The Effect of College Networks on Immigrant and Minority Labor Market Outcomes*

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Abstract

We examine the effect of same-race/same-nativity networks on the annual earnings and employment of college students using data from multiple cohorts of students entering New York City's public university system merged with state unemployment insurance records. We identify network effects from small changes in same-race/same-nativity shares across cohorts within college-majors. We find substantial earnings and employment benefits for white native-born, black native-born, and black immigrants who enroll in cohorts with larger shares of same group peers. The benefits to black immigrants are particularly large: a 10 percentage-point increase in the share of peers who are black immigrants leads to just over an 8 percent increase in annual earnings for black immigrants 10 years after college entry. Among Hispanic immigrants, the effects of same-group peers on earnings are negative in the years immediately after college entry, while the effects on employment are large and positive, suggesting that Hispanic immigrant cohortmates refer one another to low-paying jobs. Among Hispanic native-born, network effects on earnings are small and close to zero but network effects on employment are largely negative. Asian/Pacific Islander students appear to benefit from their networks but interval estimates are imprecise. These results highlight substantial heterogeneity in network effects that may partially explain earnings gaps by race/ethnicity and nativity. *Keywords: educational attainment; higher education; . JEL: I21, I22, H75, J15*

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1 Introduction

The earnings of college graduates differ markedly across racial/ethnic and nativity groups in the U.S. population. As examples, the lifetime earnings of African-Americans and Latinos with a bachelor's degree was approximately 20 percent lower than that of whites with a bachelor's degree in 2014 (Wilson and Rodgers III 2016) and immigrants with some college earned 20 percent less than native-born with some college in 2015 (Camarota and Zeigler 2016). Prior research offers a number of explanations for these raw earnings gaps, including differences in pre-college skills, college quality, major choices, labor market experiences, and for nativity gaps, the out-migration of high-wage immigrants (e.g., Rivkin 1995; Neal and Johnson 1996; Lubotsky 2007; Charles and Guryan 2008; Hellerstein and Neumark 2008; Arcidiacono and Koedel 2014; Carnevale et al. 2016).

Yet, limited attention has been paid to the networks in which postsecondary students are embedded and how these networks influence their labor market outcomes. This is in contrast to a relatively large literature on the effect of friends and neighbors on labor market outcomes in the general population, where ample evidence suggests that jobs are often obtained through social networks and that such networks are often formed by race/ethnicity and geographic proximity (e.g., Ioannides and Loury 2004; Bayer, Ross and Topa 2008; Hellerstein, McInerney and Neumark 2011). A small set of studies focused on predominantly white or highly-selective postsecondary institutions suggests that college students also rely heavily on their networks in searching for employment and that friendships with well-connected peers can lead to high-paying jobs (e.g., Marmaros and Sacerdote 2002). Little is known, however, about the effect of college peers on labor market outcomes for students from less-advantaged, minority, and immigrant backgrounds where social networking could harm employment outcomes if peers cause students to reduce their academic effort or provide poor career advice, few referrals, or referrals to predominantly low-paying jobs. Indeed, the well-documented disparities in earnings among college graduates from different racial/ethnic backgrounds could be at least partially explained by networks that operate positively for whites and negatively for students from traditionally under-represented groups.

In this paper, we investigate the effects of college networks on the annual earnings of students enrolled in one of the institutions within the City University of New York (CUNY) System, New York City's network of public colleges and universities. Based on previous findings that physical proximity (e.g., sharing the same dorm, classroom, cohort) and race/ethnicity are strong predictors of the friendships that students form in U.S. schools and colleges (e.g., Quillian and Campbell 2003; Marmaros and Sacerdote 2006; Mayer and Puller 2008), we define a network as a group of students in the same college, cohort, major, race/ethnicity, and nativity status. We identify the effects of these networks off of variation in the share of classmates

that are of the same-race/same-nativity across cohorts within the same college and major. Importantly, our sample is restricted to students who enter institutions that require them to choose a major upon enrollment, thereby minimizing potential biases driven by endogeneity of major choice to peers' decisions. Our identifying assumption is that students do not choose colleges and majors based on knowledge of the composition of each entering cohort such that deviations in the racial/ethnic and nativity composition across cohorts is uncorrelated with student traits that affect labor market outcomes. We show that this assumption holds true on observable pre-enrollment student characteristics as well as students' earnings potential.

Consistent with the previous literature on networking in predominantly white institutions, we find that white native-born students experience earnings and employment gains when the share of classmates that are also white, native-born students increases. Black native-born and particularly black immigrants also benefit from their same group peers. Black immigrant students' gains from same-group peers significantly exceed the benefits received by other student groups from increased networking opportunities. In contrast, neither immigrants nor native-born Hispanic students experience earnings gains as a result of networking with same-group peers, with estimates suggesting *negative* effects of same-group peers on Hispanic immigrants' earnings. Combined with the finding that Hispanic immigrants experience an increase in the probability of employment when they have more same-group peers, this result suggests that Hispanic immigrants may encourage their peers to enter the labor force quickly, which may take time away from schooling and lead to lower earnings (because they take lower-paying jobs and/or do not finish their degrees). Across all race/ethnicity and nativity categories, we find no evidence that the labor market benefits of same-group peers are driven by increased academic effort.

2 Related Literature

Our paper informs and draws from research on network and peer effects in neighborhoods and postsecondary institutions. A long line of research has established that job market searches are at least partially dependent upon social networks and that networks operate differently (and lead to different outcomes) for white, black, and Hispanic job-seekers (e.g, Massey et al. 1987; Munshi 2003; Ioannides and Loury 2004; Patel and Vella 2013; Bayer, Ross and Topa 2008; Hellerstein, McInerney and Neumark 2011; Topa 2011). Networks of friends and neighbors can affect employment outcomes through career advice and information about jobs as well as direct referrals. For instance, Hellerstein, McInerney and Neumark (2011) find strong evidence of race-based neighborhood networks where individuals of the same race and zip code are more likely to work in the same establishment than what would be expected from a random allocation of individuals across organizations. Hellerstein, McInerney and Neumark (2011) also find larger network effects on same-

establishment employment for Hispanic than for black and white neighbors, indicating that the effect of a network is larger for job-seekers who face barriers to job searches through traditional channels (e.g., limited familiarity with English). Related to these findings, McManus (1990) finds that living in a community with many co-ethnic members who speak the same language (a "language enclave") provides better jobs for Hispanic adults who are not English proficient than for those who are, thereby lowering the returns to English language ability.

These results highlight the potential heterogeneity in effects: whether networks operate negatively or positively will depend on the opportunities and information that the network offers. High rates of immigrant entrepreneurship, for example, may lead to stronger network effects for some communities, particularly if the hiring managers are from the same ethnic group (Kerr and Kerr 2016). At the same time, extensive ethnic networks may afford opportunities outside of the mainstream labor market or in lower-paying industries, which could lead to lower earnings for some groups (Loury 2006).

In the postsecondary education literature, networks (or "peers") have been shown to influence students, with effects on both non-academic (e.g., drinking, exercising) and academic outcomes.[1] Thus, in addition to influencing labor market outcomes through job-related information and referrals, college classmates can influence the degree of effort that individuals put into their schooling and/or their job searches. A small set of papers explores the effect of college peers on labor market outcomes. All of these studies consider the effect of peers in relatively elite institutions, such as Harvard Business School (Shue 2013; Josh Lerner and Ulrike Malmendier 2013), Dartmouth College (Marmaros and Sacerdote 2002), Indiana University Business School (Hacamo and Kleiner 2016), and top universities in Chile (Zimmerman 2015). These inquiries overwhelmingly conclude that friendships with fellow elites leads to better labor market outcomes.

Our analysis contributes to this emerging literature by exploring network effects on employment outcomes among postsecondary students who come from a wide range of socioeconomic and racial/ethnic backgrounds, including many students who are low-income, immigrants, and from traditionally under-represented minority groups. With these expansive data, we can uncover heterogeneity in network effects that prior studies have been unable to examine. We also aim to uncover some of the mechanisms through which these college networks operate, specifically whether networks influence earnings through access to employment and/or indirectly through proxy measures of academic effort, including degree completion and credit accumulation.

[1] See, for instance, Sacerdote (2001), Duncan et al. (2005), Carrell, Fullerton and West (2009), and Carrell, Hoekstra and West (2011). Sacerdote (2011) provides a thorough review of this literature.

3 Data and Background

Our analyses rely on administrative data from the CUNY System, which includes information on first-time, degree-seeking students' demographic characteristics (including race/ethnicity and immigration status) and academic outcomes. We observe academic outcomes, such as credits completed, GPA, and degree completion up to ten years after college entry. Student records have been merged with state Unemployment Insurance records, thus, we are able to track quarterly employment and earnings of all students who remain employed in New York State from 1996 through 2015.[2]

3.1 Analysis sample

We focus on the 11 cohorts of degree-seeking students who entered in the fall semester of the 2000 through 2011 academic years.[3] To minimize endogeneity of major choice, we limit our sample to students who choose a major/program at college entry and exclude students who enrolled in one of three senior colleges where very few students enter with a major (Hunter, Queens, and Lehman Colleges). We also drop the small number of Native American students (less than 1 percent of the sample), since this group is too small to generate reasonably precise estimates. To ensure sufficient numbers for estimation of network effects, we further limit our sample to students who enter into a college-major with at least 25 students on average across all years and a minimum of 10 students in any given year. Our resulting sample includes 145,310 students; we track labor market outcomes for all students up to 5 years after college enrollment with declining numbers of students used in the estimation of network effects 6 to 10 years after enrollment.

We classify students by race/ethnicity and nativity, resulting in eight groups: Asian or Pacific Islander (API), black, Hispanic, and white students who are either born in the U.S. or U.S. territories ("native-born") or born outside the U.S. ("immigrant"). As shown in the top two rows of Table 1, CUNY serves a large number of students from each of the eight groups. The smallest, API native-born students, make up 6 percent of students in our sample and the largest group, native-born Hispanics, make up 24 percent. The table also provides the number of college, cohort, major (CCM) cells for each group, which reflects the level at which the network share varies (note that "major" refers to "degree and major" as students in bachelor's and associate's degree programs who declare the same major typically enroll in different classes and are likely to form separate networks).

Figure 1 shows large racial/ethnic differences in major choice where, for instance, white and Hispanic native-born are far more likely to choose business majors than their API and black counterparts (Panel

[2]Over 80 percent of CUNY graduates remain in the state of New York over the long term (up to 30 years after degree receipt). See http://www2.cuny.edu/wp-content/uploads/sites/4/page-assets/about/administration/offices/oira/policy/research-briefs/NY_Residency_Research_brief_v_11_rev20121022.pdf for additional details.

[3]This selection criteria allows for a minimum of five years of post-entry outcomes to be observed.

A). And among immigrants, Hispanic students are far more likely to choose a health-related major than students from the other three racial/ethnic groups (Panel B). Our empirical framework, described in Section 4, controls for any possible effects of major on earnings as well as the differential sorting of students into different majors.

