Does Immigration Affect whether U.S. Natives Major in a STEM Field?*

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Abstract: The United States experienced a dramatic increase in high-skilled immigration from the early 1990s though the mid 2000s. Many of these immigrants study or work in science, technology, engineering, or mathematics (STEM) fields. This inflow may have affected whether natives majored in a STEM field in college. We examine this question using data on college majors from the 2009-2011 American Community Surveys together with data on immigrant shares from the 1970-2000 decennial Censuses. We find that non-Hispanic whites and female Asian natives—but not other groups—are slightly less likely to major in STEM fields as immigrant shares rise.

Key words: immigration, higher education, STEM, college major

JEL codes: I21; J15

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I. Introduction

The number of workers in science, technology, engineering, and mathematics (STEM) fields is commonly viewed as critical to the future of the U.S. economy. Concern that not enough U.S. natives are studying STEM fields to maintain the nation's pace of innovation and its long-term economic competitiveness underlie a number of recent policy proposals. Policymakers have proposed granting permanent resident status to foreign students who earn a U.S. graduate degree in a STEM field and revamping undergraduate education in STEM, for example, while corporations have advocated for increased resources in STEM education at the K-12 and college levels as well as for more temporary and permanent visas for skilled foreign workers.[1]

Proposals to admit more immigrants trained in STEM and to improve STEM education are motivated by the belief that not enough U.S. natives earn degrees in STEM fields. During the period 1977 through 2009, the proportion of U.S. citizens and permanent residents earning bachelor's degrees in STEM fields fluctuated between 15 and 20 percent with little discernible trend.[2] During that period, the number of bachelor's degrees in STEM fields awarded to temporary residents increased faster than the number awarded to U.S. citizens and permanent residents. Many of those foreign students stayed in the U.S. after completing their studies. Inflows of foreign graduates also boosted the number of immigrants in the U.S. who hold degrees in STEM fields. Freeman (2009) reports that the foreign-born share of U.S. residents who hold a bachelor's degree in science or engineering increased from 11 in 1990 to 17 percent

[1] For example, the STEM Jobs Act of 2012 (H.R. 6429) would have allocated 55,000 green cards to immigrants holding a postgraduate degree in a STEM field from a U.S. university. The President's Council of Advisors on Science and Technology advocated changes to STEM undergraduate teaching (see http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_feb.pdf). Microsoft's proposal is available at http://www.microsoft.com/en-us/news/download/presskits/citizenship/MSNTS.pdf.

[2] Authors' calculations based on data from National Science Foundation (2002, 2012). We do not include social sciences as STEM fields; including social sciences raises the proportion to about one third.

in 2000. This increase was in large part made possible by the creation of the H-1B visa program and the increase in the number of employment-based permanent resident visas during the early 1990s.

This study examines whether these patterns are related. Specifically, we examine the relationship between whether U.S.-born college graduates majored in a STEM field and the foreign-born share of their age cohort or the labor force. We focus on whether natives choose STEM majors at the undergraduate level because this is a critical step toward a STEM graduate degree and a career in a STEM field. We are able to take advantage of a large-scale survey, the American Community Survey, that asks about college major. We look at several measures of the immigrant share, including the foreign born share of an age cohort both before natives are in college and while they are in college. These measures capture the immigrant intensity of natives' educational experience. We also examine the immigrant share of the labor force as a whole, the college graduate labor force, and the college graduate labor force in STEM occupations while natives are in college. These measures capture whether immigration affects natives' choice of major via changes in the labor market. Although there is a large literature on the effect of immigration on natives' labor market outcomes and a smaller literature on natives' educational outcomes, no previous research has directly examined whether immigration appears to affect natives' choice of college major.

The next section explains why immigration might affect natives' educational outcomes and provides an overview of previous research in this area, focusing on the U.S. Section III discusses the data and empirical methodology. Section IV presents the results. We control for potential endogeneity in immigrant shares by measuring them in natives' state of birth and using an instrument based on historical immigrant settlement patterns, and we control for the

attractiveness of STEM jobs using measures of the proportion of college graduates in a state working in STEM occupations, wages of those jobs relative to non-STEM jobs, and the 10-year changes in those measures. The results suggest that immigration reduces the fraction of natives who major in a STEM field, although the estimated effect is small. This result is largest for the immigrant share of young adults enrolled in higher education and is concentrated among non-Hispanic whites; female Asian natives also appear to be less likely to major in a STEM field as immigrant shares increase. Section V concludes with a discussion of limitations of this study and directions for future research.

II. Literature Review and Theoretical Background

Immigration can theoretically have a positive or negative effect on natives' educational outcomes, and effects can occur through several channels. First, immigrants may compete directly with natives for educational resources. Immigration may crowd out natives from education in the short run if the supply of education is not perfectly elastic. In the medium to long run, however, larger inflows of immigrant students may lead to more course offerings and new or larger programs, particularly since foreign students tend to boost college revenues. Relatedly, immigration may affect the quality of education. Immigrants may require intensive English language instruction, for example, so attending K-12 school with immigrants may lower natives' level of human capital or its return. On the other hand, foreign students attending U.S. universities tend to be among the better students in their home country, and immigrants often outperform their U.S-born peers at the K-12 level.[3] Attending school with high-achieving

[3] For studies comparing educational outcomes among foreign- and U.S.-born K-12 students, see Schwartz and Stiefel (2006) and references therein.

immigrants may increase the quality of natives' education through peer effects and other spillovers.

The labor market is another channel through which immigration may affect the return to human capital and hence natives' educational outcomes. Immigrant inflows that do not mirror the education or skill distribution among natives are likely to change the return to human capital, particularly in the short run when natives' education and skill levels are fairly fixed. Natives have an incentive to acquire additional human capital if immigrants have lower skill levels, on average, than natives and immigration therefore increases the return to skill; the converse is true if immigrants have higher skill levels than natives. Such endogenous changes in human capital will dampen the adverse labor market effect of immigration.[4]

The empirical evidence on how immigrant inflows affect U.S. natives' educational outcomes is mixed. Hunt (2012) finds that higher immigrant population shares, particularly of immigrants who have not completed high school, when natives are aged 11-17 increase natives' high school completion; the effect is largest among blacks and is not significant among U.S.-born Hispanics. Betts (1998) suggests that immigration has a negative effect on black and Hispanic natives' high school completion, in contrast. Betts and Lofstrom (2000) similarly find that natives' years of schooling completed and probability of completing high school are negatively related to the immigrant share of their age cohort for all races/ethnicities. Chin, Daysal, and Imberman (2012) find that bilingual education programs, which typically place limited-English-proficient (LEP) students in separate classrooms, appear to have positive spillovers onto non-LEP students' scores on standardized tests, suggesting that attending school

[4] Chiswick (1989) and Eberhard (2012) present formal models with simulations for the United States suggesting that immigration affects natives' human capital accumulation, which dampens immigration's labor market effect.

with some groups of immigrants may adversely affect natives.[5] Neymotin (2009) finds that immigration does not adversely affect natives' SAT scores or their likelihood of applying to selective colleges.

