacts on skills and attitudes, we would expect that cohort composition will also influence college completion and other longer term outcomes.

However, there are reasons that cohort composition might influence college enrollment decisions even if it does not influence skills and attitudes. An important strand in the literature on post-secondary attainment has emphasized the importance of the information provided through social networks (Granovetter 1995). Information about opportunities can influence decisions to attend college even if we hold expectations, grades, and cognitive achievement

constant. If improved information about post-secondary options both makes an individual more likely to choose to attend college and also improves a student's match with the college he or she chooses, then we might also expect effects on college completion.

Alternatively, if a student has incomplete information about the returns to attending college, one might use the decisions of one's peers as a guide (Bikhchandani, Hirshleifer, and Welch 1992; Manski 1993). As students on the margin of enrolling or not enrolling in college see other students applying for and preparing to attend college, they might be tipped toward enrolling themselves (Fletcher 2012). Thus, peers can influence behavioral choices without influencing attitudes or skills. If cohort composition influences the college enrollment decision in this way, without substantially changing skills, attitudes, or information, then we might expect to see the effect of cohort composition on college enrollment fade as individuals age. As individuals enter their mid-twenties and make decisions about whether or not to return to school, the influence of high school peers is likely to wane, and underlying skills and attitudes are likely to be more telling. Also, if those on the margin of enrolling, whose decisions are influenced by what their peers are doing, are among those least likely to succeed in college, then effects on the enrollment decisions will often not translate into effects on degree attainment. Unlike in the case of policies to reduce the cost of attending college, which might have continuing effects on persistence in college by either reducing students' need to work while they are in enrolled or limiting students accumulation of debt, there is little reason to expect cohort composition to increase persistence in the absence of changes in individual skills and attitudes, or improved matches with the college they choose.

Bifulco, Fletcher, and Ross (2011) present evidence that the percent of classmates with college educated parents, although it increases the likelihood of having attending college by

one's early 20s, does not have any effect on individual skills and attitudes during school. That study also documents that children of college educated parents are substantially more likely to attend college themselves, even when compared to other students who have selected into the same high school. This evidence suggests that the effects of the percent of classmates with college educated parents on college attendance is due largely to imitative behavior during or shortly after high school, rather than any change in underlying skills or attitudes. Thus, we might expect that any short-term effects on college attendance will fade as individuals make decisions about returning to school during their 20s, and also that any positive effects on degree attainment will be substantially smaller than the short-term effects on college attendance. In the remainder of this article we refer to these expectations as the fade-out hypothesis.

III. Data and Samples

The Add Health is a school-based, longitudinal study of the health-related behaviors of adolescents and their outcomes in young adulthood. The study used a clustered sampling design in which first a nationally representative set of high schools, and then a random sample of students from each grade in each school were selected. The survey consists of four waves. Wave 1 was conducted between April 1995 and December 1995. In addition to an extensive in-home survey for the students selected for the longitudinal study, an in-school survey was administered to all of the students attending each sampled school. Wave 2, 3, and 4 consist of follow-up in-home surveys of individuals in the longitudinal sample conducted 1, 7, and 13 years after the Wave 1 survey.

Approximately 20,000 individuals completed the full Wave 1 survey and of these approximately 12,300 responded to the Wave 3 and Wave 4 surveys. Following Bifulco, Fletcher, and Ross (2011), the analyses presented here are conducted using subsamples of these

students who, during Wave 1, were: in grades 9-12; attended a school serving each of grades 10, 11, and 12; reported themselves as either white, black, Hispanic, or Asian; and had 10 or more students in their school cohort. We focus primarily on those who responded to Waves 1, 3 and 4 so that we can test for the fade-out of educational attainment effects.

The independent variables of interest in the analyses are the percent of students in an individual's school cohort who have a college educated mother and the percentage who are either black or Hispanic. These variables are computed using information from the in-school survey administered to students in the sample schools, and thus are based on a census of students in each cohort. The Wave 3 outcomes examined include whether or not the individual is a high school dropout, whether or not the student has attended college, and whether or not the individual was idle. High school dropouts are defined as individuals who had not completed 12^{th} grade and were not in high school at the time of Wave 3 survey, and include students who had GEDs. Being idle is defined as neither working nor attending school at the time of the survey.

Wave 4 outcomes examined include each of the outcomes measured in Wave 3, plus indicators of whether or not the individual has received an associate degree or higher, has received a bachelor degree, and is currently employed at the time of Wave 4. In addition, we examine the log of household income and the log of earnings reported at the time of Wave 4. Respondents were asked to report total household income before taxes in $5,000 to $50,000 increments up to $150,000 or more. Values were coded at the midpoint of the reported range

and at $150,000 for those in the top category.[2] Respondents also reported the dollar amount of income from personal earnings during the most recent year.[3]

Table 1 provides the descriptive statistics for each of the cohort composition variables, each of the outcome variables just described, and an additional set of variables that are used in either the regression models that we estimated or the balancing tests conducted (both of which are described below). Means and standard deviations are provided for individuals who meet the primary sampling criteria described above.