3.2 Average Annual Earnings by Race/Ethnicity and Nativity

To motivate our analyses, we present both raw and adjusted average earnings post enrollment in the CUNY System by race/ethnicity and nativity. The y-axis of Figure 2 represents average annual earnings 10 years after enrollment and each bar reflects the difference in earnings between white native-born and the group identified on the x-axis. As indicated by the legend, the darkest bar shows the raw earnings gap while the other shaded bars reflect the earnings gap conditional on adding sets of covariates, including pre-college characteristics, college, major, and degree attainment (referred to as "attainment" adjusted in the figure); employment; and industry.[4] Appendix Figure A.1 displays unadjusted average earnings for each group.

Looking first at the raw earnings disparities, white native-born students (whose average annual earnings ten years after college entry equal $34,302) earn far more than their API, black, and Hispanic counterparts (both those who are immigrant and native-born). API immigrants have the lowest relative earnings; 10 years after school entry, they earn approximately 30 percent less than white native-born. Native-born also significantly out-earn immigrants, overall and within-race. In fact, the lower earnings of white immigrants relative to their white native-born counterparts renders the racial/ethnic earnings gaps larger among native-born than among immigrants.

Raw disparities in earnings are attenuated or amplified by conditioning on pre-enrollment characteristics, attainment, and employment outcomes. However, for most groups, earnings disparities are not entirely explained by these factors. The fully-adjusted earnings gaps shown in the bars furthest to the right for each group reveal substantially higher average earnings for native-born whites relative to all other groups except white immigrants. The largest disparity is between white native-born and black native-born, where black native-born earn over $9,000 less on average than their observationally-equivalent white counterparts 10 years after college entry. In fact, the unadjusted gap between native-born black and white students is essentially the same as the adjusted gap. Taken together, these results reveal that the earnings disparities among students in the CUNY System resemble those reported at the national level with large racial and

[4] All pre-enrollment characteristics are measured at the beginning of the first semester of college including high school GPA, high school type (NYC public, GED, or other), disability, a quadratic in age, gender, single parent status, any employment in the three years prior to entry, and average annual earnings in the three years prior to college entry. Attainment measures include initial major and degree, cumulative credits earned, bachelor's degree receipt, and associate degree receipt. Industry is measured using 3-digit NAICS codes for the primary job (that which produced the highest annual earnings for individuals with more than one employer during the year). Point estimates and standard errors for raw and adjusted earnings gaps are displayed in Appendix Table A.1

nativity gaps that cannot be explained entirely by pre-enrollment traits, success in college, employment, or industry.

4 Empirical Framework

We estimate the effect of network shares using a generalized differences-in-differences approach:

$$Y_{iscm} = \beta CCM_{iscm} + \boldsymbol{\gamma}\mathbf{X_i} + \delta_{sc} + \delta_{cm} + \delta_{sm} + \epsilon_{iscm} \tag{1}$$

In equation (1), Y_{iscm} is the earnings for student i who initially entered college s as a member of entry cohort c and major m. CCM_{isc} represents the share of classmates in student i's cohort-college-major that are of the same race and nativity. $\mathbf{X_i}$ is a vector of student covariates measured in the first semester of college, including high school GPA, high school type (NYC public, GED, or other), disability, a quadratic in age, gender, race/ethnicity by nativity, single parent status, any employment in the three years prior to entry, and average earnings in the three years prior to college entry. We include college by entry cohort, entry cohort by major, and college by major fixed effects, δ_{sc}, δ_{cm}, δ_{sm}, respectively. Finally, under the identifying assumption that CCM_{isc} and ϵ_{iscm} are uncorrelated, ϵ_{iscm} represents a random error component. We also estimate impacts of same-group peers on on employment and degree completion to determine whether same-group peers might operate on earnings through these outcomes. For all estimations, standard errors are clustered at the college by entry cohort by major level.

4.1 Identifying Variation

The precision of our estimates depends upon a sufficient amount of within college major variation in same-race/same nativity shares across cohorts. To that end, Panel A of Table 2 presents the total (across and within college/major) variation in network shares for all eight groups; and Panel B presents the within college-major variation. The distribution shown in Panel B is calculated from the residuals of a regression of network share on college by entry cohort, entry cohort by major, and college by major. Panel B shows substantial variation in the proportion of same-race, same-nativity shares across cohorts within college-majors. Among black native-born, for instance, the average across-cohort, within-college major change in the share black native-born ranges from a roughly 25 percentage-point decrease to a 17 percentage-point increase. The within college-major standard deviations for each group range from 1 percentage-point (API native-born) to 3 percentage-points (black native-born).

4.2 Testing identifying assumptions

Our main identifying assumption is that variation in network shares across cohorts within college-majors is uncorrelated with variation in student attributes that affect labor market outcomes. For instance, if students with high levels of ambition select into college-majors that experience an increase in the share black native-born, then our estimated effect of black native-born peers will be upwardly biased. To test this assumption, we first estimate separate regressions of each pre-enrollment characteristic as a function of same-race/same nativity shares as well as college by major, college by cohort, entry cohort, and major fixed effects. Panel A of Table 3 reports the parameter estimates and standard errors from these regressions. The point estimates are extremely small and most are statistically insignificant. For instance, even if we were to choose one of the largest coefficients (0.0003 on proportion native-born API), this result indicates that a ten percentage-point increase in the share of students that are single parents is associated with a 0.00003 percentage-point increase in the share of classmates that are native-born API .

We further test our assumption by exploring correlations with predicted earnings. Specifically, we use all of the pre-enrollment characteristics in Panel A to predict earnings 5 years after college entry. Appendix Table A.2 contains these estimates. We then estimate a regression of the proportion same race/same nativity on the predicted earnings from this regression along with college by major, college by cohort, cohort, and major fixed effects. The point estimates and standard errors on predicted earnings are reported in Panel B and can be thought of as the degree to which students sort into CCMs (college, cohort, major) based on their earnings potential. All of the estimates are near-zero and all but one are statistically insignificant, which provides further evidence that our estimates are not biased by endogenous sorting of students into CCMs (either based on pre-enrollment attributes or earnings potential).

5 The Effect of College Networks

5.1 Effect of Network Shares on Annual Earnings

Figure 3 displays the results of estimation of equation (1) for each of the four native-born racial/ethnic groups where all estimates have been scaled to capture the effect of a 10 percentage-point increase in network share (roughly 10 more students given the mean CCM size of 92) on annual earnings (Table 4 contains corresponding point estimates and standard errors). Each marker represents the estimated effect at the number of years past college entry specified on the x-axis; the dashed lines represent 95 percent confidence intervals. Confidence intervals increase with years since entry because we do not observe labor market outcomes for all cohorts up to 10 years post entry.

Point estimates suggest positive effects of same-race peers on black, white, and possibly API native-born students, although estimates for the latter group are no longer significant at the 5 percent level more than 6 year after entry due to the small number of native-born API students. To quantify these effects, a 10 percentage-point increase in the black native-born share within a student's college, cohort, and major leads to an approximate $300 increase in a black native born student's annual earnings five years after college entry. By year 10, the boost in earnings equals $597, which translates to a 2 percent increase in earnings relative to the group mean of $25,299 (see Appendix Figure A.1 for average earnings for each group). For white native-born, the estimated effect of a 10 percentage-point increase in white native-born cohortmates on earnings 10 years post entry is approximately $615 (1.8 percent). A different picture emerges for Hispanic native-born where the estimated effects are negative up to 6 years after entry, albeit small in magnitude and statistically insignificant. Ten years after entry, 95 confidence intervals exclude effects larger in magnitude than a $500 increase or decrease in annual earnings from a 10 percentage point increase in same-group cohortmates. Estimates for API native-born are largely positive but also imprecise in later years.

Figure 4 displays the results for immigrants where the magnitudes differ from those of native-born students, but the general patterns are relatively similar. Again, we observe large positive network effects for blacks that begin almost immediately upon entry and grow over time. In fact, the benefits to sharing networks with other black immigrants are significantly larger than those for black native-born in most time periods (see bottom panel of Table 4, where p-values from tests for equality between black immigrant and black native-born show that most differences between parameter estimates for black students by nativity are statistically significant with $p < 0.001$). An increase of just 10 other black immigrants within a CCM leads to a $1,985 (8.2 percent) increase in annual earnings for black immigrants 10 years after college entry. We also observe large positive effects on white immigrants starting four years after college entry, though none of the point estimates are significantly different from zero at the 5 percent level. Impacts of same-group peers for API immigrants are small and near zero. Finally, like their native-born counterparts, Hispanic immigrant earnings are negatively affected by increases in Hispanic immigrant cohortmates in the first 5 years after entry, with significant and negative effects in the first three years, and remain small and close to zero for the duration of years we observe student outcomes.

In sum, for both natives and immigrants, there appears to be earnings benefits to same-group peers among white and black (particularly immigrant) students, and possibly Asian native-born. In contrast, we observe negative effects among Hispanic immigrants (and possibly Hispanic native-born) early in their schooling.

5.2 Mechanisms: Employment and Education

The effects of same group peers on earnings could operate through career advice, job search, and referrals consistent with the networking literature described in Section 2. Yet peers can also influence the level of effort that students put into completing their degrees. In this section, we aim to unpack the total effect of peers on earnings by exploring whether same-group peers influence students' probability of being employed and their probability of degree completion. Figure 5, Figure 6, and Table 5 present estimates from estimation of equation (1) on the probability of employment.

Across both figures, there are roughly three types of results. The first relate to the three groups that experience clear employment gains from an increase in same-group cohortmates, including white native-born, black immigrants, and Hispanic immigrants. Among black immigrants, for instance, a 10 percentage-point increase in same-group cohortmates leads to a 2.3 percentage point increase in the probability of being employed 10 years after college entry. All three of these groups also experience earnings gains, suggesting that boosts in employment are partial mechanisms. The second category of results pertain to the four groups for whom the point estimates are largely positive but the interval estimates are imprecise and zero effects cannot be ruled out; these four groups are API native-born, API immigrant, black native-born, and white immigrant.

The final category of results belong to one group for whom networking with same group cohortmates has a negative impact on employment: among native-born Hispanics, the point estimates are consistently negative, and statistically significant between years 3 and 6. The differences between Hispanic native-born and Hispanic immigrants are striking and tell two very different stories. Both groups experience modest negative to zero effects from same-group peers. For Hispanic native-born, this effect may be partially driven by a reduction in employment (for instance, Hispanic native-born do not provide employment opportunities or referrals to their cohortmates). Hispanic immigrants who network with other Hispanic immigrants, in contrast, experience large employment gains suggesting that the negative earnings effects are partially driven by referrals to low-paying jobs and/or poor career advice.

Turning to degree completion, we find largely positive point estimates of same-group peers on all native-born students' outcomes, with 95 percent confidence intervals that also include zero and negative effects as the time since college entry increases (Figure 7and Table 6). For whites, the effects are statistically different from zero only in the early years. Among immigrants (see Figure 8), the estimates for black and API students small are insignificant at the 5 percent level at every period. Yet for white and Hispanic immigrants, the effects of same-group peers on degree completion are primarily negative, with statistically significant impacts

on Hispanic students' degree completion in almost every year since college entry.[5] This finding, paired with the positive effects of same-group peers on employment, is consistent with the hypothesis that Hispanic immigrants networks may reduce earnings by encouraging students substitute away from college in favor of lower paying jobs.

