Some Benefit, Some Are Left Behind: NAFTA and Educational Attainment in the United States

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Abstract

This paper examines the persistent effects of eliminating tariffs on Mexican imports, following the implementation of the North American Free Trade Agreement (NAFTA), on Americans' human capital investment. We leverage quasi-experimental changes in tariffs on Mexican imports following NAFTA across birth cohorts and within states. We show that NAFTA increases the probability of ever attending college and earning a degree. These results, however, mask important heterogeneous effects within the sample. In terms of race and ethnicity, gender, and their intersection, we find white Americans drive these positive effects, which in turn are smaller for white women. In contrast, the educational attainment of racial and ethnic minorities, especially men, shrank under NAFTA, decreasing their probability of graduating from high school.

Keywords: NAFTA; human capital; trade openness; inequality.

JEL classification: F14, F61, I24, J15, J16.

1 Introduction

Between the inception of the North American Free Trade Agreement (NAFTA) in 1994 and its replacement with the United States-Mexico-Canada Agreement (USMCA) in 2020, there has been a substantial increase in the influx of imports from Mexico to the United States (Agama and McDaniel, 2002).[1] At the same time, offshoring under lower tariffs provided the American manufacturing sector an opportunity for higher profit margins. Meanwhile, Americans enrolled in high school during NAFTA had to make decisions steeped in the agreement's consequences.[2] Earlier empirical studies have found that trade openness increased Americans' high school graduation rates and college enrollment (Hickman and Olney, 2011; Greenland and Lopresti, 2016; Lee, 2021) because it worsened the job prospects of low-educated workers. In this paper, we show that these findings mask significant heterogeneity in educational attainment among different types of individuals, and that the effects persist in the long run.

Trade openness might not elicit homogeneous education responses across all agents for several reasons. First, some individuals will be unable to afford more education, no matter how beneficial it might be (Ferriere et al., 2018). Second, liberalization might reduce the expected income of low educated labor, but at the same time acquiring more education is costly because of both monetary and opportunity costs. Therefore, in a cost-benefit analysis, investing in human capital after trade liberalization might not be the most rational decision

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[1] The growth of U.S. imports from Mexico between 1993 and 2001 was 190%, more than twice that from Canada (69%) and more than three times that from the rest of the world (60%).

[2] In this paper we speak of "NAFTA" for brevity, but refer exclusively to its Mexico-U.S. dimension.

for all agents (Gómez-Ramírez and Padilla-Romo, 2021).[3] Finally, globalization might elicit heterogeneous incentives for individuals with different skill levels. For example, Blanchard and Willmann (2016) present a theoretical model in which globalization increases education costs and reduces the real wages of middle-skilled labor while having the opposite effect on both low and high-skilled labor;[4] and Hakobyan and McLaren (2016) show that trade openness slowed wage growth for low-skilled workers.[5]

We contribute to the literature on globalization and human capital investment by providing new evidence on skills acquisition heterogeneity in the long-run. We leverage quasi-experimental changes in tariffs on Mexican imports following NAFTA and individual-level data on schooling outcomes to estimate the persistent effects of trade openness on Americans' educational attainment. Using a difference-in-differences research design, we compare education outcomes across birth cohorts and within states, allowing us to control for time-invariant state characteristics and nationwide education trends. Specifically, we estimate how industries losing protection from competition following NAFTA affected education outcomes of individuals who had not completed compulsory education in 1994. To do so, we use educational attainment data from the American Community Survey (ACS) for individuals aged 24 years and older as well as U.S. tariffs on Mexican imports, and on total exports from

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[3]In fact, a classic insight of the poverty traps literature is that behaving in ways which self-reinforce poverty is a rational decision under some circumstances (Azariadis and Stachurski, 2005).

[4]Along those lines, Autor et al. (2013) and Pierce and Schott (2016) show that trade openness reduces employment in the manufacturing sector. Moreover, Ebenstein et al. (2014) examine the effects of offshoring on U.S. employment, finding negative effects on employment when offshoring occurred in low-wage countries but beneficial ones when it occurred in high-wage countries. Similarly, Bernard et al. (2006) show that imports from low-wage countries negatively impacted U.S. plant survival rates and growth.

[5]The general point raised by contributions like Blanchard and Willmann's is that, if globalization exerts heterogeneous effects among different types of individuals, then it should not be controversial to find that their responses are also heterogeneous.

Mexico to the U.S. and the rest of the world, reported by Hakobyan and McLaren (2016).[6]
We start by analyzing the effects for the full sample and then examine heterogeneous effects by gender, minority status, and their intersection.[7]

Our findings are indeed different at each level of investigation. The analysis of the full sample shows that NAFTA drove Americans to attain higher levels of education overall. Specifically, we find that a one percentage point (pp) decrease in tariffs on Mexican imports considering products in which Mexico had a revealed comparative advantage did not affect high school graduation while it increased Americans' probability of attending college, attaining an associate's degree or higher, and attaining a bachelor's degree or higher by 0.6, 0.4, and 0.7 pp, respectively. Yet these results mask important differences in terms of minority status, gender, and their intersection. Our heterogeneity analysis shows white Americans drive these positive effects, which are smaller for white women. In contrast, minority Americans' educational attainment shrank under NAFTA. We find that the same one pp decrease in tariffs reduced minority Americans' probability of graduating from high school by 1.2 pp, 1.8 pp for men and 0.8 pp for women.

The validity of these estimates relies on the assumption that absent NAFTA, states with a high *vulnerability* to NAFTA would have followed the same education trends than states with a low vulnerability (within the same region of the country).[8] We relax this assumption and provide graphical and empirical evidence that it is plausible in our setting. Specifically, we show education trends separately for the most and the least affected states before and after

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[6]These data were originally collected by John Romalis and are described in Feenstra et al. (2002).

[7]We define minorities as Black, Hispanic, and Native Americans.

[8]States' vulnerability to NAFTA is a measure of a state's industries losing protection from competition following NAFTA. See Section 2 for a more detailed description of our vulnerability measure.

NAFTA came into effect. We also estimate placebo effects for individuals less likely to be affected by NAFTA, namely individuals aged 18 years and older in 1994. Moreover, we show that our estimates are robust to controlling for the introduction of merit-based financial aid programs. These represent major potential confounders in our setting, particularly, because many of these programs were rolled out in states with a high vulnerability to NAFTA (e.g., Georgia and South Carolina).[9]

Several empirical studies have examined the effects of globalization on human capital investment in a variety of countries.[10] A number of papers study the effects of U.S. trade liberalization on different measures of human capital. Using offshoring and immigration in the United States as measures of globalization, Hickman and Olney (2011) examine the effects of trade liberalization on enrollment in post-secondary education. They find that average enrollment increased with larger gains for community colleges. They attribute this response to increased competition for low-skilled labor. Interestingly, they also find Black Americans did not increase their enrollment at any level. Greenland and Lopresti (2016) and Ferriere et al. (2018) examine the effects of Chinese imports' growth on educational attainment in the United States. Greenland and Lopresti (2016) find positive effects on high school graduation rates, which they posit were prompted by worsening job prospects for high school dropouts. Ferriere et al. (2018) examine the same import growth but in the context of

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[9]For example, Dynarski et al. (2000) shows that the Georgia's HOPE Scholarship increased college attendance; Goodman (2008) shows that the Massachusetts' Adams Scholarship increased enrollment in public 4-year institutions; Dynarski (2008) shows that Georgia's and Arkansas' HOPE scholarships increased college enrollment and completion; Sjoquist and Winters (2015) find no significant effects on college completion of twenty-five merit-based financial aid programs; and Bruce and Carruthers (2014) show that Tennessee's HOPE Scholarship had no effects on college attendance overall but it caused a substitution from 2-year community college to 4-year institutions.