If we compare Wave 3 and Wave 4 outcome measures we see that the number of dropouts changes little from Wave 3 to Wave 4. Because we count GED recipients as dropouts in the analysis, there is very little opportunity for students to change their dropout status after Wave 3.[4] The percent of individuals who have ever attended college, however, increases from 58.5 percent in Wave 3 to 70.7 percent in Wave 4, which suggests that a substantial number of people first attended college sometime after Wave 3. Our first question is whether these delayed choices to attend college lead to a fade out of the effect of high school cohort composition. Note also that many who have attended college had not earned a degree—41.8 percent earned an associate degree or higher and 33.3 percent earned a bachelor degree by Wave 4. Part of our second question is whether the effect of cohort composition on the decision to delay college has any lasting impact on degree attainment.

[2] We also estimated interval regression models coding each interval as its own category and assuming that conditional log income has a normal distribution. The results of these regressions were substantially similar.

[3] In the analysis below we use the log of household income and the log of earnings. When income or earnings were zero the log was coded as 0.

[4] In coding the Wave 4 dropout and college attendance measures we imposed the restrictions that an individual's education level cannot be less in Wave 4 than in Wave 3 and anyone who reported a GED in Wave 3 is recorded as a dropout in Wave 4.

IV. Method of Estimating Cohort Composition Effects

The primary challenge in estimating cohort composition effects is the potential correlation between unobserved student characteristics and cohort attributes created by self-selection of individuals into schools (Moffitt 2001). Under the assumption that families do not select schools based on the differences between their child's cohort and the average school composition, a cross-cohort, within-school design breaks the correlation between unobserved student characteristics and cohort attributes.

To implement this strategy, we estimate the following regression equation:

$$Y_{ics} = \beta_0 + \beta_1 \%CollEd_{cs} + \beta_2 \%Minority_{cs} + \beta_3 MomEd_{ics} + \beta_4 Ethnicity_{ics} + \delta_c + \phi_s + \gamma_s C + \varepsilon_{ics}$$

Here, Y_{ics} is an outcome for student i, who was a member of cohort c in school s; $\%CollEd_{cs}$ is the proportion of students in the individual's school-specific cohort who have a college educated mother; $\%Minority_{cs}$ is the proportion of students in the individual's school cohort who are either black or Hispanic; β_1 and β_2 are the parameters of interest and represent the effect of cohort composition on individual student outcomes; $MomEd_{ics}$ is a set of dummy variables indicating the education level of the student's own mother; $Ethnicity_{ics}$ is an indicator of the student's own race/ethnicity; δ_c is a non-school specific, cohort fixed-effect; ϕ_s is a school fixed effect; C is the cohort variable indicating the student's grade during Wave 1, the effect of which is allowed to vary by school; and ε_{ics} is a random error term.

The inclusion of school fixed effects ensures that the estimation of cohort composition effects is based on comparisons across cohorts within a school. Inclusion of $\gamma_s C$ controls for school specific trends as well. In models that only include school fixed effects, schools that

show a systematic trend in cohort attributes are a concern. For instance, parents might observe when the share minority in a school is increasing over time. If the preferences for racial composition differ across families, students from older cohorts who select into a school might differ in systematic, unobserved ways from students in younger cohorts. Also, minorities and students whose parents have less education are more likely to drop out between grades 9 and 12, and also tend to be less motivated to continue their schooling. Thus, compared to younger cohorts the older cohorts in the Add Health will have higher percentages of classmates with a college educated mother and lower percentages of minorities and also students who are generally more motivated, creating a potential correlation between cohort composition and unobserved student characteristics. If we assume, however, that families do not choose schools based on unanticipated changes in cohort composition, and that the effects of dropouts on cohort composition and student unobservables are approximately linear in grades within schools, then controlling for school trends will eliminate any correlation between cohort composition and unobserved student characteristics.

The results that we report here are from models that include controls for the individual student characteristics related to our cohort variables. Race and parents' education are correlated with several factors that influence outcomes. Thus, even if deviations from school trends in the cohort composition measures are randomly distributed, students in cohorts with higher than predicted percentages of minority students or college educated parents will systematically differ from students in other cohorts. Including individual controls for race and parent education is necessary to prevent these systematic differences from biasing the estimates of cohort composition effects. We also estimated models that include a more extensive set of individual level controls including those listed in Table 1. In principle, if the identification strategy

employed here successfully isolates idiosyncratic variation in cohort composition, additional individual level controls are not necessary. And in fact, models with additional controls provide results substantively similar to those reported below.[5]

Because of clustering of students within schools, we compute Huber/White standard errors that are robust to clustering within schools for all our regressions. The sampling weights used in computing our estimates depend on the sample used. Our primary analysis uses a sample of individuals who responded to the Wave 1, 3 and 4 surveys, and so the Wave 1, 3, and 4 longitudinal sampling weights are used. In estimates that make use of the Wave 1 and 3 respondents and the Wave 1 and 4 respondents, the corresponding longitudinal weights provided by the Add Health are used.