6 Conclusions

Our investigation into the labor market impact of networking with peers who are of the same race and nativity status reveal a great deal of heterogeneity. Consistent with the previous literature on networking in predominantly white institutions, white native-born experience earnings and employment gains to networking with other white native-born (e.g, Marmaros and Sacerdote 2002). Black native-born and particularly black immigrants also benefit from their same group peers. In fact, the magnitude of the benefit is the same between white native-born and black native-born and much larger for black immigrants. The fact that black native-born experience employment gains from networking with other black native-born is consistent with the literature on neighborhood-based networks (Hellerstein, McInerney and Neumark 2011), yet we also document earnings gains as a result of these employment gains and network effects that are much larger among black immigrants than among black native-born. We find no evidence that the labor market benefits of same-group peers are partially driven by increased academic effort.

Among Hispanics, however, peer effects operate quite differently than they do among the other racial/ethnic groups and by nativity status. Neither Hispanic immigrants nor native-born experience earnings gains as a result of networking with same-group peers; indeed most of our estimates suggests negative effects on earnings for Hispanic immigrants. Yet the effect of same group peers on the employment of Hispanic immigrants is large and positive, while the effect on their degree attainment is negative, suggesting that Hispanic immigrants may encourage their peers to enter the labor force quickly, which may take time away from schooling and lead to lower earnings (because they take lower-paying jobs and/or do not finish their degrees). Hispanic native-born reduce their employment as a result of networking with other Hispanic native-born (with no effect on degree completion), suggesting that Hispanic native-born provide limited referrals and job information to their cohortmates.

Our findings suggest that the earnings gaps that are currently observed between white native-born and black native-born are unlikely to be explained by differences in networks and that black immigrant earnings would be lower in settings with fewer same-group peers. For Hispanics, however, the current earnings gaps could be partially explained by poor networking. At a minimum, our results suggest that postsecondary

[5] We also estimate the effects of same group peers on credit accumulation; results are largely consistent with degree completion estimates (Appendix Table A.3).

institutions that encourage networking among students might also do more to ensure that students have up-to-date and accurate information about the potential earnings of their respective job opportunities and that information be delivered through structured or formal career counseling. Hurwitz and Smith (2016) show that the release of median earnings data through the U.S. Department of Education's College Scorecard affected college application decisions of students at the higher end of SAT scores from well-resourced high schools, but had no impact on educationally-disadvantaged and less well-performing students. Students who are well prepared for college are best positioned to access information and to act on that information; lower performing students need more structure and formal assistance in accessing and using information such as wage data. For Hispanic students, for instance, relying more on labor market information provided through career services offices and less on networks might lead to greater earnings gains.

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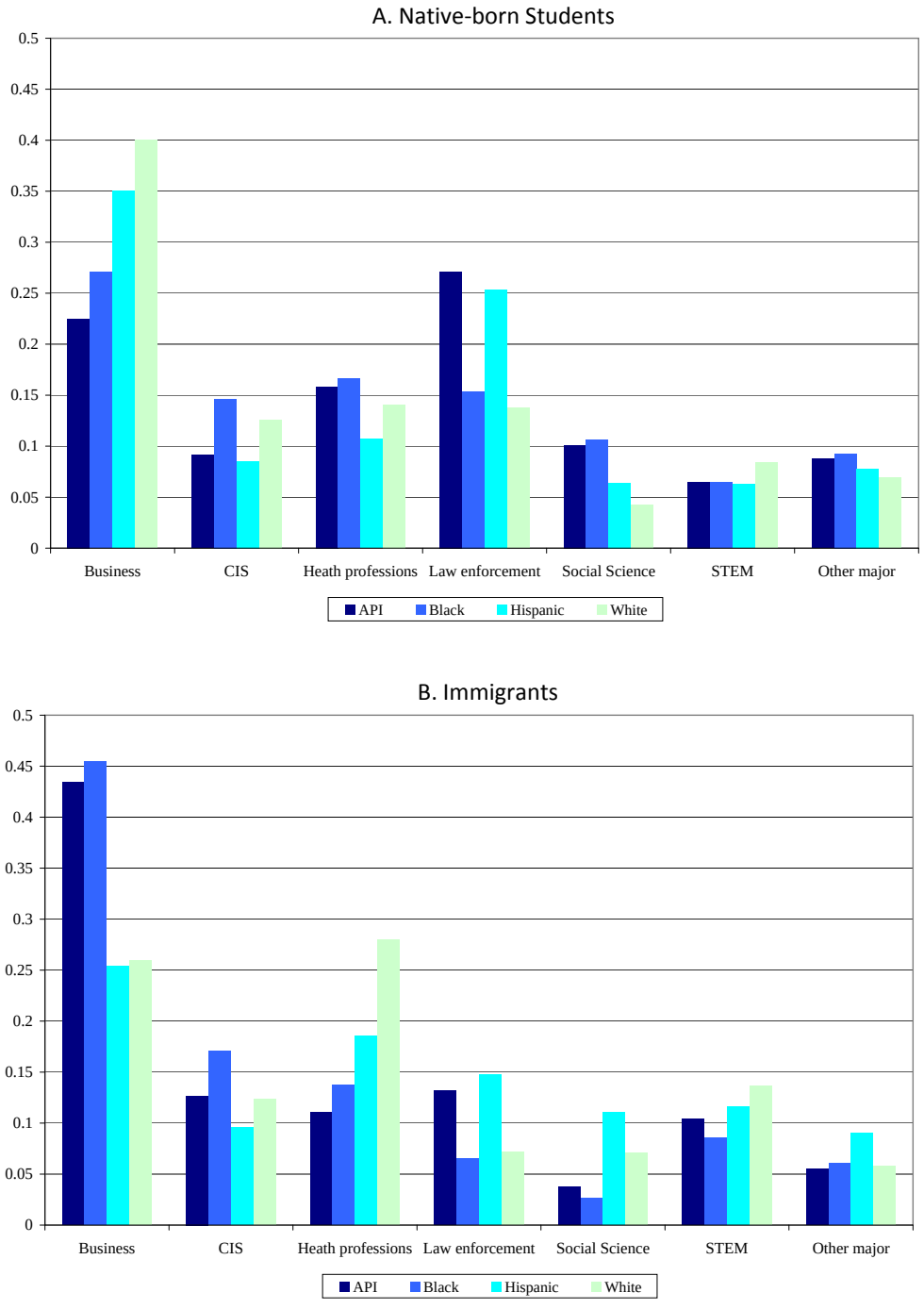
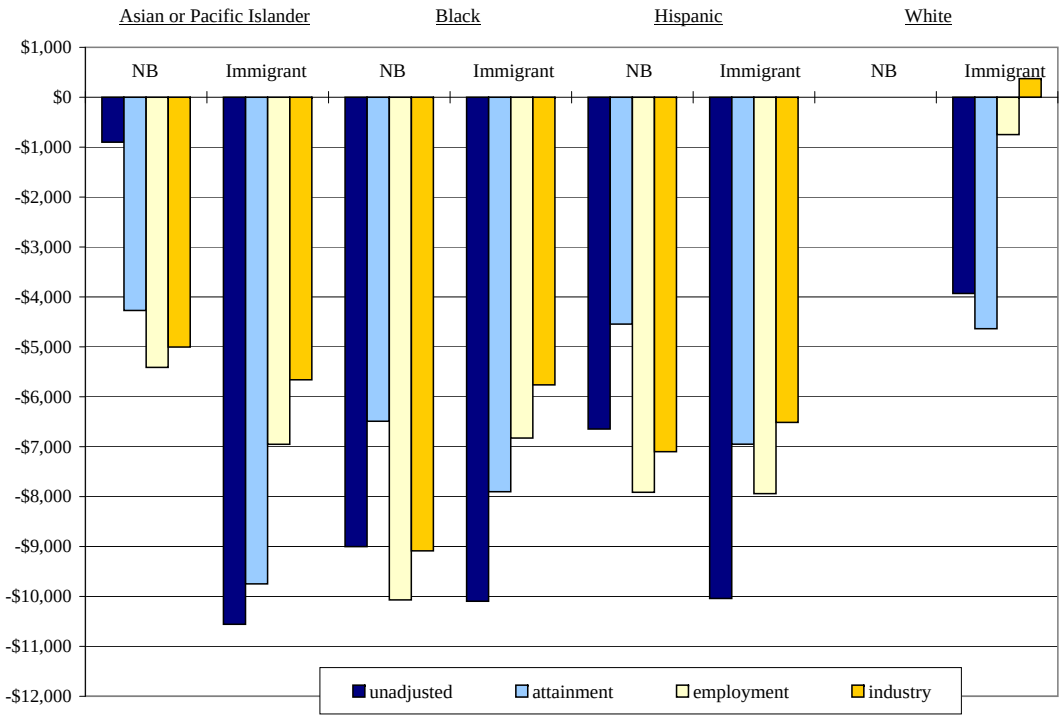
Figures and Tables

Figure 1: Major by Race/ethnicity and Nativity



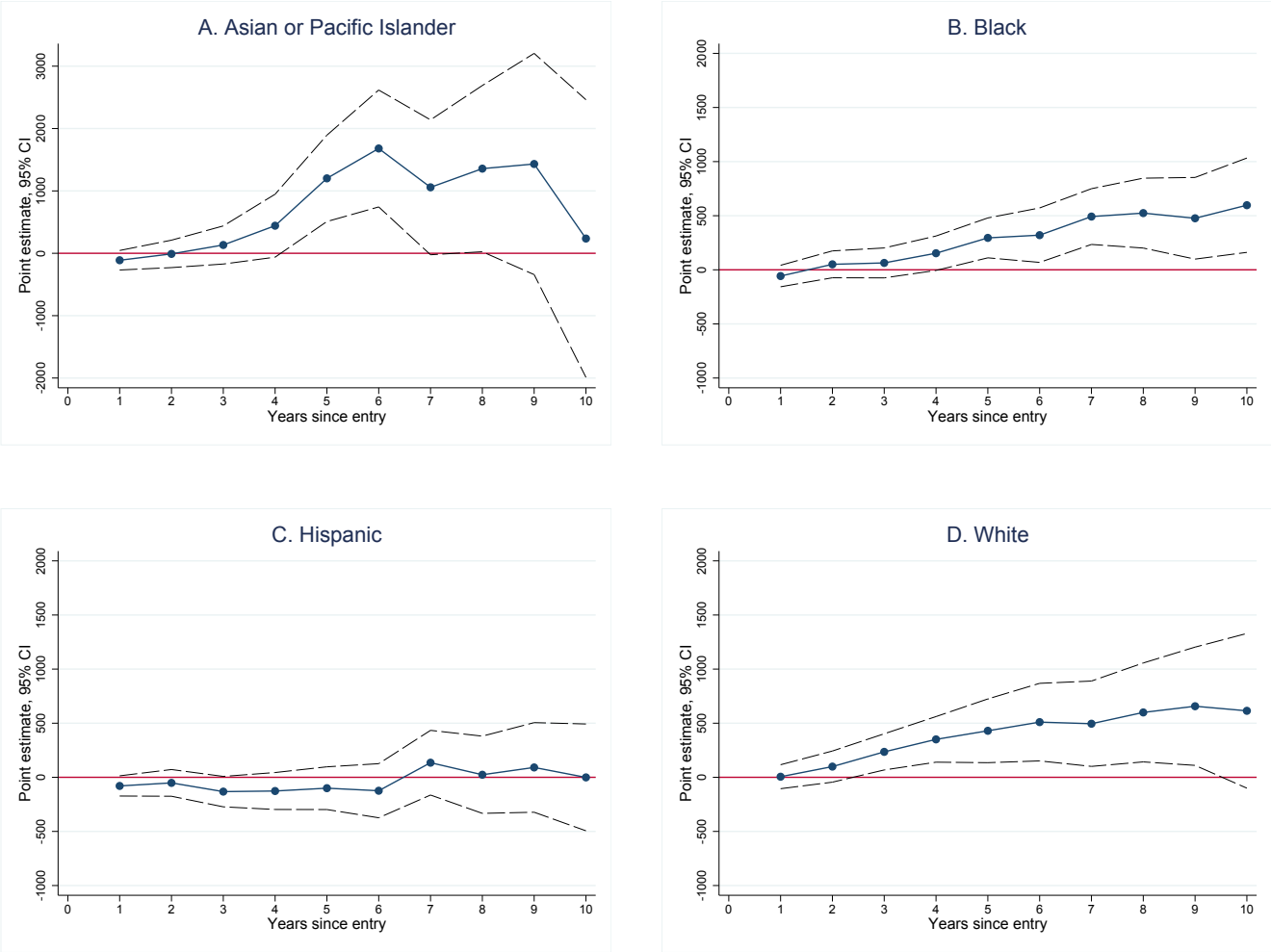
Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2011. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded. Business majors include business, management, marketing, and related support services programs. CIS majors include computer and information sciences and support services programs. Health majors include health professions and related programs. Law enforcement includes homeland security, law enforcement, firefighting and related protective services programs. STEM majors include biological and biomedical sciences, engineering, engineering technologies, and physical science programs.