Results are also mixed for higher education. Betts and Lofstrom (2000) find a positive relationship between blacks' college completion and the immigrant share of their age cohort. Jackson (2011) finds that increases in the number of foreign-born college students do not affect the fraction of natives enrolled in college while increases in the ratio of low- to high-skilled immigrants in the labor force boost natives' college enrollment. Immigration also may affect what institutions natives attend. Hoxby (1998) finds that foreign students displace black and Hispanic natives from selective colleges but not from other colleges. At the graduate level, Borjas (2007) concludes that foreign graduate students appear to crowd out white male natives.

Turning to the choice of major, there are several reasons why immigration might reduce the likelihood that college graduates majored in a STEM field. First, immigrants may compete with natives in the same age cohort for educational resources. When natives attend school with more immigrants, natives' academic preparedness in math and science may decline, either absolutely or relative to immigrants, resulting in natives being less willing or able to major in STEM fields. For example, attending K-12 school with more immigrants who need intensive English education may reduce the quantity or quality of math and science preparation that natives receive, reducing the likelihood they ultimately major in those fields in college. Levine and Zimmerman (1995) show that high school preparation in math and, to a lesser extent, in

[5] Brunello and Rocco (2011) find a negative relationship between natives' test scores and the immigrant share of pupils across 27 developed countries. The effect is greatest for natives with a disadvantaged parental background. Gould, Lavy, and Paserman (2009) find a negative effect of the immigrant share in the fifth grade on whether natives pass a high school matriculation exam in Israel. Jensen and Rasmussen (2011) find that children's math test scores are negatively related to immigrant shares in school in Denmark. Schwartz and Stiefel (2011) find a negative (positive) relationship between natives' test scores and the immigrant share in the school (class) for children in third through eighth grade in New York City public schools.

science affects the likelihood of majoring in a technical field in college. Alternatively, attending K-12 school or college with more immigrants may increase the competition for high grades in math and science classes. Barnett, Sonnert, and Sadler (2012) report that immigrants earn higher grades, on average, than U.S. natives in college calculus classes, which are crucial gateway courses for STEM majors. Natives who move down in the grade distribution may be less likely to major in STEM fields.

Even if the distributions of immigrants and natives by ability or achievement are the same, immigration may reduce natives' academic preparedness if educational resources are relatively fixed. At the K-12 level, dividing fixed resources across more students may reduce the average student's preparedness and ultimately reduce the likelihood of majoring in a STEM discipline. At the college level, immigrants may crowd natives out of STEM majors if the number of slots available is inelastic in the short run.[6] For example, natives may have more difficulty getting into necessary introductory math and science classes their first year of college as the number of foreign-born college students increases. Natives may become more likely to major in other disciplines as a result. Bettinger (2010) reports that students who take more STEM classes their first semester of college are more likely to persist in STEM majors, although the direction of causality is unclear.

Second, immigration may reduce the relative returns to STEM occupations, reducing the incentive for natives to major in those disciplines. Expected returns affect students' choice of college major (e.g., Arcidiacono, Hotz, and Kang 2012). Inflows of highly skilled immigrant workers trained in STEM fields may reduce earnings or employment opportunities in STEM occupations. Students also may perceive higher immigrant shares in their own age cohort as

[6] Bound and Turner (2007) suggest that the supply of higher education is inelastic. College enrollment and completion rates drop substantially as the size of a cohort at age 18 increases.

increasing the competition for STEM jobs in the future, reducing their willingness to major in STEM disciplines. The literature on the effect of immigration on natives' earnings and employment is hotly divided, with some studies finding evidence of substantial negative effects among college graduates (e.g., Borjas 2003) and other studies finding little evidence of adverse effects (e.g., Ottaviano and Peri 2011).

The high concentration of immigrants in STEM fields may affect natives' willingness to major in STEM fields even if labor market outcomes, educational opportunities, and natives' academic preparedness do not change as a result of immigration. Natives may perceive STEM fields as primarily filled by immigrants and therefore be less inclined to major in them. Natives may have difficulty finding role models "like them" in STEM fields as the proportion foreign born increases in those fields.[7] Almost 29 percent of college graduates living in the U.S. who majored in a STEM field are foreign born, versus 13 percent of non-STEM majors.[8]

Alternatively, immigrant inflows may boost the likelihood that natives major in a STEM field. Immigrant inflows, particularly of highly skilled immigrants, may put pressure on schools to increase educational resources in math and science. Immigrants and their children may have positive peer effects on other natives. Larger inflows of foreign students who study STEM fields may cause universities to increase the size or quality of their STEM programs, resulting in more natives majoring in those fields.

[7] Having foreign-born professors may matter as well. Rothstein (1995), Bettinger and Long (2005), and Hoffman and Oreopoulos (2007) find that women's performance is positively related to having a same-sex professor, although the effects are small. Borjas (2000) finds that student performance in undergraduate economics principles classes is negatively related to having a foreign-born teaching assistant.

[8] Authors' calculations from the 2009-2011 ACS on college graduates ages 25-65.

III. Data and Methodology

A. Data

We use data from the 2009-2011 American Community Surveys (ACS) together with immigrant shares derived from decennial Censuses. The ACS is a large-scale survey that replaced the long-form decennial Census but is conducted every year. The ACS asks about demographic characteristics and labor market outcomes. Since 2009, it has asked respondents who have at least a bachelor's degree to report their college major. We examine only U.S.-born respondents who hold at least a bachelor's degree.[9] We classify those who report majoring in biology and life sciences, physical sciences, engineering, computer and information sciences, or mathematics and statistics as STEM majors.

The main advantage of the ACS is that it offers very large, nationally-representative samples of multiple cohorts. However, it does not have data on important factors that are related to the choice of college major, such as family background and academic ability.[10] Other datasets that do include such measures, such as the Baccalaureate and Beyond Studies and the National Longitudinal Surveys of Youth, have much smaller samples. The large sample sizes in the ACS allow us to look at racial and ethnic subgroups. This is important since blacks and Hispanics, along with women, are underrepresented among STEM majors and are disproportionately likely to switch from a STEM major to a non-STEM major (Griffith 2010). Blacks and Hispanics also disproportionately attend K-12 schools with other minority students, including immigrants (Orfield, Kucsera, and Siegel-Hawley 2012). Meanwhile, Asians are overrepresented among STEM majors, making them an interesting group to examine.

[9] We term people who have at least a bachelor's degree "college graduates" throughout; all measures of college graduates shown here include people who hold an advanced degree as well as people who only hold a bachelor's degree.

[10] Altonji, Blom, and Meghir (2012) provide an overview of the relatively sparse literature on the determinants of college majors.

We examine four 5-year age cohorts in the ACS. The cohorts are all U.S.-born college graduates aged 28-32, 38-42, 48-52, and 58-62 in the 2010 ACS (one year younger for the 2009 ACS, and one year older for the 2011 ACS). These cohorts were chosen because they were aged 18-22, or approximately college age, when a decennial Census was conducted. For example, people aged 28-32 in the 2010 ACS were aged 18-22 at the time of the 2000 Census, and those aged 58-62 in the 2010 ACS were aged 18-22 at the time of the 1970 Census.