[10]See Sun et al. (2019) for a systematic review highlighting 25 papers published in scholarly journals since 1995.

post-secondary enrollment. After their econometric analysis found positive average effects, they build and calibrate a theoretical model to uncover significant heterogeneity in their results, finding that richer households with good credit access drive the results while those who are credit-constrained are adversely affected.

Moreover, Batistich and Bond (2019) examine the 1970s-1980s Japanese trade impact on U.S. manufacturing employment, finding on average no adverse effect. They further explore heterogeneous effects by race, separating white from Black men and finding increased hiring among whites but decreased employment among Black Americans. They attribute such heterogeneous results to the educational attainments of each group: white men were more and better educated than Black men, and Japanese trade decreased(increased) the demand for less(more) educated labor. In addition, Kalil and Wightman (2011) show that parental job loss is associated with a decreased likelihood of obtaining any post-secondary education for children regardless of parents' race. However, that negative association is three times stronger for children of black parents. These results support the notion that trade openness might have different effects on different types of individuals, including their decision to attain higher levels of education.

Directly related to our work, Lee (2021) studies the impact of NAFTA on community college enrollment and completion between 1991 and 2001, finding positive effects on enrollment and, although smaller, on completion rates. Like Hickman and Olney (2011) and Greenland and Lopresti (2016), Lee attributes this increase in educational attainment to the worsening of labor market conditions.[11] In this paper, we use individual-level data and allow

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[11]Interestingly, Lee (2021) further examines the effects of NAFTA on enrollment by commuting zones'

our model to capture heterogeneous responses to trade liberalization for different types of individuals.

Our paper contributes to the above literature by first examining the persistent effects of NAFTA, one of the most hotly-debated trade policies in the United States, on individual-level educational attainment and college degree completion. Second, we allow for heterogeneous human capital responses to liberalization, which aggregated approaches had not uncovered and which are important to understanding long-run sources of inequality and for targeting policies in the future.

More broadly, our paper contributes to the extensive literature on the consequences of NAFTA (for an overview see Burfisher et al., 2001). For example, Romalis (2007) and Caliendo and Parro (2015) examine the effects of the agreement on trade and welfare measures, finding large trade effects but small welfare gains. Hakobyan and McLaren (2016) examine how NAFTA impacted U.S. wages, at the industry and local geographic levels of a Consistent Public-Use Microdata Area (*conspuma*), finding lower wage growth among blue-collar workers in the most affected locations and industries. Other contributions have examined the impact of trade liberalization on the Mexican side of the border.[12] Most related to our work, two studies have examined its effects on human capital. Using data from 1990 and 2000, Le Brun et al. (2011) find manufacturing job growth had positive effects on compulsory school attainment in children aged 7 to 15; but these effects were insignifi-

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demographic characteristics and finds that the positive effects on community enrollment are mainly driven by areas with lower-than-average share of black Americans and those with fewer women. These results are consistent with the heterogeneous findings of our analysis.

[12]Trefler (2004) examines the effects on Canada of CUSFTA (the Canada-United States Free Trade Agreement) and its NAFTA extension to Mexico, highlighting short-run adjustment costs and long-run gains.

cant for older high schoolers. Also analyzing the effects by gender, they find adverse effects among females, which they attribute to the increased opportunity costs of schooling for teenage girls. In addition, Atkin (2016) finds Mexico's export-manufacturing jobs growth decreased schooling among teenagers. Unlike Le Brun et al. (2011), Atkin (2016) finds that teenage boys were more likely to drop out of school than girls, and attribute this difference to manufacturing jobs being more male-oriented.

The rest of this paper is organized as it follows. In Section 2, we present the data used in our analysis. We then turn to our empirical strategy in Section 3. Results from full-sample and minority status and gender heterogeneity analyses are presented in sections 4 and 5, respectively. Section 5 also explores secondary and post-secondary educational choices by birth cohort to determine whether schooling decisions after NAFTA were immediate or gradual. Section 6 concludes the paper.

2 Data

To analyze how NAFTA affected Americans' human capital investment, we use survey and administrative data from various sources to create a panel of states with individual-level educational outcomes, demographic characteristics, and a measure of individual exposure to NAFTA in their state of birth.

Educational attainments are our key outcome variables. Specifically, these variables include indicators of whether an individual (a) has a high school diploma or higher, (b) attended some college, (c) has an associate's degree or higher , and (d) has a bachelor's degree

or higher; for brevity, in what follows we omit the words "*or higher*" in these categories. This information comes from the American Community Survey (ACS) for the 2001-2019 period and is collected from the Integrated Public Use Microdata Series from the United States (IPUMS-USA). The ACS also provides information on demographic characteristics, including gender, race, ethnicity, English-speaking status, and year and state of birth. We use the year and state of birth to identify the time at which individuals decide whether to pursue the levels of education identified above, and to match those individuals with our measures of exposure to NAFTA. Specifically, we use the year of birth to calculate their age when the agreement came into effect (January 1, 1994). This information allows us to identify at what age an individual born in a given state had to make education decisions; we define that age as 17 years or younger in 1994.[13]

Our key variable of interest is states' *vulnerability* to NAFTA. It is a measure of a state's industries losing protection from competition following NAFTA. To construct this measure, we use data regarding U.S. tariffs on Mexican imports, and on total exports from Mexico to the United States and the rest of the world, reported by Hakobyan and McLaren (2016) and originally collected by John Romalis and described in Feenstra et al. (2002).

Hakobyan and McLaren estimate the local (Consistent Public-Use Microdata Areas, or *conspumas*) change in tariffs on imported goods, excluding agriculture, from Mexico during the 1990-2000 period accounting for Mexico's revealed comparative advantage in given goods.[14] To measure a state's vulnerability to NAFTA, we follow Hakobyan and McLaren

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[13]It is important to mention that the amount of compulsory education in 1994-1995 varied across states (between 16 and 18 years). In our model, we use 17 years as our key age of exposure; but our results are robust to using 16 or 18.