Figure 2: Raw and Adjusted Earnings Gap 10 Years After Entry (Relative to White Native-born)



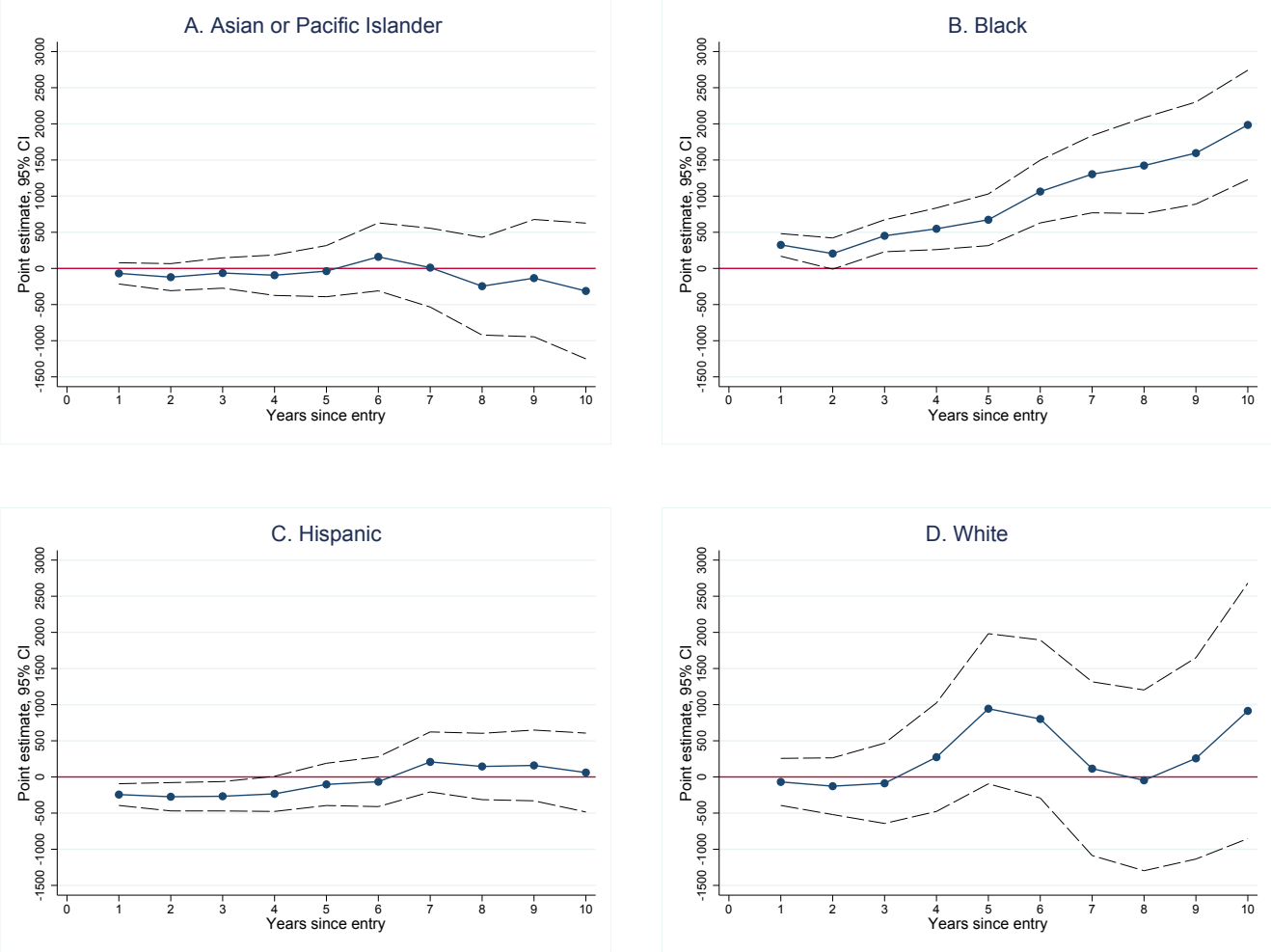
Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2011. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure 3: Estimated Effects of Network Share on Earnings: Native-born Students



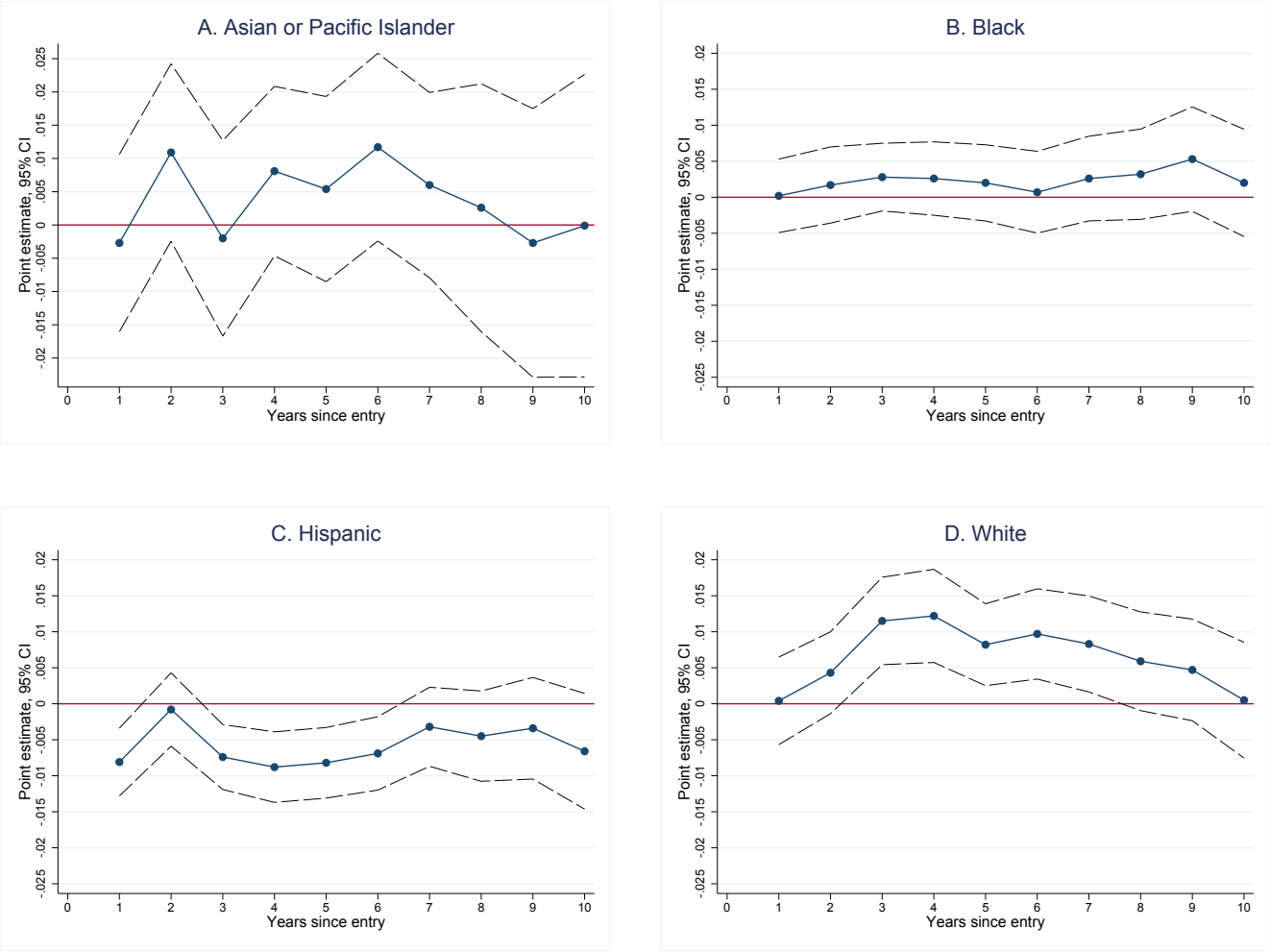
Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008 and were born in the U.S. or U.S. territories. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure 4: Estimated Effects of Network Share on Earnings: Immigrant Students