Figure 1 shows the proportion of U.S.-born college graduates who majored in a STEM field by the year in which they were age 22, the modal age at college graduation. This proportion rose from 1974 until 1986 and has been fairly flat since the mid-1990s. The increase in the 1970s and early 1980s likely reflects the emphasis on science and math while these age cohorts were in school (the "Sputnik generation"). The Internet boom of the late 1990s did not have a major effect on the proportion of STEM majors; if it led students to switch from science to computer science majors, that would be not be discernible here.

Figure 1 also shows an estimate of the foreign-born proportion of U.S. college graduates who majored in a STEM field.[11] This measure only includes people living in the U.S. at the time of the ACS and so will miss any foreign students who have returned home. It does not include immigrants who are earned their bachelor's degree abroad and subsequently moved to the U.S. This immigrant share rose fairly steadily from the mid-1970s until 1995 and shows a slight downward trend since then. The downward trend may be due to the U.S. attracting fewer foreign students who want to study STEM fields or to fewer foreign students remaining in the U.S. after receiving a bachelor's degree in STEM. The difficulty foreign students experienced getting visas after 9/11 and the expansion in other countries' higher education systems in recent years may

[11] Based on reported age and year of arrival in the U.S., immigrants who have a bachelor's degree or higher and arrived in the U.S. by age 20 are assumed to be U.S. college graduates. National Science Foundation data on degree recipients groups together U.S. citizens and permanent residents.

have contributed to fewer foreign students earning bachelor's degrees in STEM in the U.S. The Great Recession of 2007-2009 and relatively strong economic growth in China and India may have led to a decline in the number of foreign-born STEM graduates staying in the U.S.

The top row of Table 1 reports the fraction of native college graduates who majored in a STEM field for the four cohorts we examine. This fraction reflects the pattern shown in the figure—it is higher for the cohort who were college age in 1980 than for the 1970 cohort, and it is lower for the 1990 and 2000 cohorts than for the 1980 cohort. The rest of the analysis focuses on college graduates in these four college cohorts and how the probability that they majored in a STEM field is related to immigrant shares.

We created five measures of immigrant shares from the 1970-2000 decennial Censuses. The first is the share of the age cohort—the population aged 18-22—that is foreign born. Immigrants who report arriving in the U.S. in the five years prior to the Census are not included in the construction of this variable so that it approximates the immigrant intensity of U.S. natives' K-12 educational experience and does not capture immigrants who arrived as undergraduates or graduate students.[12] The second immigrant share variable is the share of the age cohort that is enrolled in college at the time of the decennial Census.[13] This measure captures the immigrant intensity of U.S. natives' college educational experience. Since 1950, college students have been instructed to give their current residence, not their parents' residence, in the Census if they live in campus or off-campus housing instead of with their parents. Foreign

[12] Because the Census stopped asking about parents' place of birth in 1970, we cannot examine the proportion of the age cohort that is second generation (the children of immigrants). We also cannot distinguish second generation immigrants from the children of U.S. natives in the ACS.

[13] The Census educational categories and questions have changed over time. The 1990 Census does not ask about grade attending, so we classify people ages 18-22 who are enrolled in school and are at least high school graduates as enrolled in college; we classify people in the 2000 Census in the same manner for comparability. For the 1980 and earlier Censuses, which did not ask specifically about high school graduation, we classify people are 18-22 who report being at least college undergraduates as college undergraduates; less than 3 percent report being in graduate or professional school.

students studying in the U.S. are instructed to answer the Census with their household location in the U.S. (Cork and Voss 2006).

The other three immigrant share variables measure immigrant shares of the labor market when natives were in college. The first of these variables is the foreign-born share of the overall labor force that is foreign born. The second is the foreign-born share of college graduates in the labor force. This measure may more closely reflect any effect of immigrant competition in the labor market on natives' choice of college major than the overall immigrant share of the labor force since our ACS sample only includes college graduates.[14] The last measure is the foreign-born share of college graduates working in STEM occupations. This measure most directly captures any effect of competing with immigrants for STEM jobs. However, this measure will not capture immigrants (or natives) with STEM degrees who are not working in STEM fields.

All five immigrant share measures increase across the college cohorts, reflecting the general increase in the foreign-born fraction of the U.S. population since the 1960s. In 1980 and later, the immigrant share is slightly higher for the labor force as a whole (Table 1, row 4) than for the college graduate labor force (row 5). This reflects the disproportionate and growing share of immigrants who have relatively little education, predominately immigrants from Latin America who have not graduated from high school. However, the gap is not large, which is consistent with the overrepresentation of immigrants at both ends of the education distribution; immigrants are both much more likely than natives to have not graduated from high school and more likely to have a college degree. The immigrant share is highest when looking at college graduates who work in STEM occupations (row 6). This is not surprising since the share of STEM majors is about twice as high among foreign-born college graduates as among U.S. native

[14] We use the IPUMS categories of four or more years of college to indicate college graduates in the Censuses. In the 1990 and 2000 Censuses, this only includes people who report having at least a bachelor's degree.

college graduates of the same age. The immigrant share is lowest for the measure of the age cohort, excluding recent immigrants (row 2). This reflects the fact that most people who immigrate do so as adults, not as children.

The five immigrant share measures are created from the decennial Censuses at the state level. We merge the immigrant share measures with the ACS data by individuals' cohort and their state of birth, which is the only place of residence available in the ACS data besides current place and place one year ago. Other studies similarly use state of birth to examine state-level variables related to education.[15] Using state of birth avoids endogeneity bias that would arise if immigration affects natives' place of high school or college attendance. Because only about 80 percent of people go to high school in their state of birth (and about 65 percent to college in their state of birth), the estimates below likely underestimate any effect of immigration on natives' college major.

Some of the analysis below stratifies the sample on race and ethnicity. The relationship between college major and immigrant shares may differ across races and ethnicities for several reasons. Differences in average K-12 school quality may make some groups less or more sensitive to the immigrant share. Because they have higher average family incomes, non-Hispanic whites and Asians may attend schools that provide better preparation in math and science and therefore may be less affected than blacks and Hispanics by the immigrant share. The effect of the immigrant share may differ between second-generation natives (the children of immigrants) and third- and higher generation natives. Hispanic and Asian natives are more likely to be the children of immigrants than non-Hispanic whites and blacks. Because the immigrant share variables are measured at the state level, they may not fully capture differences in the

[15] Studies using state of birth to proxy for state of high school attendance include Card and Krueger (1992), Dynarski (2008), and Bound, Hershbein, and Long (2009). Dynarski (2008) notes that about 20 percent of high-school-age youth live outside their state of birth.

immigrant share of the K-12 or college education experiences of different groups. Blacks and Hispanics are likely to attend K-12 schools with higher immigrant shares than are non-Hispanic whites.

Asians are about twice as likely as other groups to major in a STEM field, as Table 2 reports. The fractions of Asians and blacks who majored in a STEM field have increased the most over time, although the fraction of Asians majoring in a STEM field was unchanged between the 1990 and 2000 college cohorts. The black-white gap in the fraction majoring in a STEM field has narrowed over time.

Table 3 shows the characteristics of STEM and non-STEM majors for our four college cohorts. The fractions of STEM majors that are black, Asian, and Hispanic have increased over time. This reflects increases in these groups' population shares and college graduation rates. The fraction of STEM majors who are female has increased over time as well, but women continue to be underrepresented among STEM majors. There are no major differences between STEM and non-STEM majors in the sample means of the immigrant share variables, indicating no systematic differences between STEM and non-STEM majors in their distribution across states of birth.