[14]A good measure of NAFTA's impact should take into account Mexico's comparative advantage in the

(2016) approach; however, given that we do not observe individuals' *conspuma* of residence at age 17, we aggregate industries to the state level. The states' change in tariffs, Δt^s, is then expressed as:

$$\Delta t^s = \frac{\Sigma_{j=1}^{N} L_{1990}^{sj} RCA^j \Delta t^j}{\Sigma_{j=1}^{N} L_{1990}^{sj} RCA^j} \tag{1}$$

where Δt^j is the change in tariffs from 1990 to 2000 in industry j; N is the total number of industries; L_{1990}^{sj} is the number of workers in state s working in industry j in 1990; and RCA^j is Mexico's revealed comparative advantage in good j. The latter is expressed as:

$$RCA^j = \frac{\left(\frac{x_{j,1990}^{MEX}}{x_{j,1990}^{ROW}}\right)}{\left(\frac{\Sigma_i x_{i,1990}^{MEX}}{\Sigma_i x_{i,1990}^{ROW}}\right)} \tag{2}$$

where $x_{j,1990}^{MEX}$ are total exports of good j from Mexico to the rest of the world excluding the United States; $x_{j,1990}^{ROW}$ are total exports of good j from the rest of the world excluding the United States and Mexico.

To illustrate the geographic distribution of states' vulnerability to NAFTA, we group states by quartiles of our vulnerability measure, Δt^s : high, medium, low, and very low. States in the top quartile of Δt^s are the most vulnerable, and states in the bottom quartile are the least vulnerable. Figure 1 shows the geographic distribution of vulnerability. It is important to note that there is variation across the four U.S. regions as well as within region.[15] We leverage both sources of variation in our identification strategy.

good(s) it is referring to because, as Hakobyan and McLaren (2016) observe, "a high tariff on imports of good j from Mexico makes no difference if Mexico has no comparative advantage in j and will not export it regardless of the tariff." See Hakobyan and McLaren (2016) for more details on the construction of this measure of U.S. locations' vulnerability to NAFTA.

[15]The U.S. regions we consider are: the Northeast, the Midwest, the South, and the West.

In some specifications, we control for indicators of whether and when merit-based financial aid programs were adopted in individuals' state of birth at the time they were aged 18 years or younger. These data come from Sjoquist and Winters (2015) who classify states with merit-based programs as weak or strong depending on how generous the financial aid was.[16]

Our analytical sample consists of 5,624,233 white, Black, Native American, and Hispanic individuals aged 24 years and older in the survey year, and born in the United States between 1970 and 1982.[17] The rationale behind this sample's selection is that individuals' schooling decisions were likely to be affected by trade openness for people who had yet to complete compulsory education by 1994.[18] We then include individuals on both sides of the compulsory age of school attendance threshold (17 years) and avoid overlap with China's accession to the World Trade Organization in 2001. The 24 years or older in survey year threshold was selected to be just above the average college graduation age of 23 years.

Figures 2 and 3 show education trends for individuals born in states with high and very low vulnerability to NAFTA, separately for whites, and racial and ethnic minorities. Overall, very low and high vulnerability states for both whites and minorities followed the same trend prior to 1994. However, after NAFTA came into effect, they started to diverge. While it is difficult to appreciate the size of the effects, panel (a) of Figure 2 and panels (a) and (c) of Figure 3 show that there is an increase in the share of white individuals ever attending

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[16]Strong merit-based states include Florida (1999), Georgia (1993), Kentucky (1999), Louisiana (1998), Nevada (2000), New Mexico (1997), and South Carolina (1998). Weak merit-based states include Alaska (1999), Arkansas (1991), Illinois (1999), Mississippi (1996), Missouri (1997), New Jersey (1997), New York (1997), North Dakota (1994), Oklahoma (1996), Utah (1999), and Washington (1999).

[17]They turned 18 during the 1988-2000 period—i.e., in the time span from 6 years before to 6 years after NAFTA was implemented.

[18]The ACS also reports whether an individual's education attainment is imputed. To provide a cleaner measure for our outcome variables, we dropped from the sample individuals with imputed educational attainment. Our results, however, are robust to including those observations.

college and earning a degree (relative to white individuals born in very low vulnerability states). In contrast, panel (b) of Figure 2 shows that there is a decrease in the share of racial and ethnic minorities graduating from high school after NAFTA came into effect.

3 Empirical Strategy

We estimate the effects of eliminating tariffs on Mexican imports on educational attainment using a difference-in-differences research design that leverages within state of birth variation in states' vulnerability to NAFTA. Our baseline specification is expressed as:

$$Schooling_{iscy} = \beta_0 + \beta_1 \Delta t_c^s + X_{iscy}\delta + \alpha_s + \omega_{rc} + \theta_y + u_{iscy} \tag{3}$$

where $Schooling_{iscy}$ are indicator variables of whether individual i born in state s in year c and observed in survey year y has a high-school diploma, some college, an associate's degree, or a bachelor's degree; X_{iscy} are indicator variables for whether the individual is a female, Black, Native American, or Hispanic, and whether he or she speaks English; α_s are state of birth fixed effects; ω_{rc} are region-of-birth-by-birth-cohort fixed effects; θ_y are survey year fixed effects; and u_{iscy} is an error term that we allow to be correlated within state of birth. Our key variable of interest is Δt_c^s, which is our measure of states' lost protection following NAFTA (i.e., the change in tariffs for cohorts that were 17 years and younger in 1994, and zero otherwise). Because we do not observe the state in which students turned 17, we use state of birth as a proxy. Although we could have used state of residence as a proxy, we declined to do so to avoid introducing endogeneity issues, given that individuals are likely

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to migrate to attend college and remain in the college's state after graduation (Groen and White, 2004; Groen, 2004; Gottlieb and Joseph, 2006).

Our coefficient of interest is, thus, β_1. It measures the average intent-to-treat effect on educational attainment of a one *pp* decrease in tariffs on Mexican imports between 1990 and 2000. This coefficient is identified under the common trends assumption that, absent NAFTA, individuals born in vulnerable states would have followed similar education trends to those born in the states with low vulnerability. We relax this assumption by additionally including region-of-birth-by-birth-cohort fixed effects, thereby comparing affected and non-affected individuals born in states in the same region of the country. We also show that our estimates are robust to the inclusion of time-varying individual controls, including demographics and whether and when states implemented merit-based financial aid programs. We further control for birth-cohort-by-survey-year fixed effects, thereby comparing changes in the education decisions between individuals of the same age in affected and non-affected states the same survey year. Finally, to provide evidence in favor of the parallel trends assumption of our difference-in-differences design, in figures 2 and 3, we show education trends by birth cohort, minority status, and states' vulnerability to NAFTA before and after the agreement came into effect.

4   Full-sample Results

Panel A in Table 1 shows the estimated average intent-to-treat effects of lost protection following NAFTA on having a high school diploma, and Panel B the estimated effects on

ever attending college. Column 1 presents our baseline specification based on equation (3), which includes state of birth, region-of-birth-by-birth-cohort, and survey-year fixed effects. In Column 2, we also include individual demographics, including gender, race, ethnicity, and whether the individual speaks English. In Column 3, we additionally control for whether and when states introduced merit-based financial aid programs, weak and strong, as described in Sjoquist and Winters (2015). Finally, Column 4 presents our preferred specification, in which additional controls for birth-cohort-by-survey-year fixed effects are also included, thereby comparing changes in the education decisions between individuals of the same age in affected and non-affected states the same survey year. In our four specifications, Panel A's estimates indicate trade openness did not affect whether an individual has a high school diploma, with point estimates that are negative, close to zero, and statistically insignificant. However, the estimates in Panel B indicate NAFTA did affect whether individuals attended college. Our preferred specification in Column 4 indicates that a one pp decrease in tariffs on Mexican goods increased Americans' probability of ever attending college by 0.6 pp.