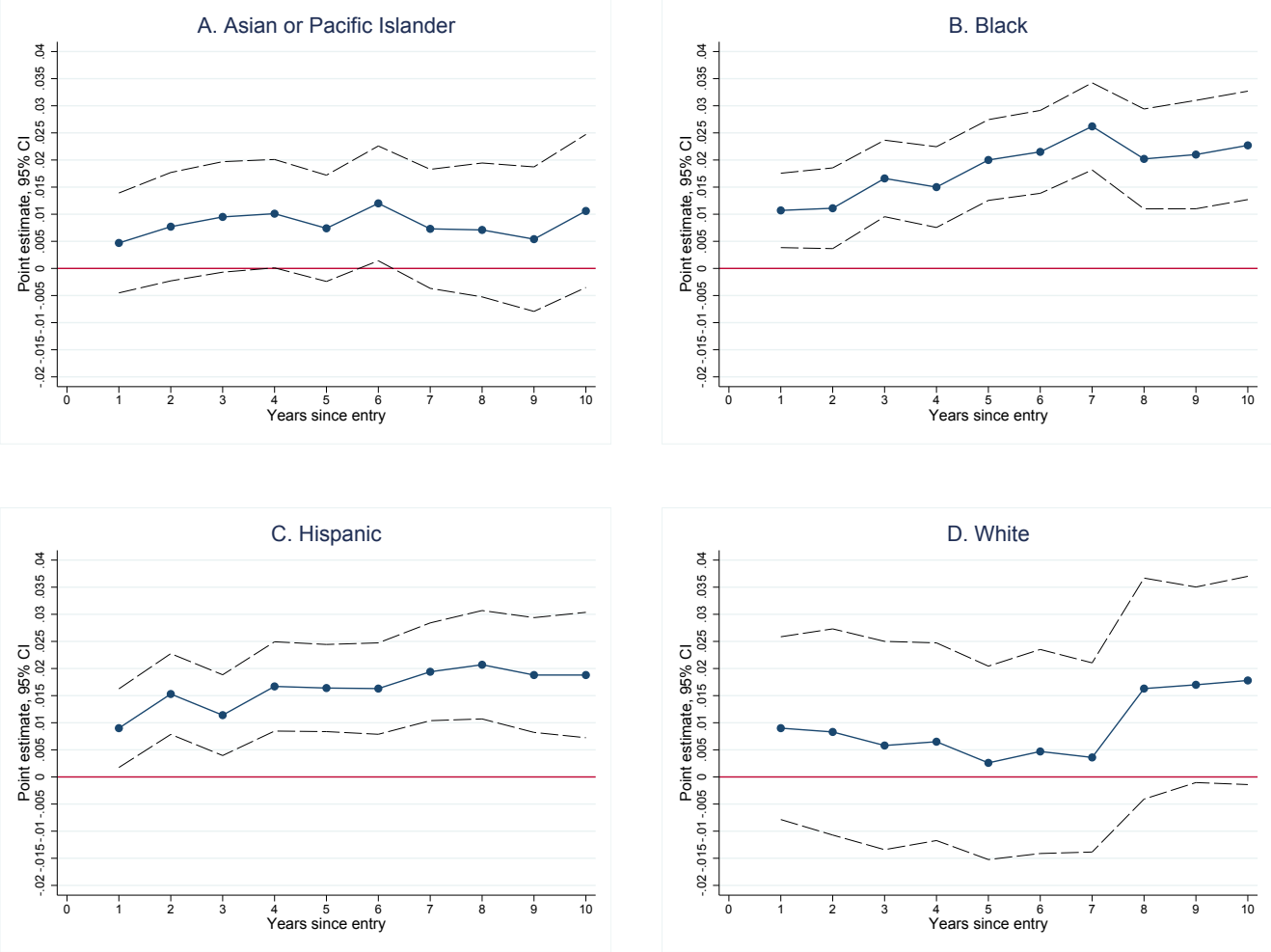
Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008 who were born outside of the U.S.. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure 5: Estimated Effects of Network Share on Employment: Native-born Students



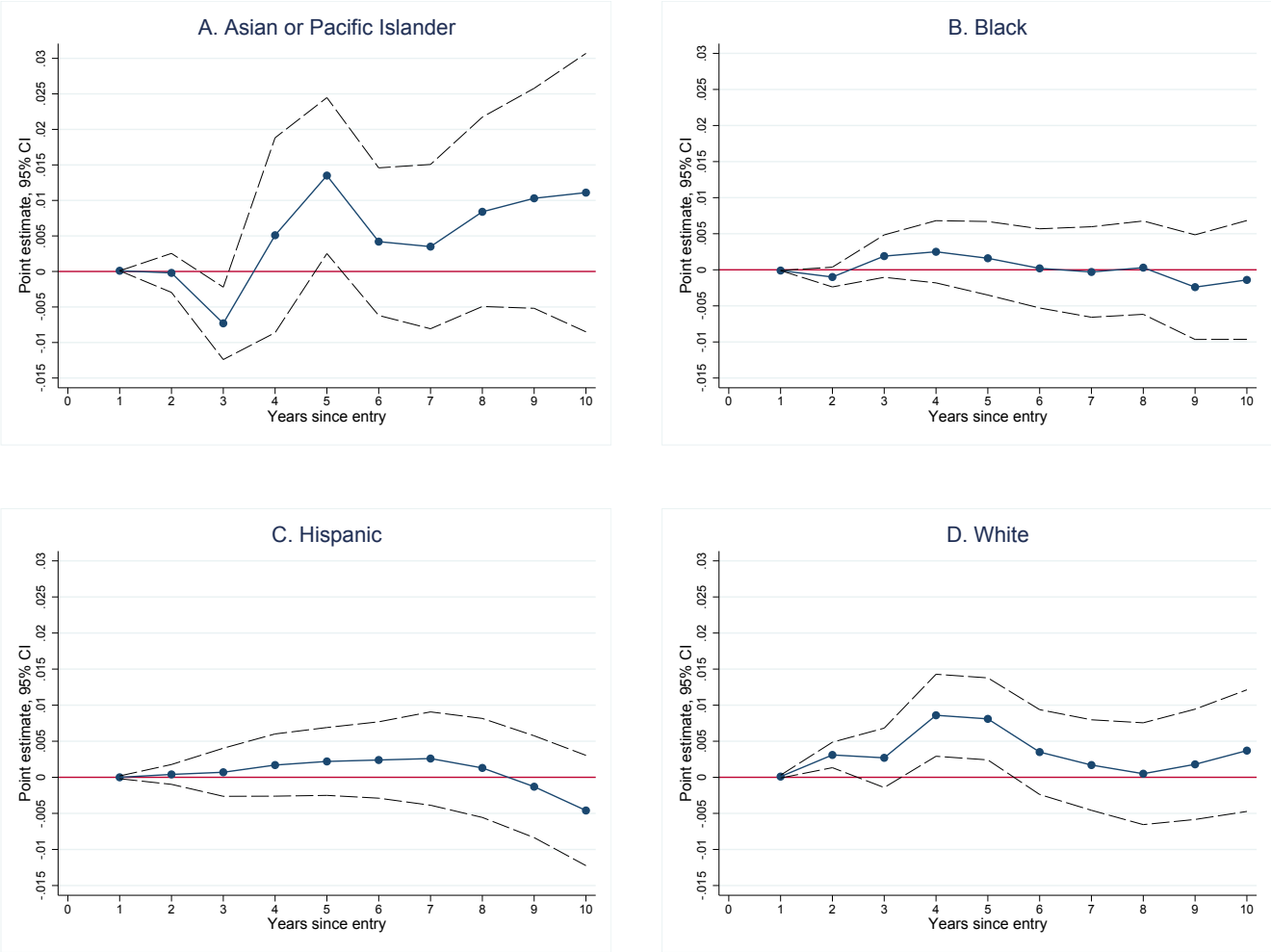
Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008 and were born in the U.S. or U.S. territories. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure 6: Estimated Effects of Network Share on Employment: Immigrant Students



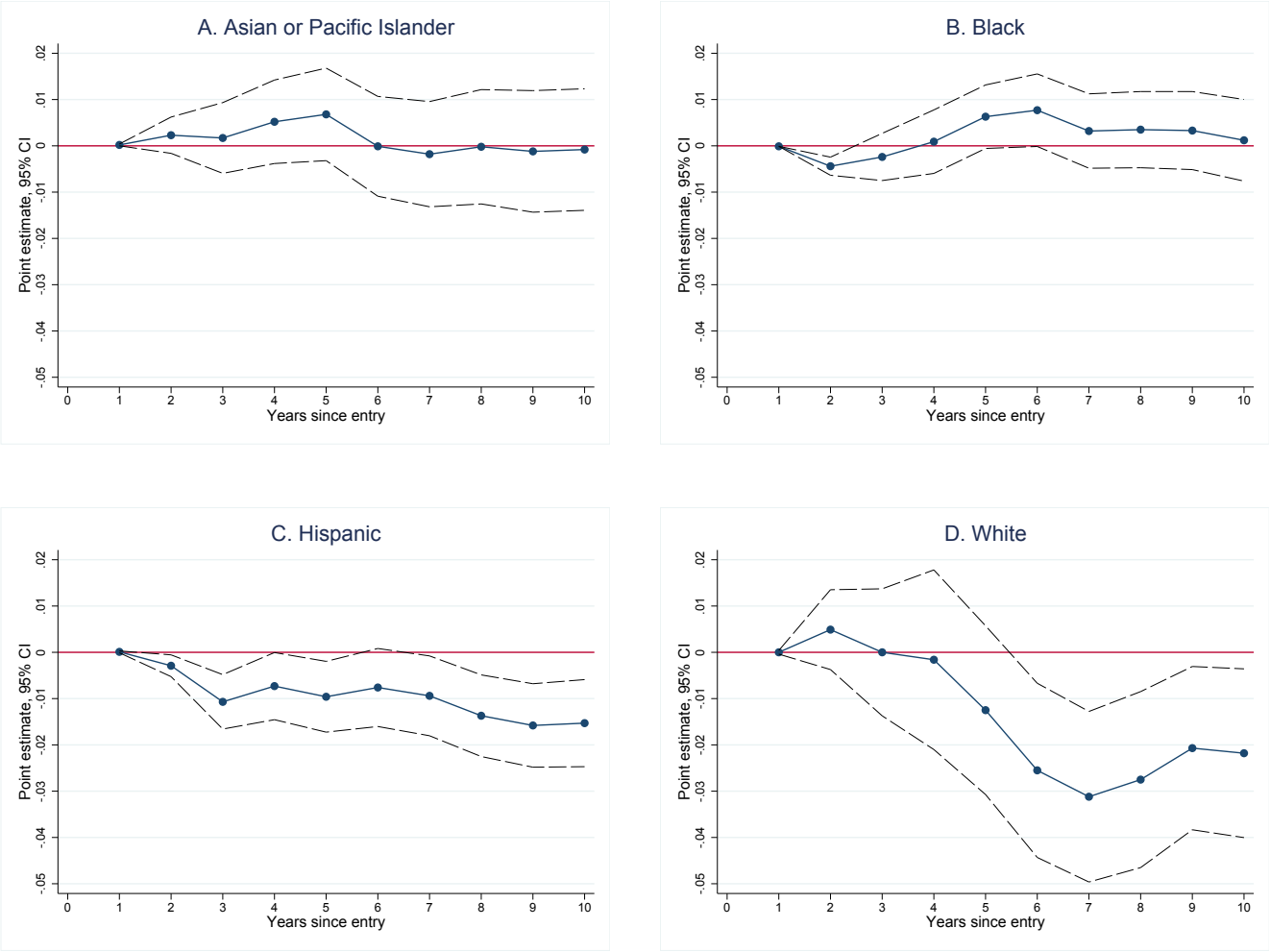
Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008 who were born outside of the U.S.. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure 7: Estimated Effects of Network Share on Degree Receipt: Native-born Students



Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008 and were born in the U.S. or U.S. territories. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure 8: Estimated Effects of Network Share on Degree Receipt: Immigrant Students



Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008 who were born outside of the U.S.. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Table 1: Sample Characteristics