If the identifying assumptions of the model specified above are met, deviations from school specific trends in the cohort composition variables should be uncorrelated with deviations from school specific trends in student background characteristics. To test that this condition is met, we regressed a series of student background characteristics on the cohort composition variables controlling for cohort fixed effects, school fixed effects and trends, the student's race/ethnicity, and the education level of the student's mother. The results of these "balancing tests" are provided in Table 2, which includes the results of 10 separate regressions and a total of 20 separate coefficient estimates. Only one, marginally significant t-statistic is obtained—the estimated relationship between percent black or Hispanic and whether or not the student's parent was born in the U.S is significant at the 0.10 level. One significant t-statistic among 20 coefficient estimates is less than we would expect to emerge by chance. Also, none of the regressions have statistically significant F-statistics. These results provide support for the

[5] These results are provided in an appendix.

assumption that the variation in cohort composition used to identify effect estimates is not systematically related to student characteristics.

V. The Fade-Out of Cohort Composition Effects

Table 3 presents our evidence on the fadeout of the cohort composition effects observed in Wave 3. The estimates presented in the first three columns of the top panel are from Bifulco, Fletcher and Ross (2011). A one point higher percentage of college educated mothers in one's high school cohort is associated with 0.34 percentage point lower high school dropout rate and a 0.55 percentage point higher rate of college attendance.

The first three columns of the middle and bottom panels of Table 3 indicate that these effects of cohort composition on Wave 3 outcomes are driven almost entirely by effects on males. Among males, a one percentage point increase in the percent of students whose parents are college educated is associated with a 0.53 percentage point decrease in the likelihood of dropping out and a 0.96 percentage point increase in the likelihood of attending college. These effects on males are significant considering the growing gap between males and females in educational attainment, particularly among less advantage groups (Buchman and Diprete 2006; Goldin, Katz and Kuziemko 2006; Heckman and La Fontaine 2007). We also see that a higher percentage of black and Hispanic students in one's high school cohort is associated with substantially lower rates of college attendance and higher rates of idleness among males, and the estimate on idleness is statistically significant. These effects of percent black and Hispanic, however, are offset by effects in the opposite direction for females.

The next three columns of Table 3 present estimated effects on the same Wave 3 outcomes computed using the sample of students who responded to the Wave 1, 3, and 4 surveys. These results indicate that the findings on Wave 3 outcomes are robust to this sample

change. Both for the entire sample and among males, the estimated effect of percent college educated mothers on the dropout variable is virtually unchanged, and the estimated effect on college attendance, although somewhat smaller, remains positive and statistically significant. These results suggest that attrition from Wave 4 of the survey does not fundamentally change the key findings of Bifulco, Fletcher, and Ross (2011). Also, a higher share of black and Hispanic students in the high school cohort continues to be significantly associated with higher rates of idleness among males.

Counter to expectations, but consistent with the results from the previous sample, the percent of high school classmates with a college educated mother is associated with higher rates of idleness and the percent black or Hispanic is associated with higher rates of college attendance among females. The counter intuitive result on idleness might be explained by childrearing. Because of household responsibilities, women with young children are especially likely to be neither attending school nor employed outside the home. When we recode the idleness variable such that women with children under the age of 5 are not counted as idle, the effect of the percent of college educated mothers in the high school cohort becomes smaller and statistically insignificant.[6] The positive effect of the share of minority students on college attendance among females is perhaps more puzzling, and is a result we discuss further below.

The last three columns of Table 3 present the estimated effects of cohort composition on the same three outcomes, only now measured at the time of Wave 4. The sample used to compute the estimated effects on outcomes measured in Wave 4 is exactly the same as that used to compute the estimated effect on outcomes measured in Wave 3. Thus, any difference between the results in the last three columns of Table 3 and the corresponding results in the previous three

[6] Results available from the authors upon request.

columns cannot be attributed to sample changes, but rather provide an indication of how much the effects of cohort composition on Wave 3 outcomes fade by Wave 4 within the same sample.

The estimated effect of the percent college educated mothers on the dropout for Wave 4 is very close to that obtained from Wave 3, which is not surprising, given that there is very little opportunity for individuals to change dropout status between Waves 3 and 4. Thus, as expected, we see little fade out of the effect of percent with a college educated mother on the dropout variable. For the college attendance variable, however, there is strong evidence that the effects of the percent of classmates with a college educated mother fades. The estimated effect of percent with a college educated mother on college attendance by Wave 4 not only is statistically insignificant, but the point estimate is about one-third the size of the estimated effect on college attendance by Wave 3. We see a similar difference between the estimated effect on college attendance measured in Wave 3 and Wave 4 among males. Similarly, the effect of the percent black or Hispanic in the high school cohort on idleness among males fades--a statistically significant effect estimate of 0.446 in Wave 3 is very close to zero in Wave 4. Among females the statistically significant effect of percent of classmates with a college educated mother on idleness during Wave 3 also becomes much smaller and statistically insignificant in Wave 4.