In Table 2, we further investigate the effects of NAFTA trade openness on college degree completion. Panel A shows the estimated effects on attaining an associate's degree and Panel B on completing a bachelor's degree. The estimates in our preferred specification, given in Column 4, indicate that the states' lost protection following NAFTA increased the likelihood of completing a college degree. In particular, we find that a one pp decrease in tariffs increases Americans' probability of attaining an associate's degree and of attaining a bachelor's degree by 0.4 and 0.7 pp, respectively. To put the magnitude of the effects

in context, the white-minority college degree gap in our data is 18 *pp*, 39% for whites and 21% for racial and ethnic minorities.[19] For example, for individuals 17 and younger in 1994, born in South Carolina, the most vulnerable state, where tariffs on products from Mexico decreased by 2.48 *pp*, NAFTA increased bachelor's degree completion by 1.7 *pp* or 9.4% of the White-minority bachelor's degree gap.

5   Treatment Effect Heterogeneity

Being aware that the above aggregate analysis may be masking important heterogeneous effects, we now present a disaggregated analysis. We examine the impact of states' vulnerability to NAFTA on educational attainment—distinguishing first by gender, then by minority status, and by both gender and minority status. Finally, we conduct the analysis by birth cohort to further explore whether schooling responses to NAFTA were immediate or gradual and to empirically test for pre-trends.

5.1   Gender

Table 3 presents the results of the analysis disaggregating by gender. Panels A and B show the estimated effects of NAFTA for men and women, respectively, on the different measures of education decisions; all estimates are from our preferred specification. Columns 1 through 4 show the estimated effects on having a high-school diploma, attending college, obtaining an associate's degree, and obtaining a bachelor's degree, respectively. Our estimates indicate

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[19]For some college, the White-minority gap is 14 *pp*, 71% for whites and 57% for minorities.

gender differentiated NAFTA's effects. In particular, we find that a one *pp* decrease in tariffs on Mexican goods decreased men's likelihood of graduating from high school by 0.3 *pp*, while it increased men's probability of attending college, of attaining an associate's degree, and of attaining a bachelor's degree by 0.6, 0.5, and 0.9 *pp*, respectively. We find the same decrease in tariffs did not affect women's probabilities of graduating high school while it did increase their probability of attending college and of attaining a bachelor's degree by 0.6 and 0.6 *pp*, respectively.

5.2   Minority Status

Table 4 presents the results of our analysis disaggregating by minority status, separating white from Black, Native American, and Hispanic Americans. Panels A and B show the estimated effects of NAFTA for white and minority individuals, respectively, on the different measures of education decisions; as above, all estimates are obtained using our preferred specification. Columns 1 through 4 show the estimated effects on the four education categories. The estimates clearly indicate NAFTA had different effects on racial and ethnic minorities than on their white counterparts. In particular, we find that a one *pp* decrease in tariffs on Mexican imports increases white Americans' probability of attending college, of obtaining an associate's degree, and of obtaining a bachelor's degree by 0.9, 0.5, and 0.8 *pp*, respectively. In contrast, among minority Americans we find the same *pp* decrease in tariffs reduced their likelihood of graduating high school by 1.2 *pp*.

5.3   Gender and Minority Status

Table 5 presents the results of this more detailed analysis for men. Panels A and B show the estimated NAFTA effects on schooling for white and minority men, respectively; as before, columns 1 through 4 show the estimates effects across the previously mentioned education categories, and all are obtained with our preferred specification. Again, our estimates indicate heterogeneous NAFTA effects among American men. On the one hand, among whites we find that a one *pp* decrease in tariffs increases their probability of attending college, of obtaining an associate's degree, and of obtaining a bachelor's degree by 0.9, 0.6, and 1.1 *pp*, respectively. On the other hand, and in sharp contrast, we find that among minority Americans the same decrease in tariffs decreases their likelihood of finishing high school by 1.8 *pp*. In fact, this is the largest (in absolute value) estimate in our disaggregated examinations, suggesting that human capital among Black, Native American, and Hispanic men at the bottom of the educational ladder was the most severely and adversely affected by NAFTA's trade openness.

Table 6 presents the same analysis for women. Panels A and B show the estimated effects of NAFTA for white and minority women, respectively. Again, columns 1 to 4 follow the four aforementioned education categories, and all estimates are from our preferred specification. Our estimates clearly indicate heterogeneous effects of NAFTA among American women. On the one hand, we find that among white women a one *pp* decrease in tariffs following NAFTA increases their likelihood of attending college and of obtaining a bachelor's degree by 0.9 and 0.6 *pp*, respectively. On the other hand, and in stark contrast, we find that among

minority women the same one *pp* decrease in tariffs decreases their probability of graduating from high school by 0.8 *pp*.

We summarize these results in Figure 4, where we present the estimated effects of NAFTA on our four education outcomes for the overall sample, and separately for white men and women, and for minority men and women. We can see that the overall positive effects on attending college and degree completion are driven by white men and women while we see a decrease in the probability of graduating from high school for minority men and women.[20]

5.4   Birth Cohort

We further explore heterogeneity of treatment by birth cohort and provide empirical support to the validity of our research design. It is possible, for example, that people did not immediately adapt their schooling decisions to NAFTA, but rather gradually updated their beliefs about education's future returns. Moreover, individuals aged 18 and older in 1994 are less likely to be affected by NAFTA because they have already graduated from high school in 1994. To allow for this possibility, we estimate a modified version of Equation (3) in which we interact our variable of interest, Δt_c^s, with indicator variables of whether individual i was born in year c using an event study-like specification.

Figure 5's panels (a) through (d) present the estimated effects, on having a high school diploma, attending college, attaining an associate's degree, and attaining a bachelor's degree, respectively, for individuals aged between 12 and 20 years in 1994. All estimated differences

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[20]The findings that both minority men and women high school graduation rates were negatively affected by NAFTA is worrisome, because according to Heckman and LaFontaine (2010), "the high school graduation rate is a barometer of the health of American society."

are compared to the omitted cohorts: aged 21 to 24 years in 1994. We present the results separately for whites and for racial and ethnic minorities in our sample. The estimated effects in Panel (a) indicate that NAFTA decreased minorities' likelihood of having a high school diploma while having no effect among whites. The point estimates for minorities are small and not statistically significant for individuals that were 17 years old or older in 1994 but the effects are negative and do increase over time for individuals aged 16 years or younger in 1994. This pattern of effects is consistent with the idea that individuals gradually adapted their beliefs about potential returns to education and that older individuals' decisions to acquire more education are unlikely to be affected by NAFTA. The estimated effects in Panel (b) indicate NAFTA trade openness increased the likelihood of ever attending college for white individuals while it had no effects for minorities (their estimated effects are negative but noisier and not statistically significant at conventional levels). The estimates shown in panels (c) and (d) indicate NAFTA did not affect the probability of minorities attaining a college degree; in contrast, it increased the likelihood of attaining a bachelor's degree among whites.