	Full sample	Native-born				Immigrant			
		API	Black	Hispanic	White	API	Black	Hispanic	White
Number of students	145,310	8,305	31,652	34,683	18,693	13,896	15,381	14,068	8,632
Share of sample		0.06	0.22	0.24	0.13	0.10	0.11	0.10	0.06
Number of CCM cells	1,450	1,122	1,438	1,440	1,271	1,261	1,374	1,350	1,193
Demographic characteristics									
Age	20.2	19.0	19.9	19.5	19.3	20.6	22.4	20.9	20.9
	(4.1)	(2.4)	(4)	(3.1)	(3.3)	(3.8)	(6.1)	(4.7.0)	(4.7)
Female	0.53	0.41	0.57	0.56	0.42	0.47	0.60	0.59	0.49
Single parent	0.06	0.03	0.07	0.07	0.02	0.06	0.09	0.09	0.05
Disabled	0.02	0.02	0.03	0.03	0.05	0.01	0.01	0.01	0.01
Academic/labor market chars at entry									
NYC public high school graduate[i]	0.57	0.67	0.61	0.63	0.42	0.58	0.47	0.61	0.51
GED recipient[i]	0.09	0.07	0.09	0.08	0.07	0.05	0.14	0.10	0.07
High school GPA (0-100)[ii]	76	78	73	75	77	79	74	76	79
	(7)	(8)	(6)	(7)	(7)	(8)	(7)	(7)	(8)
Missing high school GPA	0.17	0.12	0.21	0.15	0.13	0.14	0.22	0.19	0.13
Earnings in year prior to entry	2,484	1,189	2,771	2,353	2,528	1,299	3,792	2,752	2,246
	(7691)	(5126)	(8436)	(6737)	(9043)	(4963)	(9367)	(7484)	(7435)
Any earnings in year prior to entry	0.43	0.33	0.50	0.47	0.47	0.26	0.43	0.42	0.35
Bachelor's degree program	0.18	0.36	0.13	0.17	0.28	0.21	0.10	0.11	0.22

*Note*s: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2008. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, Lehman, City, or Brooklyn Colleges are excluded. Standard deviation of continuous variables displayed below means in parentheses. i) Type of high school only for students with nonmissing data (N = 93,844). ii) High school GPA average only applies to students with nonmissing data (N = 89,416).

Table 2: Variation in Network Shares Overall and Within Cohort-College-Major

	Proportion in network			
	Mean	SD	Min	Max
Panel A: Total Variation				
All students	0.217	0.134	0	0.741
API native-born	0.107	0.091	0	0.385
Black native-born	0.267	0.125	0	0.741
Hispanic native-born	0.289	0.115	0	0.700
White native-born	0.228	0.149	0	0.725
API immigrant	0.157	0.096	0	0.484
Black immigrant	0.175	0.116	0	0.583
Hispanic immigrant	0.157	0.119	0	0.632
White immigrant	0.091	0.061	0	0.360
Panel B: Variation after College by Cohort, College by Major, and Cohort by Major FE				
All students	0	0.119	-0.54	0.318
API native-born	0	0.011	-0.125	0.066
Black native-born	0	0.028	-0.246	0.165
Hispanic native-born	0	0.025	-0.336	0.167
White native-born	0	0.017	-0.282	0.099
API immigrant	0	0.020	-0.178	0.088
Black immigrant	0	0.021	-0.173	0.092
Hispanic immigrant	0	0.026	-0.379	0.111
White immigrant	0	0.015	-0.141	0.052

*Note*s: For sample, see Table 1 notes. Panel A provides the distribution in network proportion where network is calculated as the proportion in the same racial/ethnic and nativity group. Panel B provides the distribution in residuals from regressions of network proportion on college, major, and cohort fixed effects.

Table 3: Correlations between Network Share and Predetermined Student Characteristics

Dep var: proportion in network	Native-born				Immigrant			
	API	Black	Hispanic	White	API	Black	Hispanic	White
A. Individual characteristics								
Age	-0.0001	0.0002	-0.0002	0.0001	0.0002	0.00002	-0.0001	-0.00005
	(0.0001)	(0.0001)	(0.0001)+	(0.0001)	(0.0001)*	(0.0001)	(0.0001)	(0.0001)
Age^2	0.000001	-0.000004	0.000004	-0.000002	-0.000003	0.0000002	0.000004	0.000001
	(0.000001)	(0.000003)	(0.000002)	(0.000002)	(0.000002)+	(0.000002)	(0.000002)+	(0.000001)
Female	-0.00004	0.0001	0.0001	-0.0004	0.0001	0.00001	0.00004	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)**	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Single parent	0.0003	0.0002	-0.001	0.0004	-0.0002	0.0003	-0.0003	0.0001
	(0.0001)**	(0.0003)	(0.0003)**	(0.0002)*	(0.0002)	(0.0002)	(0.0002)	(0.0001)
Disabled	-0.001	-0.0004	-0.001	0.001	0.00003	0.001	-0.00003	0.0003
	(0.0002)**	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0003)*	(0.0003)	(0.0002)
GED recipient	0.0001	0.0001	0.0002	0.00004	-0.0003	0.0001	-0.0002	-0.0001
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)**	(0.0001)	(0.0001)	(0.0001)+
NYC public hs graduate	0.0001	0.001	0.0003	-0.00002	-0.001	0.0001	-0.0002	-0.0001
	(0.0001)	(0.0003)*	(0.0003)	(0.0002)	(0.0002)**	(0.0002)	(0.0003)	(0.0002)
Nonmissing high school GPA	-0.00002	-0.002	0.002	-0.001	-0.001	0.001	-0.0001	0.0004
	(0.0004)	(0.001)	(0.001)*	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
× High school GPA (0-100)	0.0000002	0.00001	-0.00003	0.00001	0.00002	-0.00001	-0.000001	-0.000001
	(0.00001)	(0.00001)	(0.00001)**	(0.00001)	(0.00001)*	(0.00001)	(0.00001)	(0.00001)
Any pre-college earnings	-0.0001	0.0001	-0.00002	0.0003	0.00003	-0.0003	-0.00002	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)**	(0.0001)	(0.0001)**	(0.0001)	(0.0001)
Pre-college earnings	0.00003	-0.0001	0.0001	-0.0001	-0.0001	0.00003	0.0001	0.00001
(three year average, $10K)	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.00005)
B. Linear prediction of t+5 earnings								
Predicted earnings ($10K)	-0.00003	-0.00004	-0.00003	0.00004	-0.00004	-0.00001	0.0002	-0.0001
	(0.00005)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)*	(0.0001)
Test of significance (*p*-value)	0.511	0.740	0.784	0.596	0.616	0.888	0.043	0.257
Observations	145,310	145,310	145,310	145,310	145,310	145,310	145,310	145,310

Notes: For sample, see Table 1 notes. Panel A provides estimates from a regression of proportion of classmates in the specified race-nativity category on the specified characteristic from a model that also includes school by major, school by entry cohort, and entry cohort by major fixed effects. Panel B includes estimates from a regression of the proportion in the specified race-nativity category on a linear prediction of earnings five years after entry based on the characteristics shown in Panel A (see Appendix Table A.2 for coefficients) from a model that also includes school by major, school by entry cohort, and entry cohort by major fixed effects. Robust standard errors, clustered at the college-entry-cohort-major level in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table 4: Effect of Network Share on Annual Earnings by Race/ethnicity and Nativity

Years since entry:	1	2	3	4	5	6	7	8	9	10
Proportion in network ×										
API, native-born	-1,114	-96	1,332	4,422	12,014	16,804	10,577	13,574	14,318	2,363
	(798)	(1,122)	(1,558)	(2,574)+	(3,531)**	(4,780)**	(5,517)+	(6,800)*	(9,048)	(11,355)
Black, native-born	-575	507	637	1,533	2,952	3,203	4,920	5,241	4,763	5,971
	(507)	(633)	(706)	(811)+	(940)**	(1,283)*	(1,314)**	(1,648)**	(1,925)*	(2,224)**
Hispanic, native-born	-796	-514	-1,322	-1,265	-1,004	-1,240	1,351	238	913	-7
	(476)+	(630)	(717)+	(871)	(1,007)	(1,275)	(1,525)	(1,820)	(2,112)	(2,518)
White, native-born	55	991	2,352	3,506	4,298	5,100	4,952	5,995	6,568	6,145
	(565)	(734)	(853)**	(1,075)**	(1,503)**	(1,828)**	(2,012)*	(2,332)*	(2,788)*	(3,647)+
	[0.599]	[0.470]	[0.019]	[0.006]	[0.001]	[0.001]	[0.205]	[0.086]	[0.263]	[0.253]
API, immigrant	-681	-1,207	-631	-938	-374	1,600	113	-2,457	-1,340	-3,120
	(750)	(954)	(1,071)	(1,427)	(1,806)	(2,398)	(2,782)	(3,448)	(4,140)	(4,791)
Black, immigrant	3,252	2,057	4,517	5,483	6,730	10,636	13,039	14,231	15,957	19,851
	(797)**	(1,101)+	(1,126)**	(1,469)**	(1,824)**	(2,213)**	(2,727)**	(3,384)**	(3,601)**	(3,862)**
Hispanic, immigrant	-2,438	-2,738	-2,671	-2,338	-1,028	-658	2,079	1,450	1,593	611
	(767)**	(1,000)**	(1,036)*	(1,239)+	(1,492)	(1,757)	(2,119)	(2,342)	(2,496)	(2,784)
White, immigrant	-684	-1,277	-878	2,735	9,438	8,020	1,148	-466	2,571	9,139
	(1,661)	(2,002)	(2,832)	(3,829)	(5,298)+	(5,579)	(6,130)	(6,378)	(7,105)	(9,015)
	[<0.001]	[0.005]	[<0.001]	[<0.001]	[0.003]	[0.001]	[0.003]	[0.003]	[0.004]	[<0.001]
Tests of equality (*p*-values):										
API nb = API immigrant	0.663	0.399	0.247	0.053	0.001	0.004	0.083	0.030	0.097	0.633
Black nb = Black immigrant	<0.001	0.190	0.001	0.006	0.030	0.001	0.001	0.005	0.001	<0.001
Hispanic nb = Hispanic immigrant	0.067	0.062	0.291	0.476	0.989	0.789	0.780	0.682	0.839	0.868
White nb = White immigrant	0.676	0.292	0.275	0.846	0.350	0.612	0.546	0.327	0.590	0.753
Observations	145,310	145,310	145,310	145,310	145,310	130,789	115,473	101,900	89,021	77,019

*Note*s: For sample, see Table 1 notes. Each column contains estimates from separate regressions. Dependent variable is annual earnings reported to the New York State Department of Labor. In-network defined by race/ethnicity and nativity. See Table 5 notes for additional covariates included in all regressions. Robust standard errors, clustered at the college-entry-cohort-major level in parentheses; ** p<0.01, * p<0.05, + p<0.1. Within nativity, across-race *p*-values from a test of joint equality of coefficients in brackets.