The one result that persists from Wave 3 to Wave 4 is the positive association between the share of students in the high school cohort who are black or Hispanic and college attendance among females. We discuss this result in Section VI below.

VI. Long-Term Impacts on Attainment and Employment

Even though the effect of classmates with a college educated mother on college attendance fades out, particularly among males, differences in cohort composition might have longer lasting effects on college attainment and labor market outcomes. Delaying college, for

instance, might make it less likely that one will obtain a degree (Bozick and DeLuca 2005; Niu and Tienda 2011; Rowan-Kenyon 2007), and might also influence income and earnings by an individual in his or her late 20s and early 30s. Table 4 presents results that address this issue.

Considering the results for the sample as a whole, males and females together, we do not find significant relationships between the high school cohort composition variables and either degree attainment or labor market outcomes. Nor do we find any statistically significant relationships when we focus solely on males. In the sample of males, several of the point estimates suggest substantial effects of cohort composition, but the estimates have large standard errors. For instance, the estimated effect of the percent of classmates with a college educated mother on attaining a bachelor's degree is 0.355. An effect of this size implies that a one half standard deviation (7.1 percentage point) increase in the percent of classmates with college educated parents increases the likelihood of attaining an associate's degree by 2.5 percentage points, which is an 8 percent increase at the mean. A one half standard deviation increase in the percent of classmates with college educated parents decreases the likelihood of being unemployed by 2.2 percentage points, which represents a decrease of 18 percent at the mean. Although arguably important substantively, these effects are substantially smaller than the estimated effects on college attendance in Wave 3, and similar to the estimated effects on college attendance in Wave 4. Like the estimated effect on college attendance in Wave 4, these results are all statistically insignificant. The percent of classmates who are black or Hispanic shows a positive effect on obtaining a bachelor's degree among males, which is the sole effect that reaches statistical significance at the 0.10 level.

The estimated effects on income and earnings are generally small and statistically insignificant. For instance the point estimate of the effect of percent of mothers with a college

education on the log of family income is 0.463, one of the larger coefficients in the last two columns of Table 4. This effect implies that a one half standard deviation in the percent of college educated mothers is associated with a 3.3 percent increase in income, an effect which is not nearly statistically significant.

In an attempt to increase precision, we reestimated the regression presented in Table 4 using the sample of individuals who responded to Waves 1 and 4 of the survey regardless of whether or not they responded to Wave 3. This addition increased the sample size by more than 20 percent. The results are reported in Table 5. The effects of expanding the sample on standard error sizes are modest. The point estimates computed using this expanded sample are generally smaller, particularly among males. Among other results, the marginally significant effect of the percent black or Hispanic on the likelihood of earning a bachelor's degree among males is substantially smaller than the corresponding estimate in Table 4, and not nearly statistically significant. Given the imprecision of the effect estimates by gender and the sensitivity of the point estimates to choice of sample, it is difficult to draw strong conclusions about the impacts of cohort composition on degree attainment and employment outcomes, but the evidence of any lasting impacts is weak.

VII. An Anomalous Result?

The one result that is not completely consistent with the fade-out hypothesis is the finding that the positive effect of percent black or Hispanic in the cohort on attending college among females is at least as large in Wave 4 as in Wave 3 (see bottom panel of Table 3). Several points are worth making about this finding.

First, although a positive effect of the percent minority on college attendance might seem counterintuitive to some, it is not inconsistent with the notion that cohort composition influences

college attendance choice through imitation of peers. We suspect that the students whose decisions to enter college are most likely to be influenced by the composition of their school cohort are those choosing between going to community college and not going at all. To test this suspicion we conducted the following analysis. First, using the sample of college graduates, we estimated a logit model to determine the likelihood of receiving an associate's degree, conditional on receiving any degree, as a function of individual characteristics. The individual characteristics used were those listed in Table 2 plus ethnicity and parent education level. The estimate of this model allows us to compute for each student the probability that if they went to college they would go to a two year school.[7] Next, we estimated our model of college attendance adding to the model this predicted probability, plus an interaction between the cohort composition variables and this probability. A positive coefficient on this interaction term suggests that the cohort composition measure has a larger effect on the college enrollment choices of those on the margin of attending a two-year college or no college than on those who are on the margin of attending a four-year college.

The results of this analysis are presented in Table 6. In both the male and female samples, the estimated coefficient on the interaction between percent black or Hispanic and the probability of attending a two-year college, conditional on graduating, is statistically significant and indicates that those likely to be on the margin of deciding whether or not to go to a two-year college are substantially more likely to be influenced by the percent minority in the cohort than those on the margin of deciding whether or not to attend a four-year college. For instance, among females, the effect of percent black or Hispanic in the cohort on college attendance for

[7] Preferably we would use the sample of all students who attended college to estimate the likelihood that an individual with specified characteristics would attend a community college rather than a four year institution. Unfortunately, the Add Health allows us to determine the type of college attended only if the individual has earned a degree or is currently enrolled. Thus, for many of the college attendees in the sample we cannot determine what type of college they attended.

those with a 90 percent probability of attending a two-year school if they decide to attend college is three times as large as the effect on those with a 10 percent probability of attending a two-year school if they decide to attend college.