6   Concluding Comments

A number of studies including Hickman and Olney (2011), Greenland and Lopresti (2016), and Lee (2021) have examined the impact of globalization on U.S. human capital investment, finding that globalization increases high school graduation rates and college enrollment. The rationale of these results is that globalization adversely impacts low-skill employees

through lower wages and reduced employment, in turn spurring increased education among Americans. While this might be truth on average, it could mask important heterogeneous effects for different types of individuals.

This paper contributes to the literature by examining the persistent effects of NAFTA on educational attainment in the United States and by conducting the analysis at two levels: (a) using the whole sample, finding that NAFTA increased their schooling and (b) distinguishing by gender, minority status, and their intersection, finding that the aggregate positive effects on education were driven by white Americans, that increases in schooling were larger for men than for women, that minority men were particularly adversely affected, and that minority women were also adversely affected.

Why might globalization elicit different decisions about education among affected individuals? For the results presented by Hickman and Olney (2011), Greenland and Lopresti (2016), and of Lee (2021) to hold, it must be that (a) reducing the expected rewards to low-education jobs is the sole or most salient effect of globalization; (b) even though acquiring education is costly (because of both monetary and opportunity costs), increasing education is still the most rational decision; and (c) the affected individuals can afford to invest in more education. Thus, the reasons for which NAFTA did not produce homogeneous human capital responses should be related to situations in which either (a), (b), (c), or some combination of them did not hold.

In other words, the effects of liberalization on human capital investment are more complex than monotonic responses because they are related to the interplay of various processes.

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On the one hand, by reducing the expected rewards of low-educated labor (through lower wages and fewer jobs), liberalization calls for higher investment in human capital (Hickman and Olney, 2011; Greenland and Lopresti, 2016; Lee, 2021). On the other hand, trade liberalization could have effects other than reducing the rewards for low-educated labor (Blanchard and Willmann, 2016). Furthermore, acquiring education is costly because of both monetary and opportunity costs. Because of these reasons, therefore, in a cost-benefit analysis, increasing schooling might not remain the most rational decision for all agents (Gómez-Ramírez and Padilla-Romo, 2021). Finally, and regardless of how better or worse investing in human capital could be, some agents face credit constraints preventing them from affording more education (Ferriere et al., 2018).

Related to these reasons, this paper brings to the forefront the findings that NAFTA's trade openness is associated with increased human capital investments among some Americans while others are left behind.

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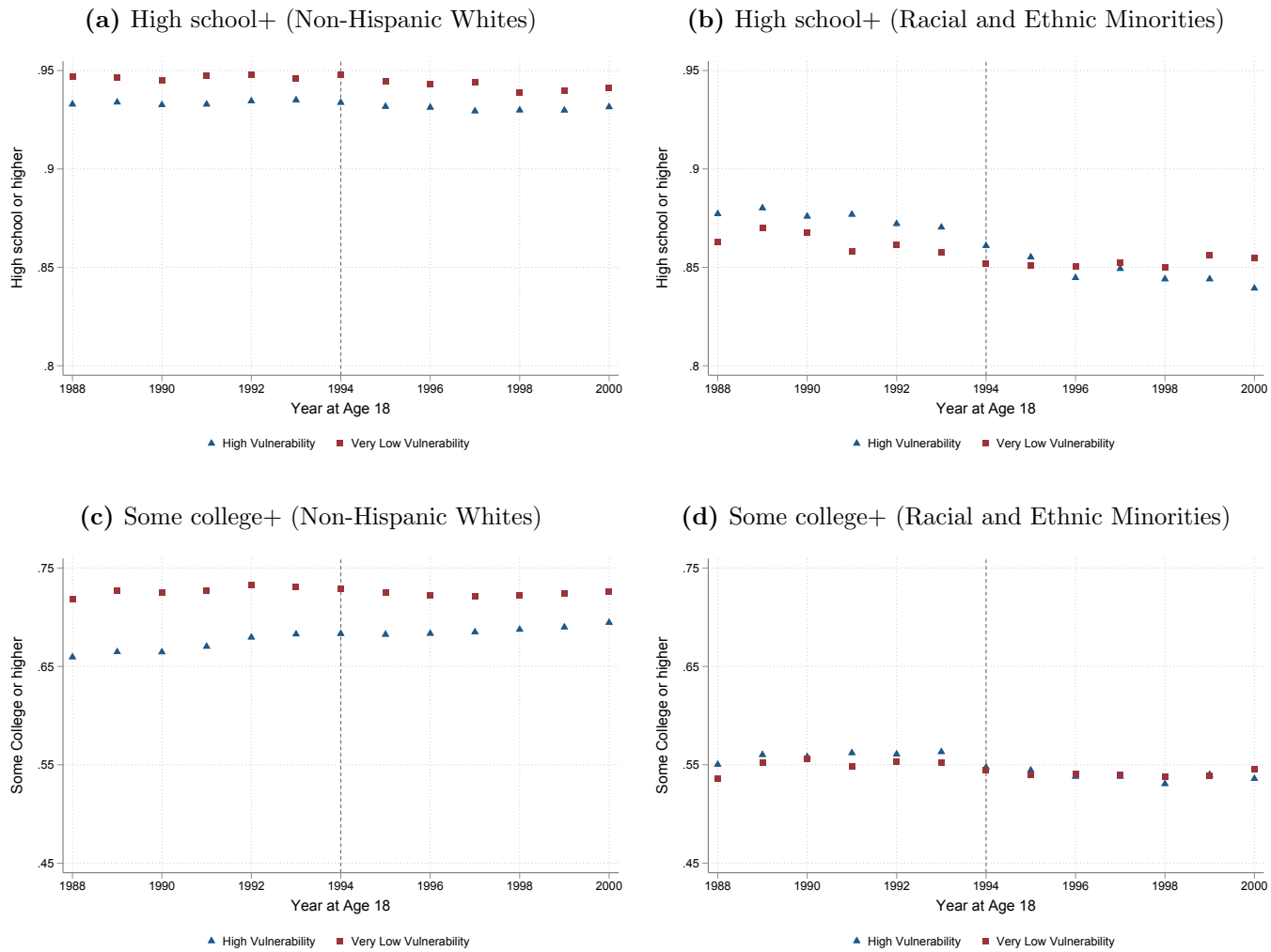
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Figure 1: States' Vulnerability to NAFTA
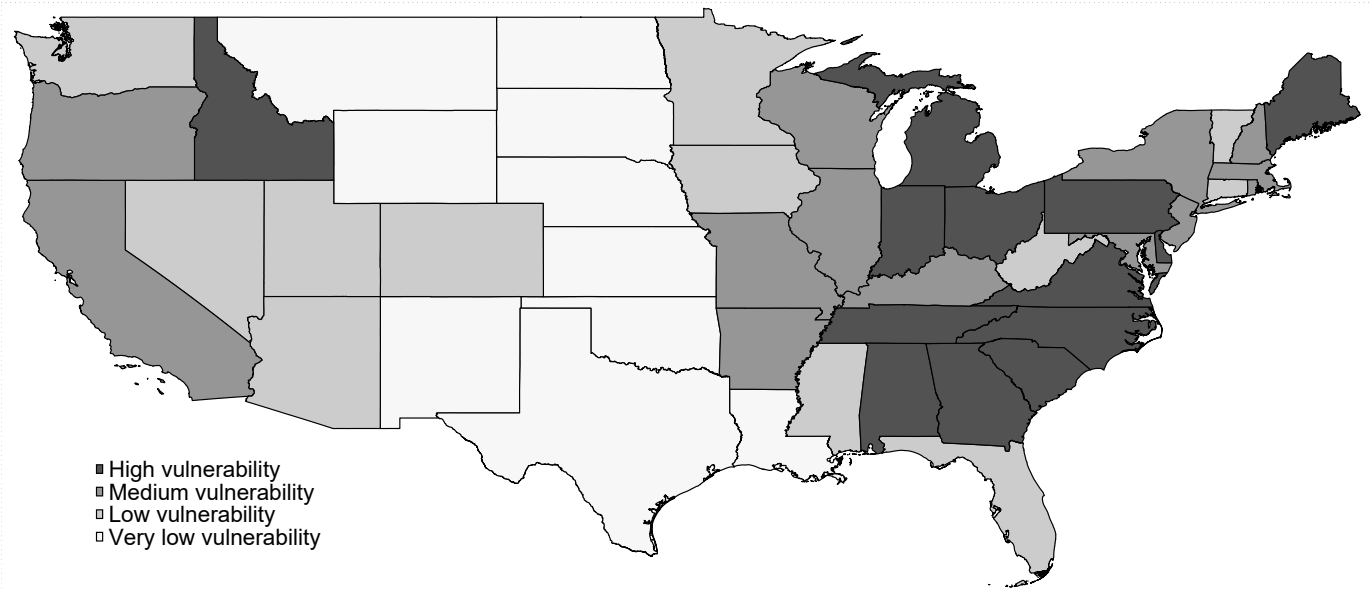
Notes: High, medium, low, and very low vulnerability corresponds to changes in tariffs in the top (0.98%-2.49%), third (0.7%-0.94%), second (0.41%-0.66%), and bottom quartiles (0.08%-0.4%). Alaska and Hawaii, with very low and low vulnerability, respectively, are not shown in the map.