Table 5: Effect of Network Share on Employment by Race/ethnicity and Nativity

Years since entry:	1	2	3	4	5	6	7	8	9	10
Proportion in network ×										
API, native-born	-0.027	0.109	-0.020	0.081	0.054	0.117	0.060	0.026	-0.027	-0.001
	(0.068)	(0.068)	(0.075)	(0.065)	(0.071)	(0.072)	(0.071)	(0.095)	(0.103)	(0.116)
Black, native-born	0.002	0.017	0.028	0.026	0.020	0.007	0.026	0.032	0.053	0.020
	(0.026)	(0.027)	(0.024)	(0.026)	(0.027)	(0.029)	(0.030)	(0.032)	(0.037)	(0.038)
Hispanic, native-born	-0.081	-0.008	-0.074	-0.088	-0.082	-0.069	-0.032	-0.045	-0.034	-0.066
	(0.024)**	(0.026)	(0.023)**	(0.025)**	(0.025)**	(0.026)**	(0.028)	(0.032)	(0.036)	(0.041)
White, native-born	0.004	0.043	0.115	0.122	0.082	0.097	0.083	0.059	0.047	0.005
	(0.031)	(0.029)	(0.031)**	(0.033)**	(0.029)**	(0.032)**	(0.034)*	(0.035)+	(0.036)	(0.041)
	[0.086]	[0.388]	[<0.001]	[<0.001]	[<0.001]	[0.001]	[0.084]	[0.166]	[0.267]	[0.458]
API, immigrant	0.047	0.077	0.095	0.101	0.074	0.120	0.073	0.071	0.054	0.106
	(0.047)	(0.051)	(0.052)+	(0.051)*	(0.050)	(0.054)*	(0.056)	(0.063)	(0.068)	(0.072)
Black, immigrant	0.107	0.111	0.166	0.150	0.200	0.215	0.262	0.202	0.210	0.227
	(0.035)**	(0.038)**	(0.036)**	(0.038)**	(0.038)**	(0.039)**	(0.041)**	(0.047)**	(0.051)**	(0.051)**
Hispanic, immigrant	0.090	0.153	0.114	0.167	0.164	0.163	0.194	0.207	0.188	0.188
	(0.037)*	(0.038)**	(0.038)**	(0.042)**	(0.041)**	(0.043)**	(0.046)**	(0.051)**	(0.054)**	(0.059)**
White, immigrant	0.090	0.083	0.058	0.065	0.026	0.047	0.036	0.163	0.170	0.178
	(0.086)	(0.097)	(0.098)	(0.093)	(0.091)	(0.096)	(0.089)	(0.104)	(0.092)+	(0.098)+
	[0.798]	[0.630]	[0.563]	[0.648]	[0.124]	[0.289]	[0.026]	[0.340]	[0.284]	[0.600]
Tests of equality (*p*-values):										
API nb = API immigrant	0.324	0.693	0.215	0.800	0.799	0.975	0.882	0.682	0.497	0.401
Black nb = Black immigrant	0.006	0.026	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.005	<0.001
Hispanic nb = Hispanic immigrant	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
White nb = White immigrant	0.345	0.687	0.576	0.554	0.554	0.616	0.610	0.329	0.195	0.089
Observations	145,310	145,310	145,310	145,310	145,310	130,789	115,473	101,900	89,021	77,019

*Note*s: For sample, see Table 1 notes. Each column contains estimates from separate regressions. Dependent variable is the probability of having any annual earnings reported to the New York State Department of Labor. In-network defined by race/ethnicity and nativity. All regressions include school by major fixed effects, school by entry cohort fixed effects, entry cohort by major fixed effects, race/ethnicity by nativity fixed effects, a quadratic in age at entry, high school GPA, average annual earnings in the three years prior to college entry, and indicators for gender, single parent, disabled, attending a New York City high school, GED recipient, nonmissing high school GPA, and any earnings from employment in the three years prior to college entry. Robust standard errors, clustered at the college-entry-cohort-major level in parentheses; ** p<0.01, * p<0.05, + p<0.1. Within nativity, across-race *p*-values from a test of joint equality of coefficients in brackets.

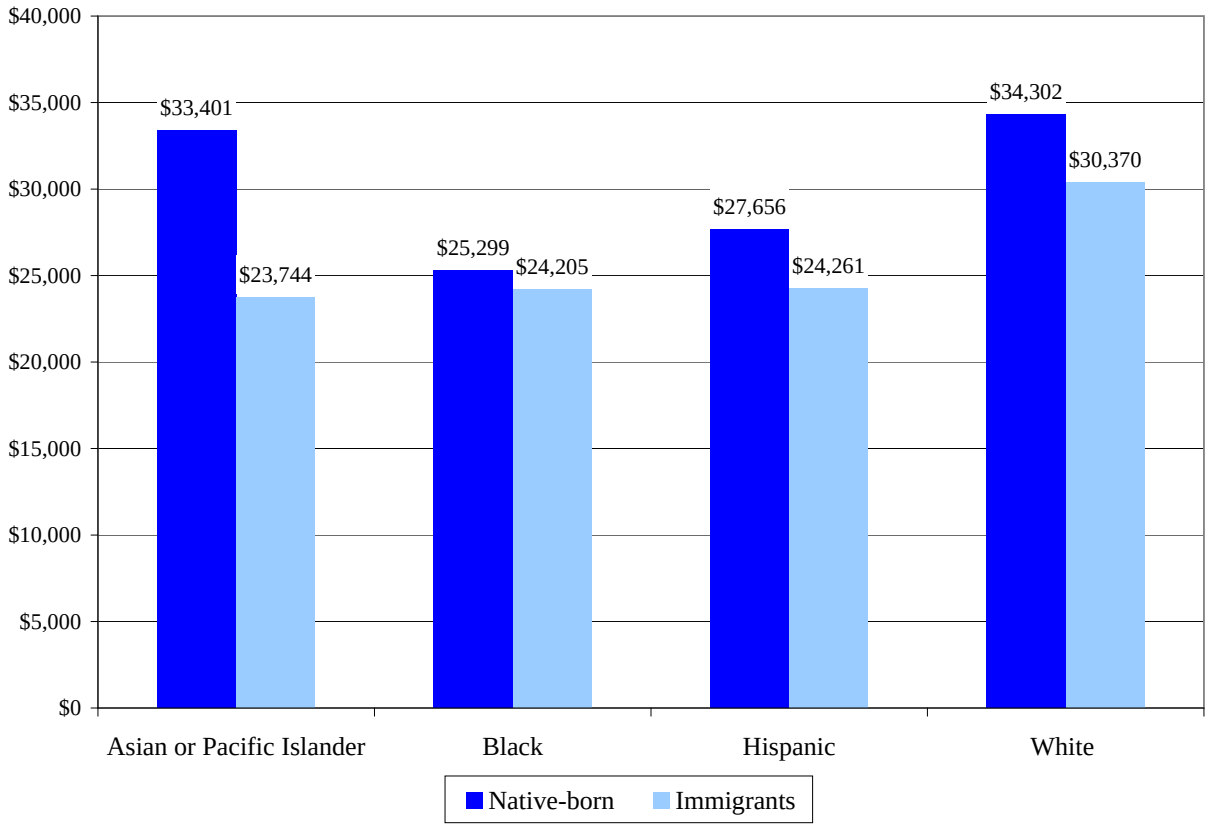
Table 6: Effect of Network Share on Degree Receipt by Race/ethnicity and Nativity

Years since entry:	1	2	3	4	5	6	7	8	9	10
Proportion in network ×										
API, native-born	0.001	-0.002	-0.073	0.051	0.135	0.042	0.035	0.084	0.103	0.111
	(0.000)*	(0.014)	(0.026)**	(0.070)	(0.056)*	(0.053)	(0.059)	(0.068)	(0.079)	(0.100)
Black, native-born	-0.001	-0.010	0.019	0.025	0.016	0.002	-0.003	0.003	-0.024	-0.014
	(0.000)	(0.007)	(0.015)	(0.022)	(0.026)	(0.028)	(0.032)	(0.033)	(0.037)	(0.042)
Hispanic, native-born	-0.000	0.004	0.007	0.017	0.022	0.024	0.026	0.013	-0.013	-0.046
	(0.001)	(0.007)	(0.017)	(0.022)	(0.024)	(0.027)	(0.033)	(0.035)	(0.036)	(0.039)
White, native-born	0.001	0.031	0.027	0.086	0.081	0.035	0.017	0.005	0.018	0.037
	(0.001)+	(0.009)**	(0.021)	(0.029)**	(0.029)**	(0.030)	(0.032)	(0.036)	(0.039)	(0.043)
	[0.110]	[0.006]	[0.016]	[0.273]	[0.103]	[0.840]	[0.902]	[0.747]	[0.479]	[0.360]
API, immigrant	0.002	0.023	0.017	0.052	0.068	-0.001	-0.018	-0.002	-0.012	-0.008
	(0.001)	(0.020)	(0.039)	(0.046)	(0.051)	(0.055)	(0.058)	(0.063)	(0.067)	(0.067)
Black, immigrant	-0.001	-0.044	-0.024	0.009	0.063	0.077	0.032	0.035	0.033	0.012
	(0.000)	(0.010)**	(0.026)	(0.035)	(0.035)+	(0.040)+	(0.041)	(0.042)	(0.043)	(0.045)
Hispanic, immigrant	0.001	-0.029	-0.107	-0.073	-0.096	-0.076	-0.094	-0.137	-0.158	-0.153
	(0.001)	(0.012)*	(0.030)**	(0.037)+	(0.039)*	(0.043)+	(0.044)*	(0.045)**	(0.046)**	(0.048)**
White, immigrant	-0.000	0.049	-0.000	-0.016	-0.125	-0.255	-0.312	-0.275	-0.207	-0.218
	(0.002)	(0.044)	(0.070)	(0.099)	(0.093)	(0.096)**	(0.094)**	(0.097)**	(0.090)*	(0.093)*
	[0.189]	[0.007]	[0.056]	[0.169]	[0.004]	[0.004]	[0.005]	[0.003]	[0.006]	[0.018]
Tests of equality (p-values):										
API nb = API immigrant	0.252	0.246	0.037	0.981	0.333	0.548	0.497	0.341	0.249	0.300
Black nb = Black immigrant	0.987	0.002	0.109	0.668	0.256	0.102	0.471	0.522	0.293	0.650
Hispanic nb = Hispanic immigrant	0.230	0.022	0.001	0.031	0.009	0.049	0.028	0.009	0.015	0.085
White nb = White immigrant	0.424	0.683	0.701	0.317	0.033	0.004	0.001	0.006	0.019	0.010
Observations	145,310	145,310	145,310	145,310	145,310	130,789	115,473	101,900	89,021	77,019

*Note*s: For sample, see Table 1 notes. Each column contains estimates from separate regressions. Dependent variable is the probability of receiving any degree from a CUNY institution. Students who have only taken remedial courses (which do not earn college credit) are excluded. In-network defined by race/ethnicity and nativity. See Table 5 notes for additional covariates included in all regressions. Robust standard errors, clustered at the college-entry-cohort-major level in parentheses; ** p<0.01, * p<0.05, + p<0.1. Within nativity, across-race p-values from a test of joint equality of coefficients in brackets.