Black and Hispanic students in our sample are, in fact, more likely to attend a two-year college than non-minorities. Although we cannot identify for each student who reports having attended college in Wave 3 what type of college they attended, we do know that among black and Hispanic students 32.9 percent report either that they are currently attending a 2-year college, obtained an associate degree, or attended college but did not receive a degree and are not currently enrolled. The corresponding number among non-minorities is 31.1 percent. Conversely, only 28.6 percent of minorities compared to 37.3 percent of non-minorities either were currently attending a four year college or had obtained a bachelor's degree by Wave 4. Thus, it is possible that students in cohorts with a high percentage of black and Hispanic students will see more of their classmates applying to and choosing to attend a two-year college, and as a result some of those on the margin of enrolling in a two-year college are persuaded to do so.

In contrast to the effect of minority classmates among females, the effect of classmates with a college educated mother among males is substantial among those on the margin of attending a four-year institution and is not significantly larger for those on the margin of attending a two-year institution than those on the margin of attending a four-year college. Although not definitive, this result suggests a reason why the effect of classmates with a college educated mother on college attendance among males fades as individuals age, but the effect of percent minority in the cohort among females does not fade. Classmates with a college educated mother influence the decision to attend college in the years immediately following high school made by those who are relatively advantaged and who may be relatively likely to attend college

at some point in their lives regardless of whether they attend immediately after high school. Thus, the effect of classmates with a college educated mother on college attendance fades as those who are not influenced by cohort composition to attend college in the years immediately following high school begin to return to school later in life. The percent minority in the cohort, in contrast, primarily influences the college going decisions of less advantaged students who are relatively unlikely to return to college in their mid and later 20s. Because those influenced by the percent minority in the cohort are not likely to return to school later in life, the effect of percent minority on college attendance persists through the mid and later 20s.

Finally, it is worth noting that the positive effect of black and Hispanic classmates on college attendance among females does not translate into significantly higher rates of college completion (see first two columns, bottom panel of Table 4). Thus, even in this case, the effect of cohort composition on encouraging college attendance is, for many students, insufficient to move them to college completion.

VIII. Conclusion

The purpose of this analysis has been to determine whether the effects of high school cohort composition on college attendance and idleness documented by Bifulco, Fletcher and Ross (2011) fade out as individuals age from their early twenties into their later twenties and early thirties. We also examine if cohort composition variables have any longer lasting effects on degree attainment and labor market outcomes. We find that the cohort composition effects on college attendance and idleness do in fact fade. The evidence on degree attainment and employment is less conclusive. Point estimates for the effect of classmates with a college educated mother on degree attainment and employment among males are similar in magnitude to the insignificant long run impacts on college attendance, and arguably large, but the estimates are

statistically insignificant and become smaller when the sample is expanded. Thus, there is not strong evidence of lasting impacts.

The fade-out of initial effects on post-secondary outcomes is consistent with the evidence Bifulco, Fletcher and Ross (2011) present that the percent of classmates with college educated parents has no effect on individual skills and attitudes during school. Combined with this earlier evidence, the fade-out of cohort composition effects suggests that the initial effect on college attendance is due largely to imitative behavior during or shortly after high school. As contact with the school cohort becomes less frequent, and individual attitudes and skills become more telling, the effect on educational enrollment fades. Also absent changes in underlying skills and attitudes, or improved college-student matches, short-run impacts of cohort composition on college enrollment do not translate into discernible effects on college completion or labor market outcomes.

It is important to note that the estimates based on within-school variation might underestimate the effect of school composition on student outcomes. Some of the mechanisms through which the composition of a school might influence outcomes are constant across cohorts. For instance, a school's ability to garner resources or teacher expectations for students might be influenced as much by other cohorts in the school as a student's own cohort. Also, the effect of school composition on skill and attitude development might depend on the amount of integration of students from different backgrounds that occurs within schools. Finally, it is worth noting that the fact that the effects of having more classmates with college educated parents fade out does not imply that the effects of other aspects of cohort composition fade. For instance, using data from Norway, Black, Devereaux, and Salvannes (2010) find that the percent female in the cohort influences educational attainment, and those effects might in fact be longer lasting. Nonetheless,

the evidence presented here suggests that the initial influence of having more educationally advantaged high school classmates on post-secondary outcomes are short-lived.