Figure 2: Education Trends by State's Vulnerability to NAFTA, Birth Cohort, and Minority Status

(a) High school+ (Non-Hispanic Whites)　　　　**(b)** High school+ (Racial and Ethnic Minorities)

(c) Some college+ (Non-Hispanic Whites)　　　　**(d)** Some college+ (Racial and Ethnic Minorities)

Notes: Each panel shows education trends separately for individuals born in states with very low and high vulnerability to NAFTA. The vertical line indicates the year in which NAFTA came into effect in 1994. Racial and ethnic minorities include Hispanic, Black, and Native Americans.

Figure 3: Degree Completion Trends by State's Vulnerability to NAFTA, Birth Cohort, and Minority Status
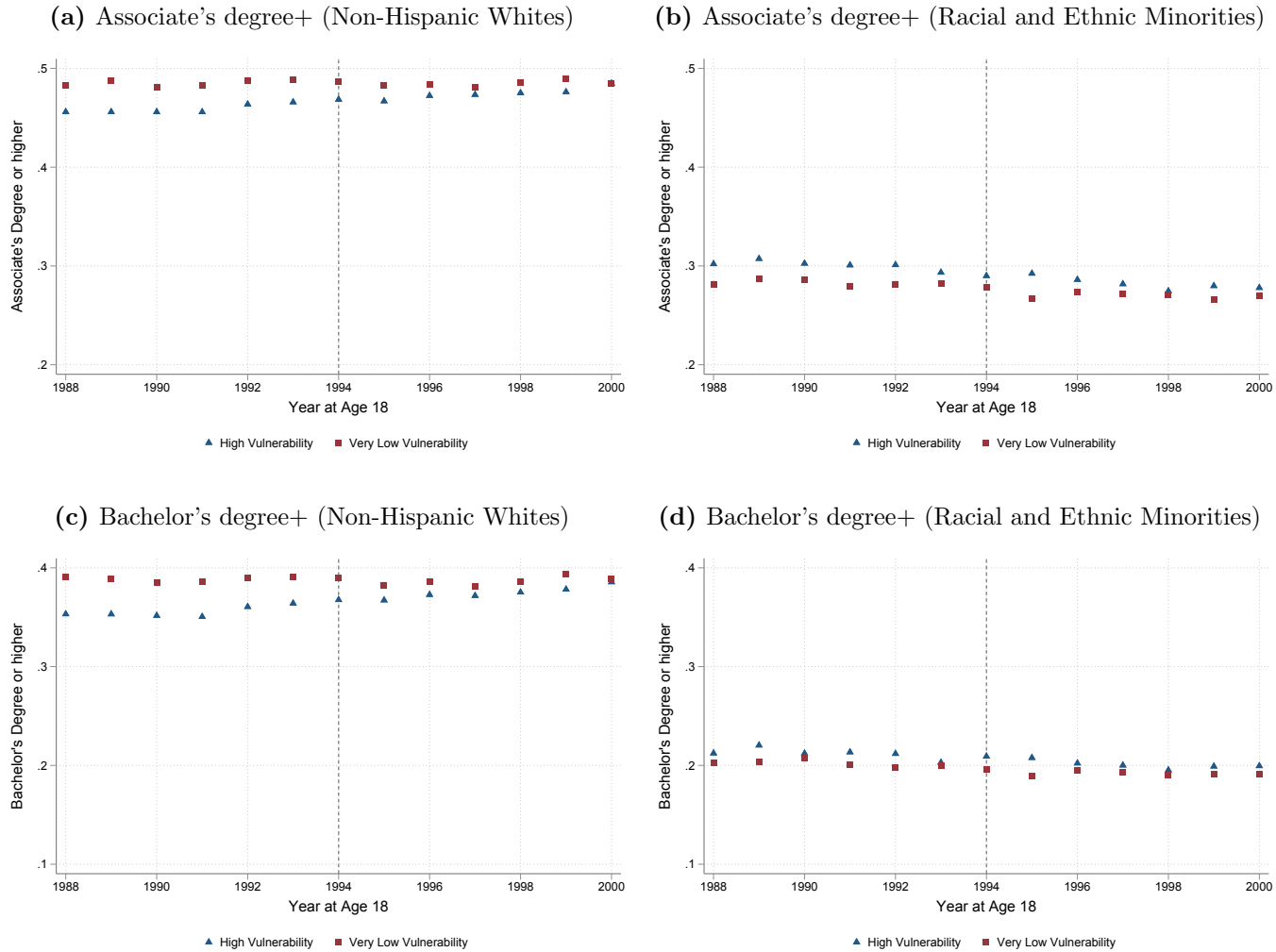
(a) Associate's degree+ (Non-Hispanic Whites)

(b) Associate's degree+ (Racial and Ethnic Minorities)

(c) Bachelor's degree+ (Non-Hispanic Whites)

**(d)** Bachelor's degree+ (Racial and Ethnic Minorities)

Notes: Each panel shows education trends separately for individuals born in states with very low and high vulnerability to NAFTA. The vertical line indicates the year in which NAFTA came into effect in 1994. Racial and ethnic minorities include Hispanic, Black, and Native Americans.