B. Empirical Methodology

We use linear probability regressions to examine the relationship between whether U.S.-born college graduates majored in a STEM field and the various measures of the immigrant share. The basic regression model is

$$STEM_{ist} = \alpha + \beta \ln(\text{Immigrant Share})_{st} + \delta \text{Characteristics}_{ist} + \theta \text{Labor Market}_{st} + \sigma \text{State}_s + \tau \text{Cohort}_t + \varepsilon_{ist}. \quad (1)$$

The dependent variable equals one if individual *i* who was born in state *s* and cohort *t* majored in STEM; the ACS sample is conditioned on having graduated from college. *Immigrant Share* is one of the five immigrant share variables described above; only one of these measures is included at a time because they are highly collinear. Again, these variables are measured when individuals were aged 18-22 and are for the state of birth. *Characteristics* includes age and its square, a dummy variable for females, and dummy variables for race/ethnicity (black, Hispanic, Asian, and other are the mutually exclusive categories, with non-Hispanic whites as the omitted category). These variables control for systematic differences in the probability of majoring in a STEM field across sexes and races/ethnicities.

The relative attractiveness of STEM jobs may influence students' decision whether to major in a STEM field. We control for the relative attractiveness of STEM jobs by including variables that measure the fraction of college graduates who are employed in STEM occupations (versus non-STEM occupations) in the state, the change in that fraction during the past 10 years, the ratio of log average annual income of college graduates working in STEM occupations to log average annual income of college graduates working in non-STEM occupations in the state, and the change in that ratio during the past 10 years. These measures of the relative labor market attractiveness of STEM jobs are calculated from the decennial Censuses.

The regressions also include state and cohort fixed effects. The state of birth fixed effects control for unobservable factors that are specific to a state but constant over time, such as proximity to international borders, size, and climate. The cohort fixed effects control for unobservable factors that are specific to a college cohort, such as changes in the national labor market and the economy and changes in the national emphasis on math and science education. The standard errors are robust and clustered on the state and cohort.

An important concern about the regression model is whether immigrant shares are exogenous. Factors that affect the propensity of immigrants (and natives) to live in a state may also affect whether natives from a state opt to major in STEM fields. Labor market shocks, such as the Internet boom in Silicon Valley in the 1990s, may attract immigrants to a state and also make natives from that state more interested in majoring in a STEM field. If our measures of the relative attractiveness of STEM jobs do not fully control for this, ordinary least squares (OLS) estimates would display a positive bias. The OLS estimates also would be biased upwards if immigrants are attracted to states with educational systems that put more emphasis on math and science. However, there are reasons why the OLS estimates may have a negative bias. First, the immigrant share may increase if firms bring in foreign workers because not enough college graduates major in STEM fields. Second, natives whose children disproportionately major in STEM fields in college (i.e., natives who themselves work in STEM occupations) may move away from states that are receiving large numbers of immigrants.

We control for the potential endogeneity of the immigrant share by using an instrumental variable. Our instrument is based on immigrants' historical settlement patterns. Immigrants tend to settle in the same areas as earlier immigrants from their country of origin (although this tendency lessened in the 1990s as immigrants moved to new destinations in the South and West, as discussed in Massey (2010)). Our instrument is based on reallocating immigrants across states based on their distribution, for 16 countries or regions of origin, across states 10 years before.[16] Specifically, we calculate the predicted immigrant share in state *s* in Census year *t* as

$$\text{Predicted immigrant share}_{st} = \frac{\sum_{j=1}^{16} \text{Number of immigrants}_{t}^{j} * \%\text{ of immigrants living in s}_{t-10}^{j}}{\text{Population}_{st}}. \qquad (2)$$

[16] The 16 countries or regions are the U.K together with Canada, Australia, and New Zealand; Ireland; Germany; Poland; Russia/USSR; other Europe; Mexico; Central America; South America; Cuba; other Caribbean; China; India, the Philippines; other Asia; and the rest of the world.

The immigrant share instrument is calculated separately for each of the five immigrant share variables based on the relevant immigrants and natives (e.g., college graduates in the labor force for the immigrant share of the college graduate labor force). Previous research similarly instruments for the immigrant share using a share predicted based on historical settlement patterns (e.g., Card and DiNardo 2000; Card 2001; Saiz 2007; Hunt 2012; Smith 2012).[17] To be valid, the instrument requires assuming that the distribution of immigrants by country or region of origin across states 10 years ago is not correlated with shocks that affect the probability that natives in a state major in a STEM field 10 years later. In other words, shocks that affect both the distribution of immigrants and natives' college major do not persist for a decade. Again, we also control for the relative attractiveness of STEM jobs at a point in time and the change in their relative attractiveness over time.

IV. Results

Table 4 reports the OLS results for the relationship between majoring in a STEM field and the five measures of the immigrant share. For the sample as a whole (column 1), the probability that a native majors in a STEM field is negatively related to the fraction of the age cohort that is foreign born and to the fraction of college students who are foreign born, but the implied effects are very small. The results suggest that a 10 percent increase in the immigrant share of the age cohort before college reduces the probability that a native majors in a STEM field by 0.08 percentage points while a 10 percent increase in the immigrant share of college students reduces the probability of majoring in STEM by 0.12 percentage points. In the OLS

[17] Some research uses the distribution of immigrants across states in a fixed based period (usually 10 years before the start of the sample period). We use a moving window (the distribution 10 years prior) because instruments based on a fixed base period (1960) performed poorly in the first stage when looking at college students, the college graduate labor force, or college graduates in STEM occupations. This is not a surprise since more educated households are more responsive than less educated households to differences in labor market conditions.

results, the immigrant share of the labor force, whether overall, among college graduates, or among college graduates working in STEM occupations, does not appear to affect the probability that a native majors in a STEM field.

The negative relationship between majoring in a STEM field and the immigrant share is concentrated among non-Hispanic whites. The probability that a white college graduate majors in a STEM field is negatively related to the immigrant share of the age cohort before college, of college students, of the overall labor force, and of college graduates in the labor force. Interestingly, the magnitude of the relationship is greatest (most negative) for the immigrant share of college graduates in the labor force. Whether blacks major in a STEM field is not significantly related to any of the measures of the immigrant share, and whether Asians major in a STEM field is significantly negatively related only to the immigrant share of college graduates in STEM occupations. The probability that Hispanics major in a STEM field is positively related to most of the measures of the immigrant share.

In results not shown here, the estimated coefficients on the other variables are largely as expected. The probability of majoring in a STEM field tends to be positively related to the fraction of college graduates working in STEM occupations and to the income ratio of college graduates in STEM occupations to those in non-STEM occupations but not significantly related to the 10-year changes in those variables.