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Table 1: Sample Descriptives, Wave 1, 3 & 4 Sample

	N	Mean	SD
Wave 3 outcome variables			
Drop out of high school	8023	0.133	0.340
Attend College	7707	0.585	0.493
Idle	7747	0.131	0.337
Wave 4 outcome variables			
Drop out of high school	8024	0.125	0.331
Attend college	7706	0.707	0.455
Associate degree	8024	0.418	0.493
Bachelor degree	8024	0.333	0.471
Employed	8023	0.833	0.373
Idle	7746	0.124	0.330
Log of household income	7566	10.83	0.809
Log of earnings	7885	9.59	2.66
Cohort variables			
Proportion with college educated mother	8025	0.288	0.140
Proportion black or Hispanic	8025	0.304	0.294
Control Variables			
Black	8025	0.164	0.370
Hispanic	8025	0.117	0.321
Asian	8025	0.043	0.204
Mother high school drop-out	8025	0.159	0.366
Mother high school graduate	8025	0.362	0.481
Mother some college	8025	0.237	0.425
Mother college graduate	8025	0.241	0.428
Grade 10 indicator	8025	0.257	0.437
Grade 11 indicator	8025	0.235	0.424
Grade 12 indicator	8025	0.257	0.437
Male	8025	0.503	0.500
Age	8025	29.53	1.31
Parent's Age	8025	42.59	5.87
Parent native born	8025	0.877	0.297
Parent years in US	8025	35.96	12.96
Parent information missing	8025	0.328	0.470
Log family income	8025	10.44	1.19
Single parent	8025	0.264	0.406
Live with both parents	8025	0.576	0.457
Number older siblings	8025	0.825	1.15

Notes: Cohort variables are calculated for each grade surveyed in each high school using the full in-school Wave I sample. Percent black or Hispanic is based and mother's education variable is based on student report. All parent variables measured using Wave 1. Wave 1, 3 & 4 longitudinal weights are used.

Table 2: Balancing tests for cohort composition measures, Wave 1, 3 & 4 Sample

Dependent Variable	% with college educated mother	% black or Hispanic	F-statistic	p-value
Male	-0.131 (0.229)	0.352 (0.261)	0.997	0.381
Age (in years)	0.111 (0.308)	-0.046 (0.340)	0.076	0.927
Parent's age (in years)	2.845 (2.025)	-4.735 (4.351)	1.338	0.269
Parent born in the U.S.	-0.047 (0.098)	-0.182* (0.103)	1.690	0.192
Missing parent information	-0.136 (0.256)	0.275 (0.310)	0.626	0.537
Log of family income	0.265 (0.597)	0.526 (0.621)	0.626	0.538
Single parent family	-0.069 (0.176)	0.048 (0.216)	0.137	0.872
Live w/both biological parents	0.394 (0.274)	-0.240 (0.246)	2.086	0.131
Number of older siblings	-0.386 (0.493)	-0.173 (0.615)	0.371	0.691
Parent alcoholism reported	-0.208 (0.189)	0.056 (0.149)	0.837	0.437

The figures in each row are coefficients from regressions that include, in addition to the cohort composition measures, controls for cohort fixed effects, school fixed effects, school trends, the student's race, and the student's mother's level of education. All variables are measured using Wave 1 of the Add Health. Figures in parentheses are standard errors robust to clustering at school level. The F-statistics is for the joint effect of percent black or Hispanic and percent with college educated mother. All models estimated using Wave 1, 3 & 4 longitudinal weights. * designates significantly different from zero at 0.10.

Table 3: Estimated impact of cohort composition on Wave 3 outcomes

	Wave 1 & 3 Sample Wave 3 Outcomes			Wave 1, 3 & 4 Sample Wave 3 Outcomes			Wave 1, 3 & 4 Sample Wave 4 Outcomes		
Cohort Composition	Dropout	Attend College	Idle	Dropout	Attend College	Idle	Dropout	Attend College	Idle
				Males & Females					
% college educated mother	-0.338**	0.547**	0.035	-0.325**	0.343*	0.218	-0.309**	0.121	-0.060
	(0.132)	(0.231)	(0.129)	(0.146)	(0.203)	(0.146)	(0.145)	(0.258)	(0.156)
% black or Hispanic	0.055	0.072	0.073	0.012	0.228	0.074	0.027	0.370	0.004
	(0.179)	(0.295)	(0.157)	(0.187)	(0.278)	(0.155)	(0.195)	(0.223)	(0.170)
Observations	9,400	9,045	9,055	8,023	7,707	7,747	8,024	7,706	7,746
				Males					
% college educated mother	-0.530**	0.962***	-0.218	-0.552**	0.752**	0.017	-0.523**	0.346	-0.248
	(0.210)	(0.268)	(0.175)	(0.241)	(0.360)	(0.223)	(0.238)	(0.328)	(0.201)
% black or Hispanic	0.109	-0.392	0.472**	-0.089	-0.181	0.446**	-0.170	-0.043	-0.028
	(0.282)	(0.471)	(0.201)	(0.315)	(0.466)	(0.192)	(0.306)	(0.322)	(0.210)
Observations	4,499	4,345	4,341	3,707	3,575	3,592	3,707	3,574	3,592
				Females					
% college educated mother	-0.184	0.103	0.282	-0.177	-0.149	0.390**	-0.178	-0.095	0.129
	(0.146)	(0.381)	(0.183)	(0.154)	(0.362)	(0.182)	(0.150)	(0.408)	(0.262)
% black or Hispanic	-0.062	0.545*	-0.159	0.066	0.623*	-0.157	0.176	0.726**	0.141
	(0.199)	(0.306)	(0.260)	(0.195)	(0.313)	(0.271)	(0.197)	(0.308)	(0.274)
Observations	4,901	4,700	4,714	4,316	4,132	4,155	4,317	4,132	4,154