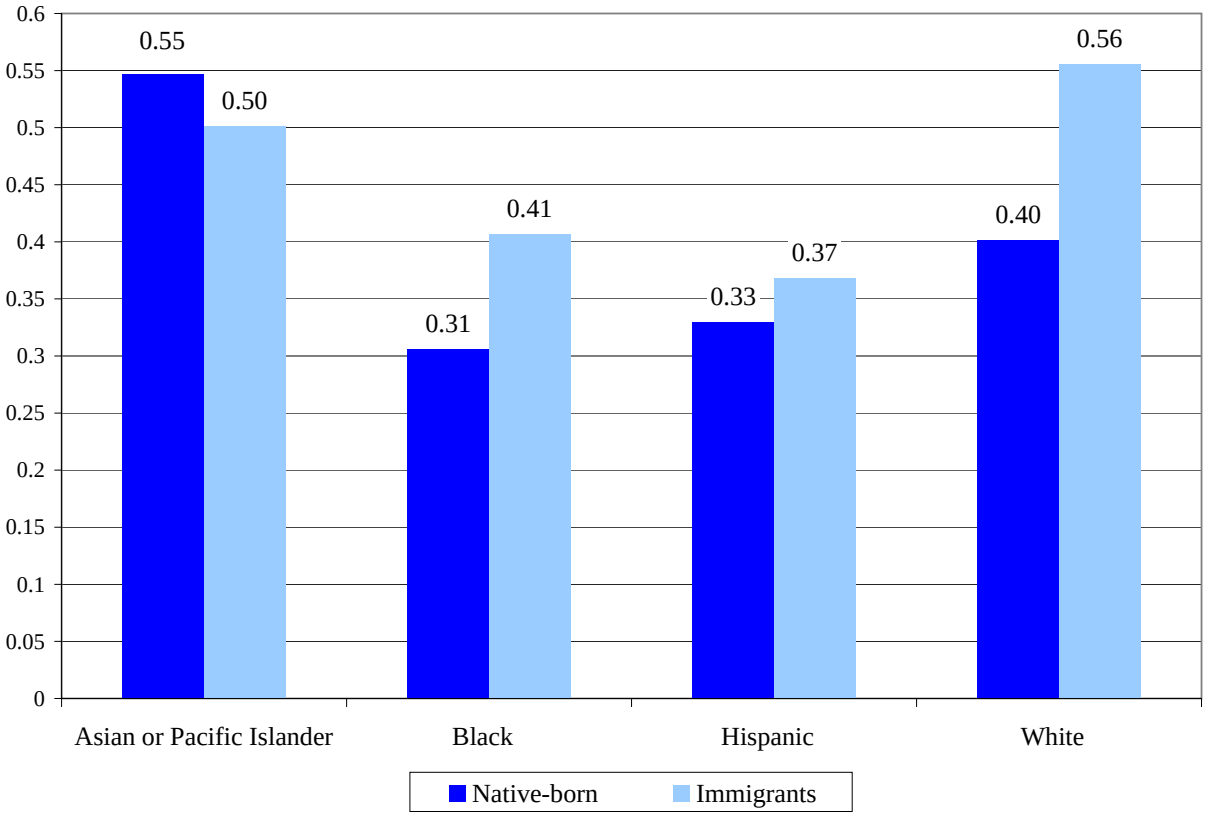
Appendix A Additional Figures and Tables

Figure A.1: Annual Earnings 10 Years After Entry, by Race/Ethnicity and Nativity



Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2005. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Figure A.2: Degree Receipt 10 Years After Entry, by Race/Ethnicity and Nativity



Notes: CUNY undergraduate degree-seeking students who first enrolled in fall 1999 through fall 2005. Sample is limited to fall entrants with declared majors at entry. Students in college-cohort-major (CCM) cells with fewer than 10 students in any year or fewer than 25 students on average are excluded. Students who initially entered Queens, Hunter, or Lehman Colleges are excluded.

Table A.1: Raw and Adjusted Earnings Gap 10 Years After Entry (Relative to White Native-born)

	(1) Unadjusted	(2) Pre-college characteristics	(3) Attainment	(4) Employment	(5) Industry
Race/ethnicity and nativity (rel. to white native-born)					
API, native-born	-901	-1,133	-4,272	-5,411	-5,004
	(800)	(806)	(842)**	(1,063)**	(1,195)**
Black, native-born	-9,002	-7,165	-6,491	-10,069	-9,086
	(579)**	(553)**	(536)**	(680)**	(755)**
Hispanic, native-born	-6,645	-5,506	-4,544	-7,914	-7,100
	(583)**	(564)**	(539)**	(684)**	(778)**
	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]
API, immigrant	-10,558	-8,749	-9,749	-6,953	-5,660
	(657)**	(688)**	(694)**	(934)**	(1,068)**
Black, immigrant	-10,097	-6,644	-7,903	-6,827	-5,762
	(617)**	(605)**	(598)**	(770)**	(862)**
Hispanic, immigrant	-10,040	-8,206	-6,950	-7,940	-6,514
	(622)**	(622)**	(598)**	(757)**	(845)**
White, immigrant	-3,932	-2,886	-4,636	-749	373
	(762)**	(772)**	(793)**	(1,063)	(1,197)
	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]
Tests of equality (*p* -values):					
API nb = API immigrant	<0.001	<0.001	<0.001	0.057	0.421
Black nb = Black immigrant	0.003	0.157	<0.001	<0.001	<0.001
Hispanic nb = Hispanic immigrant	<0.001	<0.001	<0.001	0.952	0.164
Observations	77,019	77,019	77,019	50,155	42,322

*Note*s: For sample, see Table 1 notes. Estimates from regressions of annual earnings 10 years after college entry on race/ethnicity-nativity categories (white native-born students form omitted group). Column 2 model also includes controls for a quadratic in age at entry, high school GPA, average annual earnings over the three years prior to college entry, and indicators for single parenthood, presence of a disability, New York City high school graduate, GED recipient, nonmissing high school GPA, any employment in the three years prior to college entry, and gender. Column 3 model includes column 2 controls and controls for initial major, initial degree program, bachelor's degree receipt, associate degree receipt, and cumulative credits earned 10 years after college entry. Column 4 model includes column 3 controls and limits the sample to students with nonzero earnings 10 years after college entry. Column 5 model includes column 3 controls and controls for industry of main job (NAICS 3-digit code); students in jobs with missing industry are excluded. Brackets contain *p*-values from tests of equality of coefficients across race/ethnicity categories and within nativity categories. Robust standard errors, clustered at the college-entry-cohort-major level in parentheses; ** p<0.01, * p<0.05, + p<0.1. Earnings are adjusted for inflation using the CPI-U (2016$).

Table A.2: Predicted Earnings, 5 Years After Entry

	Earnings: t+5
Age	-474
	(97)**
Age^2	9.02
	(1.74)**
Female	-1559
	(109)**
Single parent	-953
	(209)**
Disabled	-4615
	(316)**
GED recipient	-1449
	(208)**
NYC public hs graduate	955
	(126)**
Nonmissing high school GPA	-7436
	(695)**
× High school GPA (0-100)	101
	(9)**
Any pre-college earnings	3990
	(105)**
Pre-college earnings	0.614
(three year average, $10K)	(0.008)**
Race\ethnicity and nativity (rel. to white native-born)	
API, native born	-2706
	(249)**
API, foreign born	-5110
	(220)**
Black, native born	-1462
	(182)**
Black, foreign born	-1506
	(218)**
Hispanic, native born	26
	(178)
Hispanic, foreign born	-1895
	(221)**
White, foreign born	-1585
	(245)**
Observations	145,310

*Note*s: For sample, see Table 1 notes. Estimates from a regression of annual earnings 5 years after college entry. Earnings are adjusted for inflation using the CPI-U (2016$).

Table A.3: Effect of Network Share on Credit Accumulation by Race/ethnicity and Nativity

Years since entry:	1	2	3	4	5	6	7	8	9	10
Proportion in network ×										
API, native-born	-0.850	-1.933	-2.366	-1.688	-6.708	-12.279	-12.005	-11.832	-7.607	-3.010
	(0.880)	(1.826)	(2.852)	(3.716)	(4.211)	(4.816)*	(5.339)*	(6.150)+	(7.228)	(9.091)
Black, native-born	-1.492	-1.999	-1.899	-2.884	-3.751	-3.885	-2.276	-2.705	-3.589	-3.430
	(0.515)**	(1.067)+	(1.548)	(2.040)	(2.345)	(2.603)	(2.782)	(3.134)	(3.404)	(3.738)
Hispanic, native-born	0.142	0.519	1.261	1.393	2.092	3.105	2.943	-0.194	-1.050	-2.735
	(0.464)	(0.948)	(1.425)	(1.859)	(2.092)	(2.479)	(2.962)	(3.269)	(3.385)	(3.731)
White, native-born	-0.719	0.101	0.698	0.163	-2.146	-3.921	-4.582	-4.341	-3.020	-1.197
	(0.514)	(1.035)	(1.598)	(2.209)	(2.450)	(2.639)	(3.005)	(3.320)	(3.609)	(4.015)
	[0.148]	[0.281]	[0.402]	[0.493]	[0.172]	[0.029]	[0.087]	[0.425]	[0.873]	[0.984]
API, immigrant	-2.114	-0.049	2.349	4.451	3.061	0.138	0.414	3.574	1.896	1.384
	(0.849)*	(1.855)	(2.651)	(3.386)	(3.940)	(4.604)	(5.106)	(5.416)	(5.725)	(6.072)
Black, immigrant	1.973	5.669	9.693	11.539	12.782	12.952	11.919	10.976	12.930	9.383
	(0.674)**	(1.455)**	(2.147)**	(2.704)**	(3.021)**	(3.282)**	(3.531)**	(3.691)**	(3.952)**	(4.183)*
Hispanic, immigrant	-1.587	-2.038	-1.840	-1.981	-3.549	-5.227	-7.683	-9.603	-10.204	-11.602
	(0.673)*	(1.400)	(2.030)	(2.569)	(2.946)	(3.278)	(3.544)*	(3.747)*	(3.932)**	(4.197)**
White, immigrant	-1.034	-2.278	-5.378	-11.101	-17.998	-23.737	-26.600	-24.391	-19.196	-14.477
	(1.649)	(3.531)	(5.215)	(6.447)+	(7.184)*	(8.004)**	(8.719)**	(9.228)**	(9.176)*	(9.834)
	[<0.001]	[0.001]	[0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[0.003]
Tests of equality (*p*-values):										
API nb = API immigrant	0.277	0.448	0.208	0.196	0.072	0.050	0.082	0.061	0.313	0.686
Black nb = Black immigrant	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.003	0.001	0.016
Hispanic nb = Hispanic immigrant	0.031	0.124	0.203	0.277	0.112	0.039	0.019	0.053	0.074	0.107
White nb = White immigrant	0.853	0.511	0.256	0.093	0.034	0.018	0.016	0.038	0.094	0.198
Observations	145,310	145,310	145,310	145,310	145,310	130,789	115,473	101,900	89,021	77,019

*Note*s: For sample, see Table 1 notes. Each column contains estimates from separate regressions. Dependent variable is total academic credits earned within CUNY institutions. In-network defined by race/ethnicity and nativity. See Table 5 notes for additional covariates included in all regressions. Robust standard errors, clustered at the college-entry-cohort-major level in parentheses; ** p<0.01, * p<0.05, + p<0.1. Within nativity, across-race *p*-values from a test of joint equality of coefficients in brackets.