Endogeneity of the immigrant share variables may bias their coefficients either positively or negatively. Table 5 presents the instrumental variables (IV) results using the predicted immigrant share based on the distribution of immigrants across states 10 years ago. Appendix Table 1 reports the first-stage results, which are strong; the F-test statistics are above 20 with one exception. The IV results are generally similar to the OLS results—the probability that natives

major in a STEM field is negatively related to the immigrant share of their cohort before college and while in college, and this result is driven by non-Hispanic whites. The IV estimates tend to be slightly more negative than the OLS estimates for the sample as a whole and for whites. The most negative relationship between whether whites majored in a STEM field and the immigrant share variables continues to be for the immigrant share among college students. Unlike the OLS results, the immigrant share among college graduates working in STEM occupations has a negative effect on the probability that whites major in a STEM field in the IV results. The positive relationship between the probability that a Hispanic native majors in a STEM field and the various measures of the immigrant share persists in the IV results.

Because California is the center of the high-tech industry and is home to many immigrants, it may drive the results. Almost 9 percent of the sample overall was born in California, and one-third of Asians and over one-quarter of Hispanics. Table 6 presents IV results without natives born in California; the first-stage results are not shown here but are strong. The results continue to indicate a negative relationship between the probability that whites majored in a STEM field and most of the measures of the immigrant share, and a positive relationship for Hispanics. The negative relationship between whether Asian natives majored in a STEM field and the immigrant shares of their cohort before they were in college and while they were in college becomes statistically significant when natives born in California are dropped from the sample. The magnitude of the estimates for Asians is much larger than for whites.

Although the positive result for Hispanics is robust to dropping natives born in California, it is not robust to dropping natives born in Texas. Almost 22 percent of Hispanics in the ACS sample were born in Texas. In results not shown here, the first stage regressions remain strong but none of the IV results for Hispanics are statistically significant if natives born in Texas

are not included. The proportion of Hispanic college graduates born in Texas who majored in a STEM field was similar in 1980 and 1990 and then was higher in 2000, whereas for the U.S. as a whole it was similar in 1990 and 2000 and was higher in 1980. Texas-born Hispanics may have defied the national trend partly because of the rapid growth of the high-tech industry in Texas in the 1990s and university and corporate programs that encouraged Texas youth, many of whom are Hispanic, to major in STEM.[18]

The year 2000 also may drive much of the results because of the Internet bubble and the unprecedented inflows of highly skilled immigrants during the 1990s. The OLS results are robust to dropping observations from the year 2000, but the IV results are not. Table 7 reports the results. When observations from that year are not included, the estimated coefficients on the immigrant share measures are smaller in magnitude (closer to zero) for the pooled sample and for whites, and none are significant. The positive results for Hispanics are robust to dropping observations from 2000.

Our final important robustness check is to stratify the sample by sex. In results not shown here, the negative relationships between whether a white native majors in a STEM field and the immigrant share in the IV results, and the positive relationships for Hispanics, tend to hold for both men and women. However, for Asian women there is a significant negative relationship between majoring in a STEM field and each of the measures of the immigrant share other than the age cohort before college; for Asian men, the estimated relationships are all positive but not significant.

[18] Examples include programs started in the 1990s, such as UTeach at UT Austin (http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf) and STEM education programs sponsored by corporations, such as Texas Instruments (http://www.stemconnector.org/texas-instruments).

V. Discussion and Conclusion

This study examined whether higher immigration reduces the probability that natives who graduated from college did so with a STEM major. The results suggest that non-Hispanic whites are less likely to major in a STEM field the higher the immigrant share in their age cohort and in the labor force, although the estimated effects are small. This negative result is driven by data from the year 2000, the culmination of a period of strong economic growth, changes in immigration policy, and an Internet boom that led to a surge in inflows of highly skilled immigrants. Higher immigrant shares also appear to discourage Asian women from STEM majors, but they are positively related to the probability that Hispanics major in a STEM field. The immigrant share of college students appears to have the most adverse effect on whether natives major in STEM, suggesting that foreign students crowd out some natives from STEM majors.

Although the results suggest that immigration makes some natives less willing to major in STEM disciplines, there are several caveats to this finding. First, we condition on being a college graduate. The fraction of the population that graduates from college has increased over time, and the selectivity of this pool may have changed. Immigration may affect whether or where natives choose to go to college and whether they ultimately graduate from college. Immigration may raise the bar in STEM fields, increase the selectivity of natives into STEM majors, and ultimately have a positive effect on innovation. Alternatively, if immigration drives down earnings in STEM fields, immigration may reduce selectivity into STEM majors; Lowell et al. (2009) and Bettinger (2010) note a trend of top U.S. students moving from STEM majors to other fields, notably accounting and finance, which pay more. Looking at whether immigration affects selectivity into STEM majors is an important area for future research. Finally, we do not

examine whether immigration affects the career choices of STEM majors. Immigration may affect not only whether students choose to major in a STEM field but whether they pursue graduate studies and ultimately a career in STEM.

Even if immigration discourages natives from choosing STEM majors, we caution against drawing policy implications. If foreign students are on average better at STEM fields and therefore more likely to major in those fields, this frees up natives to pursue other careers. To the extent that people choose a profession in accordance with their comparative advantage, the resultant distribution of majors by nativity is optimal. Exceptions to this outcome might be situations where U.S. citizenship is a condition for STEM employment, such as in the defense industry and at national security agencies.

References

Altonji, Joseph G., Erica Blom, and Costas Meghir. 2012. "Heterogeneity in Human Capital Investments: High School Curriculum, College Major, and Careers." NBER working paper no. 17985.

Arcidiacono, Peter, V. Joseph Hotz, and Songman Kang. 2012. "Modeling College Major Choices Using Elicited Measures of Expectations of Counterfactuals." *Journal of Econometrics* 166: 3-16.

Barnett, Melissa D., Gerhard Sonnert, and Philip M. Sadler. 2012. "More Like Us: The Effect of Immigrant Generation on College Success in Mathematics." *International Migration Review* 46: 891-918.

Betts, Julian R. 1998. "Educational Crowding Out: Do Immigrants Affect the Educational Attainment of American Minorities?" In *Help or Hindrance? The Economic Implications of Immigration for African-Americans*, ed. Daniel S. Hamermesh and Frank D. Bean. New York: Russell Sage Foundation.

Betts, Julian R., and Magnus Lofstrom. 2000. "The Educational Attainment of Immigrants: Trends and Implications." In *Issues in the Economics of Immigration*, ed. George J. Borjas. Chicago: University of Chicago Press.

Bettinger, Eric. 2010. "To Be or Not To Be: Major Choices in Budding Scientists." In Charles T. Clotfelter, ed., *American Universities in a Global Market*. Chicago: University of Chicago Press.

Bettinger, Eric, and Bridget T. Long. 2005. "Do Faculty Serve as Role Models? The Impact of Instructor Gender on Female Students." *American Economic Review* VOL: 152-157.

Borjas, George J. 2000. "Foreign-Born Teaching Assistants and the Academic Performance of Undergraduates." *American Economic Review* 90: 355-359.

Borjas, George J. 2003. "The Labor Demand Curve *Is* Downward Sloping: Reexamining the Impact of Immigration on the Labor Market." *Quarterly Journal of Economics* 118: 1335–1374.

Borjas, George J. 2007. "Do Foreign Students Crowd Out Native Students from Graduate Programs?" In *Science and the University*, ed. Paula E. Stephan and Ronald G. Ehrenberg. Madison: University of Wisconsin Press.