All regressions include both cohort composition variables along with controls for cohort fixed effects, school fixed effects, and school trends as well as the individual student covariates related to the cohort variables. Estimates for the Wave 1 & 3 sample are computed using Wave 1 & 3 longitudinal sampling weights, and estimates of Wave 1, 3 & 4 sample are computed using Wave 1, 3 & 4 longitudinal sampling weights. Figures in parentheses are standard errors robust to clustering at the school level. * designates significantly different from zero at 0.10, ** significantly different than zero at 0.05 level.

Table 4: Estimated impacts of cohort composition on Wave 4 outcomes, Waves 1, 3 & 4 Sample

Cohort Composition	Associate Degree	Bachelor Degree	Employed	Log of Household Income	Log of Earnings
			Males & Females		
% college educated mother	0.312	0.214	0.013	0.463	0.296
	(0.194)	(0.178)	(0.165)	(0.319)	(1.169)
% black or Hispanic	0.175	0.307	0.083	0.068	-0.405
	(0.209)	(0.206)	(0.181)	(0.313)	(1.266)
Observations	8,024	8,024	8,023	7,566	7,885
			Males		
% college educated mother	0.345	0.355	0.305	0.325	-0.177
	(0.287)	(0.285)	(0.212)	(0.533)	(1.226)
% black or Hispanic	0.274	0.575*	0.130	-0.550	-2.222
	(0.267)	(0.323)	(0.240)	(0.518)	(1.398)
Observations	3,707	3,707	3,707	3,490	3,644
			Females		
% college educated mother	0.259	0.085	-0.268	0.370	0.904
	(0.279)	(0.240)	(0.245)	(0.711)	(1.779)
% black or Hispanic	0.157	0.168	-0.006	0.627	0.221
	(0.306)	(0.269)	(0.269)	(0.476)	(2.114)
Observations	4,317	4,317	4,316	4,076	4,241

All regressions include both cohort composition variables along with controls for cohort fixed effects, school fixed effects, and school trends as well as the individual student covariates related to the cohort variables. Dependent variables are measured using Wave 4 of the Add Health. Figures in parentheses are standard errors robust to clustering at the school level. Estimates compute using Wave 1, 3 & 4 longitudinal sampling weights. * designates significantly different from zero at 0.10, ** significantly different than zero at 0.05 level.

Table 5: Estimated impacts of cohort composition on Wave 4 outcomes, Waves 1 & 4 Sample

Cohort Composition	Associate Degree	Bachelor Degree	Employed	Log of Household Income	Log of Earnings
			Males & Females		
% college educated mother	0.140	0.100	0.012	0.528*	0.499
	(0.181)	(0.172)	(0.151)	(0.280)	(1.195)
% black or Hispanic	-0.009	0.152	0.138	-0.008	0.088
	(0.178)	(0.222)	(0.138)	(0.361)	(1.323)
Observations	9,757	9,757	9,755	9,178	9,556
			Males		
% college educated mother	-0.035	0.079	0.199	0.651	-0.527
	(0.297)	(0.259)	(0.184)	(0.472)	(1.148)
% black or Hispanic	0.037	0.225	0.121	-0.172	-0.215
	(0.296)	(0.362)	(0.198)	(0.535)	(1.998)
Observations	4,604	4,604	4,603	4,314	4,502
			Females		
% college educated mother	0.303	0.180	-0.223	0.338	1.555
	(0.263)	(0.227)	(0.239)	(0.606)	(1.907)
% black or Hispanic	-0.038	0.073	0.141	0.284	0.384
	(0.258)	(0.251)	(0.202)	(0.515)	(1.803)
Observations	5,153	5,153	5,152	4,864	5,054

All regressions include both cohort composition variables along with controls for cohort fixed effects, school fixed effects, and school trends as well as the individual student covariates related to the cohort variables. Dependent variables are measured using Wave 4 of the Add Health. Figures in parentheses are standard errors robust to clustering at the school level. Estimates compute using Wave 1 & 4 longitudinal sampling weights. * designates significantly different from zero at 0.10, ** significantly different than zero at 0.05 level.