Figure 4: Estimated Effects of NAFTA on Educational Attainment by Race and Gender

Estimated Effects on Schooling Decisions
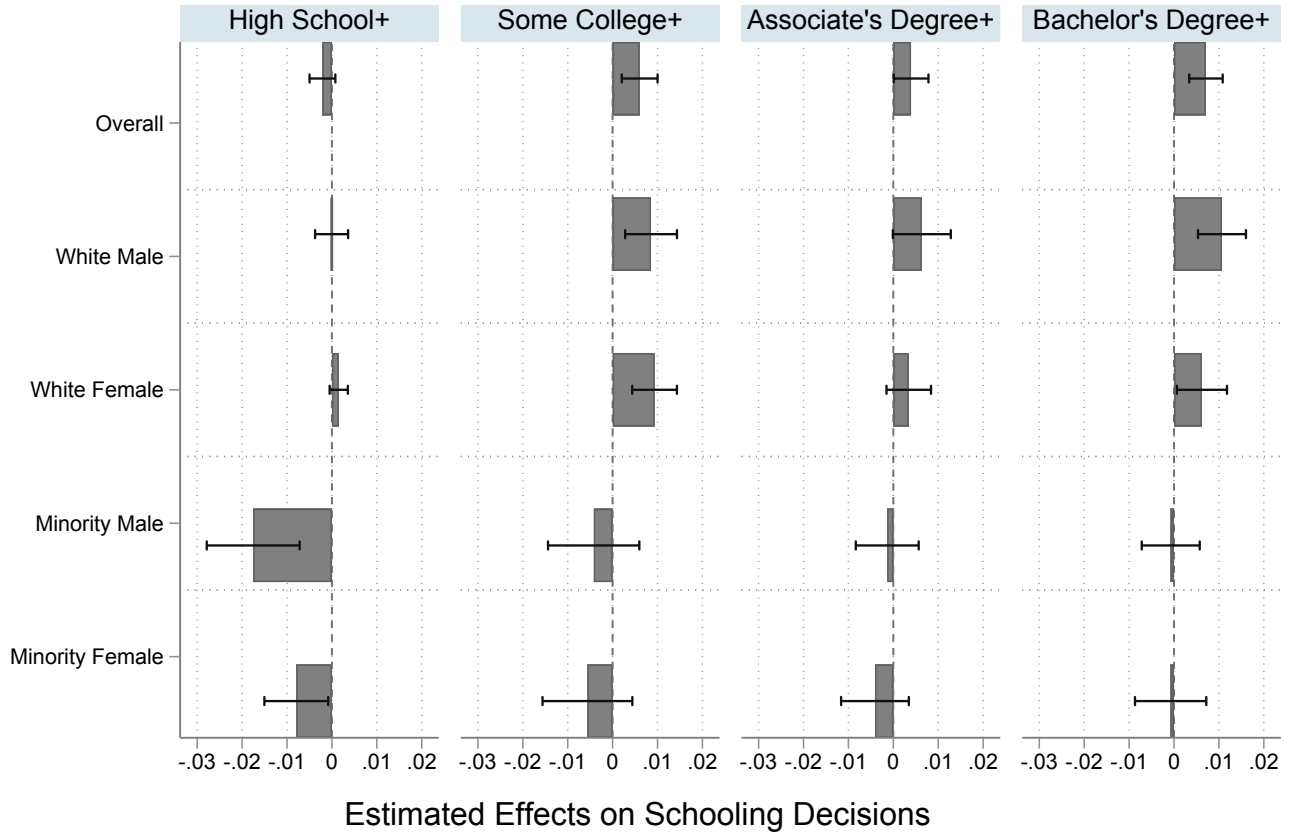
Notes: This figure shows point estimates and 95% confidence intervals, separately for whites and minorities by gender, using our preferred specification, which includes individual demographic controls, whether and when states adopted merit-based scholarships, state of birth fixed effects, survey year fixed effects, region-of-birth-by-birth-cohort fixed effects, and birth-cohort-by-survey-year fixed effects. Standard errors for confidence intervals are clustered at the state of birth level.

Figure 5: Estimated Effects of NAFTA on Educational Attainment by Birth Cohort and Minority Status

(a) High school or higher

(b) Some college or higher

(c) Associate's degree or higher

(d) Bachelor's degree or higher
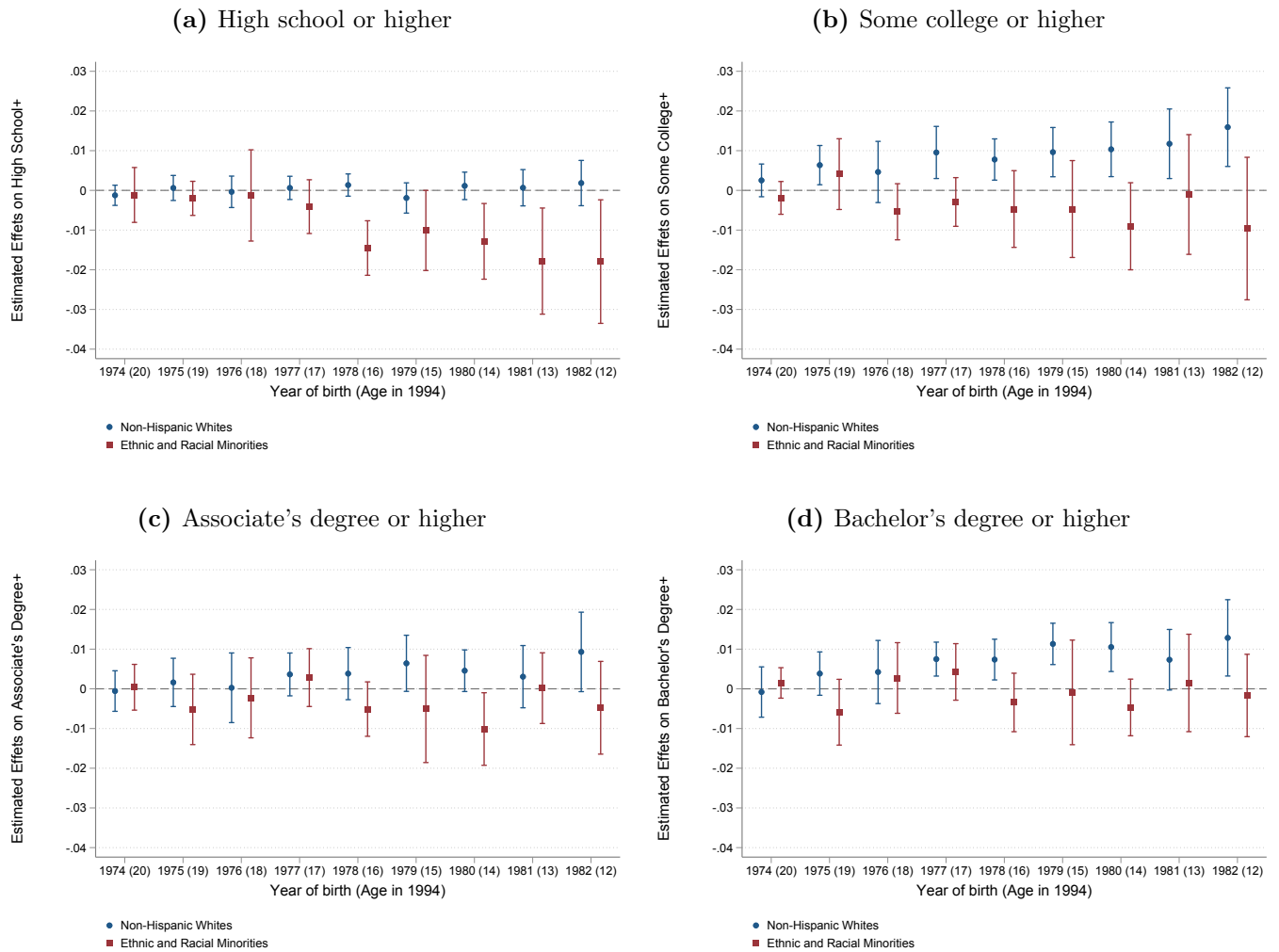
Notes: Each panel show point estimates and 95% confidence intervals, separately for whites and minorities, using our preferred specification, which includes individual demographic controls, whether and when states adopted merit-based financial aid programs, state of birth fixed effects, survey year fixed effects, region-of-birth-by-birth-cohort fixed effects, and birth-cohort-by-survey-year fixed effects. Standard errors for confidence intervals are clustered at the state of birth level.