Bound, John, Brad Hershbein, and Bridget Terry Long. 2009. "Playing the Admissions Game: Student Reactions to Increasing College Competition." *Journal of Economic Perspectives* 23: 119-146.

Bound, John, and Sarah Turner. 2007. "Cohort Crowding: How Resources Affect Collegiate Attainment." *Journal of Public Economics* 91: 877-899.

Brunello, Giorgio, and Lorenzo Rocco. 2011. "The Effect of Immigration on the School Performance of Natives: Cross Country Evidence Using PISA Test Scores." IZA discussion paper no. 5479.

Card, David. 2001. "Immigrant Inflows, Native Outflows and the Local Labor Market Impacts of Higher Immigration." *Journal of Labor Economics* 19: 22–64.

Card, David, and John E. DiNardo. 2000. "Do Immigrant Inflows Lead to Native Outflows?" *American Economic Review* 90: 360–67.

Card, David, and Alan B. Krueger. 1992. "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States." *Journal of Political Economy* 100: 1-40.

Chin, Aimee, N. Meltam Daysal, and Scott A. Imberman. 2012. "Impact of Bilingual Education Programs on Limited English Proficient Students and Their Peers: Regression Discontinuity Evidence from Texas." IZA discussion paper no. 6694.

Chiswick, Carmel U. 1989. "The Impact of Immigration on the Human Capital of Natives." *Journal of Labor Economics* 7: 464-486.

Cork, Daniel L., and Paul R. Voss, ed. 2006. *Once, Only Once, and in the Right Place: Residence Rules in the Decennial Census*. Washington, DC: National Academies Press.

Dynarski, Susan. 2008. "Building the Stock of College-Educated Labor." *Journal of Human Resources* 43: 576-610.

Eberhard, Juan. 2012. "Immigration, Human Capital and the Welfare of Natives." Mimeo, University of Southern California.

Freeman, Richard B. 2009. "What Does Global Expansion of Higher Education Mean for the US?" NBER working paper no. 14962.

Gould, Eric D., Victor Lavy, and M. Daniele Paserman. 2009. "Does Immigration Affect the Long-Term Educational Outcomes of Natives? Quasi-Experimental Evidence." *Economic Journal* 11: 1243-1269.

Griffith, Amanda L. 2010. "Persistence of Women and Minorities in STEM Field Majors: Is It the School that Matters?" *Economics of Education Review* 29: 911-922.

Hoffmann, Florian, and Philip Oreopoulos. 2009. "A Professor Like Me: The Influence of Instructor Gender on College Achievement." *Journal of Human Resources* 44: 479-494.

Hoxby, Caroline M. 1998. "Do Immigrants Crowd Disadvantaged American Natives out of Higher Education?" In *Help or Hindrance? The Economic Implications of Immigration for*

African-Americans, ed. Daniel S. Hamermesh and Frank D. Bean. New York: Russell Sage Foundation.

Hunt, Jennifer. 2012. "The Impact of Immigration on the Educational Attainment of Natives." IZA discussion paper no. 6904.

Jackson, Osborne. 2011. "Does Immigration Crowd Natives Into or Out of Higher Education?" Mimeo, Northeastern University.

Jensen, Peter, and Astrid Wurtz Rasmussen. 2011. "The Effect of Immigrant Concentration in Schools on Native and Immigrant Children's Reading and Math Skills." *Economics of Education Review* 30: 1503-1515.

Levine, Phillip B., and David J. Zimmerman. 1995. "The Benefit of Additional High-School Math and Science Classes for Young Men and Women." *Journal of Business & Economic Statistics* 13: 137-149.

Lowell, B. Lindsay, Hal Salzman, Hamutal Bernstein, and Everett Henderson. 2009. "Steady as She Goes? Three Generations of Students through the Science and Engineering Pipeline." Mimeo, Institute for the Study of International Migration, Georgetown University.

Massey, Douglas S., ed. 2010. *New Faces in New Places: The Changing Geography of American Immigration*. New York: Russell Sage Foundation.

National Science Board. 2002. *Science and Engineering Indicators 2002*. Arlington, VA: National Science Foundation.

National Science Board. 2012. *Science and Engineering Indicators 2012*. Arlington, VA: National Science Foundation.

Neymotin, Florence. 2009. "Immigration and Its Effect on the College-Going Outcomes of Natives." *Economics of Education Review* 28: 538-550.

Orfield, Gary, John Kucsera, and Genevieve Siegel-Hawley. 2012. *E Pluribus…Separation: Deepening Double Segregation for More Students*. UCLA Civil Rights Project.

Ottaviano, Gianmarco I.P., and Giovanni Peri. 2012. "Rethinking the Effects of Immigration on Wages." *Journal of the European Economic Association* 10: 152-195.

Rothstein, Donna S. 1995. "Do Female Faculty Influence Female Students' Educational and Labor Market Attainments?" *Industrial and Labor Relations Review* 48: 515-530.

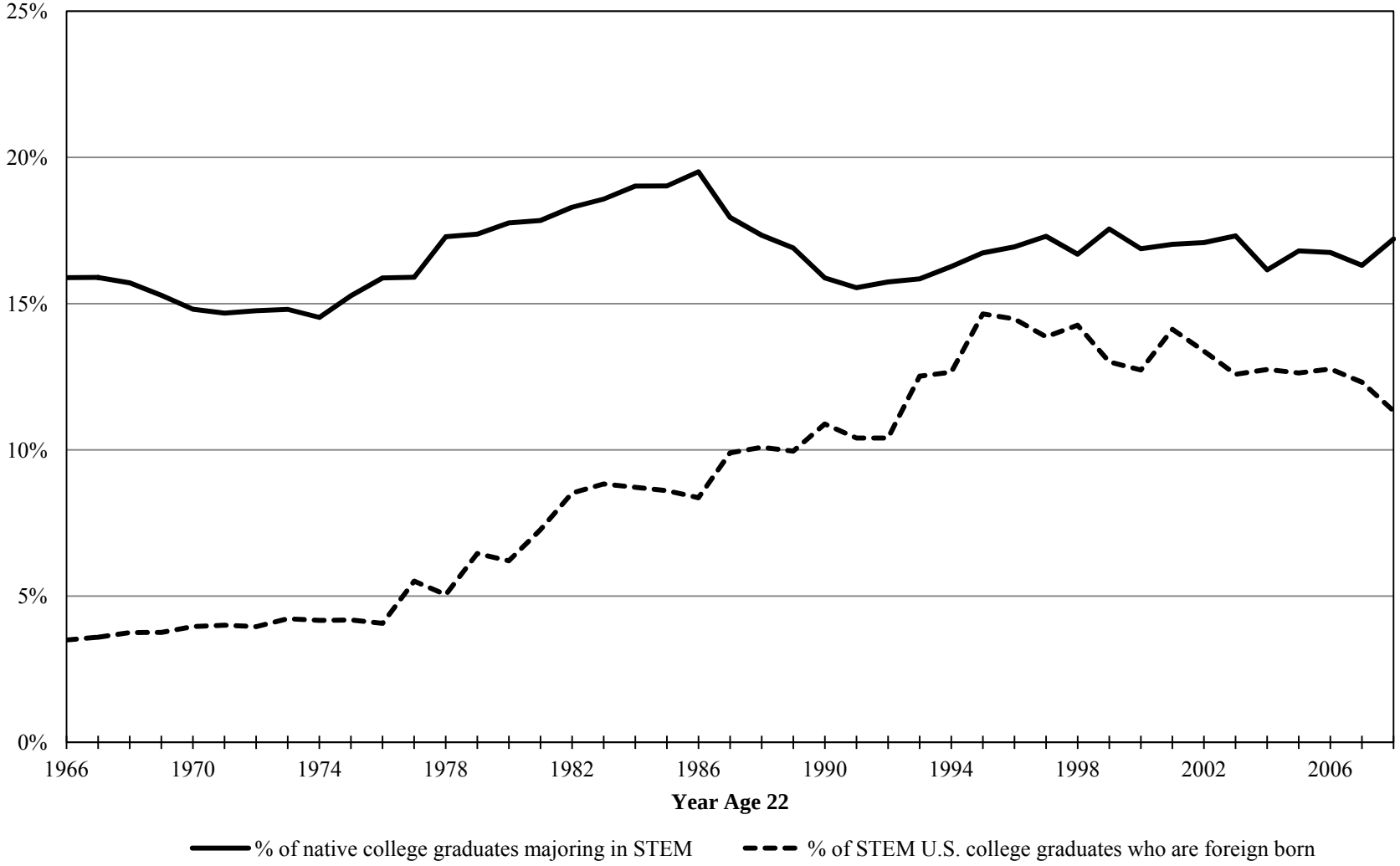
Saiz, Albert. 2007. "Immigration and Housing Rents in America." *Journal of Urban Economics* 61: 345-371.