Table 6: Estimated impacts of cohort composition on college attendance by probability of having a two-year degree conditional on having graduated from college

	Wave 1 & 3 Sample	Wave 1, 3 & 4 Sample	Wave 1 & 3 Sample	Wave 1, 3 & 4 Sample
VARIABLES	Males		Females	
% college educated mother	0.713*	0.485	0.530	0.309
	(0.371)	(0.388)	(0.356)	(0.372)
% college educated mother * conditional probability of 2-year college	0.417	0.469	-0.861	-0.913
	(0.542)	(0.639)	(0.803)	(0.816)
% black or Hispanic	-0.842	-0.719	0.209	0.244
	(0.512)	(0.539)	(0.334)	(0.334)
% black or Hispanic * conditional probability of 2-year college	0.694**	0.807**	0.698**	0.721**
	(0.305)	(0.357)	(0.313)	(0.311)
conditional probability of 2-year college	-0.371*	-0.314	-0.019	-0.109
	(0.217)	(0.248)	(0.327)	(0.323)
Observations	4,314	3,550	4,664	4,102

The dependent variable is college attendance by Wave 3. All regressions include both cohort composition variables along with controls for cohort fixed effects, school fixed effect, and school trends, as well as the individual student covariates related to the cohort variables. Estimates are computed using longitudinal sample weights. Figures in parentheses are standard errors robust to clustering at the school level. * designates significantly different than zero at the 0.10 level, ** designates significantly different than zero at the 0.05 level.

Appendix: Estimated impacts of cohort composition on Wave 4 Outcomes with and without individual control variables, Wave 1, 3 & 4 Sample

Cohort Composition	Baseline controls (Males & Females)	Baseline + extended controls (Males & Females)	Baseline controls (Males)	Baseline + extended controls (Males)	Baseline controls (Females)	Baseline + extended controls (Females)
Dropout						
% college educated mother	-0.309**	-0.282**	-0.523**	-0.473**	-0.178	-0.177
	(0.145)	(0.127)	(0.238)	(0.226)	(0.150)	(0.138)
% black or Hispanic	0.027	0.020	-0.170	-0.144	0.176	0.160
	(0.195)	(0.179)	(0.306)	(0.294)	(0.197)	(0.176)
Attend College						
% college educated mother	0.121	0.021	0.346	0.156	-0.095	-0.150
	(0.258)	(0.228)	(0.328)	(0.311)	(0.408)	(0.393)
% black or Hispanic	0.370	0.443**	-0.043	0.140	0.726**	0.689**
	(0.223)	(0.212)	(0.322)	(0.310)	(0.308)	(0.282)
Idle						
% college educated mother	-0.060	-0.046	-0.248	-0.232	0.129	0.127
	(0.156)	(0.147)	(0.201)	(0.198)	(0.262)	(0.252)
% black or Hispanic	0.004	0.034	-0.028	0.011	0.141	0.159
	(0.170)	(0.172)	(0.210)	(0.208)	(0.274)	(0.275)
Associate Degree						
% college educated mother	0.312	0.225	0.345	0.231	0.259	0.247
	(0.194)	(0.195)	(0.287)	(0.297)	(0.279)	(0.267)
% black or Hispanic	0.175	0.233	0.274	0.401	0.157	0.099
	(0.209)	(0.208)	(0.267)	(0.244)	(0.306)	(0.282)
Bachelor Degree						
% college educated mother	0.214	0.141	0.355	0.240	0.085	0.080
	(0.178)	(0.187)	(0.285)	(0.299)	(0.240)	(0.223)
% black or Hispanic	0.307	0.345*	0.575*	0.714**	0.168	0.080
	(0.206)	(0.205)	(0.323)	(0.290)	(0.269)	(0.255)
Employed						
% college educated mother	0.013	0.001	0.305	0.290	-0.268	-0.252
	(0.165)	(0.163)	(0.212)	(0.217)	(0.245)	(0.239)
% black or Hispanic	0.083	0.054	0.130	0.089	-0.006	-0.015
	(0.181)	(0.189)	(0.240)	(0.237)	(0.269)	(0.274)
Log of Household Income						
% college educated mother	0.463	0.414	0.325	0.132	0.370	0.393
	(0.319)	(0.296)	(0.533)	(0.563)	(0.711)	(0.713)
% black or Hispanic	0.068	-0.053	-0.550	-0.603	0.627	0.549
	(0.313)	(0.302)	(0.518)	(0.513)	(0.476)	(0.484)
Log of Earnings						
% college educated mother	0.296	0.188	-0.177	-0.472	0.904	0.769
	(1.169)	(1.202)	(1.226)	(1.282)	(1.779)	(1.859)
% black or Hispanic	-0.405	-0.820	-2.222	-2.200	0.221	-0.100
	(1.266)	(1.255)	(1.398)	(1.371)	(2.114)	(2.116)

All regressions include both cohort composition variables along with controls for cohort fixed effects, school fixed effects, and school trends as well as the individual student covariates related to the cohort variables. Extended controls include the individual characteristics listed in Table 2. Dependent variables are measured using Wave 4 of the Add Health. Figures in parentheses are standard errors robust to clustering at the school level. Estimates compute using Wave 1, 3 & 4 longitudinal sampling weights. * designates significantly different from zero at 0.10, ** significantly different than zero at 0.05 level.