Schwartz, Amy E., and Leanna Stiefel. 2006. “Is There a Nativity Gap? New Evidence on the Academic Performance of Immigrant Students.” *Education Finance and Policy* 1: 17-49.

Schwartz, Amy E., and Leanna Stiefel. 2011. “Immigrants and Inequality in Public Schools.” In *Whither Opportunity*, ed. Richard Murnane and Greg Duncan. Washington, DC: Brookings Institution.

Smith, Christopher L. 2012. “The Impact of Low-Skilled Immigration on the Youth Labor Market.” *Journal of Labor Economics* 30: 55-89.

Figure 1. The Proportion of U.S. Native College Graduates Majoring in STEM and the Proportion of U.S. STEM Majors Foreign Born



Note: Calculations based on 2009-2011 American Community Survey data for college graduates ages 25-65 at the time of the survey. Proportion of STEM U.S. college graduates who are foreign born is based on natives and immigrants who arrived in the U.S. by age 20, and only includes people living in the U.S. at the time of the survey. STEM does not include social sciences.

Table 1
Descriptive Statistics

	College cohort				
	All	2000	1990	1980	1970
% STEM major	16.4	16.8	15.8	18.2	14.7
% of age cohort foreign born, not including recent arrivals	3.9 (4.2)	6.3 (5.4)	4.5 (4.6)	2.9 (2.3)	1.7 (1.2)
% of college students foreign born	6.4 (5.4)	9.3 (6.7)	7.3 (6.0)	5.1 (3.3)	3.4 (2.1)
% of labor force foreign born	8.4 (7.3)	12.0 (9.0)	8.8 (7.6)	6.7 (5.2)	5.7 (4.5)
% of college graduates in labor force foreign born	8.2 (5.7)	11.5 (7.1)	8.5 (5.5)	6.8 (4.1)	5.8 (3.1)
% of college graduates in STEM occupations foreign born	13.1 (7.7)	18.8 (9.3)	13.0 (6.8)	11.1 (5.5)	9.1 (4.6)
Sample size	641,971	149,731	159,212	165,099	167,929

Note: The sample is U.S.-born college graduates who were aged 18-22 in the year indicated as the college cohort. Data are from the 2009-2011 American Community Surveys. Percentages foreign born are sample means (standard deviations) from decennial Census data for the measures indicated based on state of birth; see text for details. Observations are weighted using the person weights. Sample sizes are unweighted.

Table 2
Percent of U.S.-Born College Graduates Majoring in STEM, by Race/Ethnicity

	College cohort				
	All	2000	1990	1980	1970
All	16.4	16.8	15.8	18.2	14.7
Non-Hispanic whites	16.5	16.5	15.7	18.6	15.0
Non-Hispanic blacks	13.4	15.2	13.6	14.0	9.8
Asians	29.1	30.8	30.8	25.9	22.1
Hispanics	14.7	14.8	14.5	16.2	12.5

Note: The sample is U.S.-born college graduates who were age 18-22 in the year indicated as the college cohort. Data are from the 2009-2011 American Community Survey. Observations are weighted using the person weights.

Table 3
Characteristics of STEM and Non-STEM Majors, by College Cohort

	STEM Majors					Non-STEM Majors				
	All	2000	1990	1980	1970	All	2000	1990	1980	1970
% non-Hispanic white	85.2	78.4	83.0	88.7	91.7	84.7	80.3	83.1	86.6	89.4
% non-Hispanic black	6.2	7.3	7.5	5.7	4.2	7.9	8.2	8.9	7.8	6.7
% Asian	3.1	6.2	3.3	1.5	1.3	1.5	2.8	1.4	0.9	0.8
% Hispanic	3.7	5.6	4.5	2.8	1.6	4.2	6.6	5.0	3.2	2.0
% Female	29.6	37.0	31.0	28.3	20.5	57.1	60.0	58.0	57.4	52.6
% of age cohort foreign born, not including recent arrivals	3.9 (4.2)	6.2 (5.4)	4.4 (4.6)	2.9 (2.3)	1.8 (1.3)	3.9 (4.2)	6.3 (5.4)	4.5 (4.6)	2.9 (2.3)	1.7 (1.2)
% of college students foreign born	6.3 (5.4)	9.1 (6.6)	7.2 (6.0)	5.1 (3.3)	3.5 (2.2)	6.4 (5.4)	9.3 (6.7)	7.3 (6.0)	5.1 (3.4)	3.4 (2.1)
% of labor force foreign born	8.4 (7.2)	11.8 (8.9)	8.7 (7.5)	6.8 (5.2)	5.8 (4.5)	8.4 (7.3)	12.1 (9.0)	8.9 (7.6)	6.7 (5.2)	5.7 (4.5)
% of college graduates in labor force foreign born	8.2 (5.6)	11.3 (7.0)	8.5 (5.4)	6.9 (4.0)	5.8 (3.1)	8.2 (5.7)	11.6 (7.1)	8.5 (5.5)	6.8 (4.1)	5.8 (3.1)
% of college graduates in STEM occupations foreign born	13.2 (7.6)	18.6 (9.2)	12.9 (6.8)	11.3 (5.4)	9.2 (4.5)	13.1 (7.8)	18.9 (9.3)	13.0 (6.8)	11.1 (5.5)	9.0 (4.6)

Note: The sample is U.S.-born college graduates who were age 18-22 in the year indicated as the college cohort. Data are from the 2009-2011 American Community Survey. The totals for race/ethnicity do not sum to 100 because “non-Hispanic other race” is not shown. Observations are weighted using the person weights.

Table 4
OLS Regression Estimates for Determinants of Majoring in STEM

	All	Whites	Blacks	Asians	Hispanics
% of age cohort foreign born, not including recent arrivals	-0.008** (0.002)	-0.009** (0.003)	-0.006 (0.008)	-0.022 (0.026)	0.030* (0.012)
% of college students foreign born	-0.012** (0.003)	-0.011** (0.003)	-0.008 (0.008)	-0.009 (0.030)	0.019 (0.015)
% of labor force foreign born	-0.003 (0.003)	-0.008** (0.003)	0.007 (0.011)	0.020 (0.036)	0.055** (0.016)
% of college graduates in labor force foreign born	-0.008 (0.004)	-0.017** (0.004)	0.020 (0.016)	0.058 (0.044)	0.084** (0.021)
% of college graduates in STEM occupations foreign born	0.001 (0.003)	-0.002 (0.004)	0.005 (0.009)	-0.078* (0.031)	0.047* (0.019)

* $p<0.05$; ** $p<0.01$
Note: Each estimated coefficient is from a separate linear probability regression. Regressions also include controls for age and its square, sex, race/ethnicity categories (in column 1), and state and cohort fixed effects. Standard errors are robust and clustered on state*cohort.

Table 5
IV Regression Estimates for Determinants of Majoring in STEM

	All	Whites	Blacks	Asians	Hispanics
% of age cohort foreign born, not including recent arrivals	-0.008* (0.003)	-0.012** (0.004)	0.007 (0.018)	-0.053 (0.040)	0.040* (0.020)
% of college students foreign born	-0.021** (0.008)	-0.029** (0.009)	-0.011 (0.023)	-0.067 (0.043)	0.062* (0.031)
% of labor force foreign born	-0.010* (0.004)	-0.016** (0.004)	0.008 (0.018)	-0.059 (0.061)	0.066* (0.029)
% of college graduates in labor force foreign born	-0.010 (0.007)	-0.020** (0.007)	0.019 (0.026)	-0.151 (0.092)	0.098** (0.031)
% of college graduates in STEM occupations foreign born	-0.006 (0.008)	-0.018* (0.009)	0.035 (0.040)	-0.104 (0.059)	0.070* (0.029)

* p<0.05; ** p<0.01
Note: Each estimated coefficient is from a separate linear probability regression. Immigrant share variables are instrumented using the immigrant share if immigrants were distributed across states based on their distribution (within 16 region or country of origin groups) 10 years prior. Appendix Table 1 reports the first-stage results. Regressions also include controls for age and its square, sex, race/ethnicity categories (in column 1), and state and cohort fixed effects. Standard errors are robust and clustered on state*cohort.

Table 6
IV Regression Estimates for Determinants of Majoring in STEM, without California

	All	Whites	Blacks	Asians	Hispanics
% of age cohort foreign born, not including recent arrivals	-0.005 (0.004)	-0.011** (0.004)	0.007 (0.021)	-0.100* (0.051)	0.065* (0.029)
% of college students foreign born	-0.020* (0.010)	-0.032** (0.011)	-0.013 (0.028)	-0.135* (0.059)	0.098 (0.051)
% of labor force foreign born	-0.006 (0.004)	-0.014** (0.004)	0.006 (0.018)	-0.096 (0.080)	0.078** (0.029)
% of college graduates in labor force foreign born	-0.006 (0.007)	-0.019** (0.007)	0.017 (0.027)	-0.360 (0.219)	0.108** (0.033)
% of college graduates in STEM occupations foreign born	-0.002 (0.008)	-0.016 (0.009)	0.031 (0.040)	-0.170 (0.094)	0.074* (0.030)

* $p<0.05$; ** $p<0.01$
Note: Each estimated coefficient is from a separate linear probability regression. Immigrant share variables are instrumented using the immigrant share if immigrants were distributed across states based on their distribution (within 16 region or country of origin groups) 10 years prior. Regressions also include controls for age and its square, sex, race/ethnicity categories (in column 1), and state and cohort fixed effects. Standard errors are robust and clustered on state*cohort.

Table 7
IV Regression Estimates for Determinants of Majoring in STEM without the Year 2000

	All	Whites	Blacks	Asians	Hispanics
% of age cohort foreign born, not including recent arrivals	0.002 (0.004)	-0.003 (0.004)	0.032 (0.024)	0.023 (0.033)	0.033* (0.015)
% of college students foreign born	0.013 (0.018)	0.001 (0.016)	0.013 (0.050)	0.123 (0.071)	0.063* (0.029)
% of labor force foreign born	0.001 (0.004)	-0.004 (0.004)	0.020 (0.017)	0.045 (0.040)	0.054* (0.027)
% of college graduates in labor force foreign born	0.005 (0.008)	-0.001 (0.008)	0.013 (0.038)	0.033 (0.074)	0.110** (0.039)
% of college graduates in STEM occupations foreign born	0.004 (0.009)	-0.002 (0.010)	0.007 (0.062)	-0.010 (0.075)	0.076 (0.048)

* $p<0.05$; ** $p<0.01$
Note: Each estimated coefficient is from a separate linear probability regression. Immigrant share variables are instrumented using the immigrant share if immigrants were distributed across states based on their distribution (within 16 region or country of origin groups) 10 years prior. Regressions also include controls for age and its square, sex, race/ethnicity categories (in column 1), and state and cohort fixed effects. Standard errors are robust and clustered on state*cohort.

Appendix Table 1
First-Stage Regression Estimates for Immigrant Shares

	All	Whites	Blacks	Asians	Hispanics
% of age cohort foreign born,	0.639**	0.655**	0.550**	0.451**	0.539**
not including recent arrivals	(0.072)	(0.072)	(0.101)	(0.071)	(0.077)
F-test statistic	78.60	83.17	29.40	39.88	49.57
% of college students	0.389**	0.381**	0.497**	0.547**	0.491**
foreign born	(0.075)	(0.075)	(0.105)	(0.069)	(0.083)
F-test statistic	26.52	25.60	22.27	62.51	35.02
% of labor force foreign born	0.634**	0.651**	0.626**	0.341**	0.514**
	(0.072)	(0.069)	(0.093)	(0.053)	(0.097)
F-test statistic	77.97	88.16	44.94	40.79	28.06
% of college graduates in labor	0.455**	0.458**	0.412**	0.295**	0.539**
force foreign born	(0.048)	(0.047)	(0.062)	(0.049)	(0.060)
F-test statistic	90.34	94.61	44.35	35.74	81.83
% of college graduates in STEM	0.370**	0.370**	0.246*	0.446**	0.488**
occupations foreign born	(0.068)	(0.066)	(0.107)	(0.070)	(0.075)
F-test statistic	29.61	31.69	5.24	40.75	42.02

* $p<0.05$; ** $p<0.01$
Note: Each estimated coefficient is from a separate OLS regression. The right-hand-side variables shown are immigrant shares if immigrants were distributed across states based on their distribution (within 16 region or country of origin groups) 10 years prior. Regressions also include controls for age and its square, sex, race/ethnicity categories (in column 1), and state and cohort fixed effects. Standard errors are robust and clustered on state*cohort.