Table 1: Estimated Effects of NAFTA Trade Openness on Educational Attainment

	(1)	(2)	(3)	(4)
Panel A: High school or higher				
Lost protection	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.001)	(0.001)
N	5,624,233	5,624,233	5,624,233	5,624,233
Panel B: Some college or higher				
Lost protection	0.007***	0.007***	0.006***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
N	5,624,233	5,624,233	5,624,233	5,624,233
Individual characteristics	no	yes	yes	yes
Merit-based programs	no	no	yes	yes
Birth cohort-by-survey year FE	no	no	no	yes

Notes: Each column within each panel represents a different regression. All specifications include state of birth fixed effects, region-of-birth-by-birth-cohort fixed effects, and survey year fixed effects. Individual characteristics include indicators of whether the individual is Female, Black, Native American, and/or Hispanic, and whether he or she speaks English. Merit-based programs are indicators of whether and when the state of birth adopted strong or weak merit-based financial aid programs as described in Sjoquist and Winters (2015). We report robust standard errors clustered at the state of birth level in parentheses.

Table 2: Estimated Effects of NAFTA Trade Openness on Degree Completion

	(1)	(2)	(3)	(4)
Panel A: Associate's degree or higher				
Lost protection	0.004**	0.005**	0.004**	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
N	5,624,233	5,624,233	5,624,233	5,624,233
Panel B: Bachelor's degree or higher				
Lost protection	0.008***	0.008***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
N	5,624,233	5,624,233	5,624,233	5,624,233
Individual characteristics	no	yes	yes	yes
Merit-based scholarships	no	no	yes	yes
Birth cohort-by-survey year FE	no	no	no	yes

Notes: Each column within each panel represents a different regression. All specifications include state of birth fixed effects, region-of-birth-by-birth-cohort fixed effects, and survey year fixed effects. Individual characteristics include indicators of whether the individual is Female, Black, Native American, and/or Hispanic, and whether he or she speaks English. Merit-based programs are indicators of whether and when the state of birth adopted strong or weak merit-based financial aid programs as described in Sjoquist and Winters (2015). We report robust standard errors clustered at the state of birth level in parentheses.

Table 3: Estimated Effects of NAFTA Trade Openness on Educational Attainment by Gender

	High school+ (1)	Some college+ (2)	Associate's degree+ (3)	Bachelor's degree+ (4)
Panel A: Men				
Lost protection	-0.003**	0.006***	0.005**	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
N	2,763,867	2,763,867	2,763,867	2,763,867
Panel B: Women				
Lost protection	-0.001	0.006**	0.003	0.006**
	(0.001)	(0.002)	(0.002)	(0.003)
N	2,860,366	2,860,366	2,860,366	2,860,366
Individual characteristics	yes	yes	yes	yes
Merit-based scholarships	yes	yes	yes	yes
Birth cohort-by-survey year FE	yes	yes	yes	yes

Notes: Each column within each panel represents a different regression. All specifications include state of birth fixed effects, region-of-birth-by-birth-cohort fixed effects, and survey year fixed effects. Individual characteristics include indicators of whether the individual is Female, Black, Native American, and/or Hispanic, and whether he or she speaks English. Merit-based programs are indicators of whether and when the state of birth adopted strong or weak merit-based financial aid programs as described in Sjoquist and Winters (2015). We report robust standard errors clustered at the state of birth level in parentheses.

Table 4: Estimated Effects of NAFTA Trade Openness on Educational Attainment by Minority Status

	High school+ (1)	Some college+ (2)	Associate's degree+ (3)	Bachelor's degree+ (4)
Panel A: Non-Hispanic Whites				
Lost protection	0.001	0.009***	0.005*	0.008***
	(0.001)	(0.002)	(0.002)	(0.002)
N	4,442,128	4,442,128	4,442,128	4,442,128
Panel B: Racial and Ethnic Minorities				
Lost protection	-0.012***	-0.005	-0.003	-0.001
	(0.004)	(0.005)	(0.003)	(0.003)
N	1,182,105	1,182,105	1,182,105	1,182,105
Individual characteristics	yes	yes	yes	yes
Merit-based scholarships	yes	yes	yes	yes
Birth cohort-by-survey year FE	yes	yes	yes	yes

Notes: Each column within each panel represents a different regression. All specifications include state of birth fixed effects, region-of-birth-by-birth-cohort fixed effects, and survey year fixed effects. Individual characteristics include indicators of whether the individual is Female, Black, Native American, and/or Hispanic, and whether he or she speaks English. Merit-based programs are indicators of whether and when the state of birth adopted strong or weak merit-based financial aid programs as described in Sjoquist and Winters (2015). We report robust standard errors clustered at the state of birth level in parentheses.

Table 5: Estimated Effects of NAFTA Trade Openness on Educational Attainment for Men

	High school+ (1)	Some college+ (2)	Associate's degree+ (3)	Bachelor's degree+ (4)
Panel A: Non-Hispanic White Men				
Lost protection	-0.000	0.009***	0.006*	0.011***
	(0.002)	(0.003)	(0.003)	(0.003)
N	2,201,328	2,201,328	2,201,328	2,201,328
Panel B: Racial and Ethnic Minority Men				
Lost protection	-0.018***	-0.004	-0.001	-0.001
	(0.005)	(0.005)	(0.003)	(0.003)
N	562,539	562,539	562,539	562,539
Individual characteristics	yes	yes	yes	yes
Merit-based scholarships	yes	yes	yes	yes
Birth cohort-by-survey year FE	yes	yes	yes	yes

Notes: Each column within each panel represents a different regression. All specifications include state of birth fixed effects, region-of-birth-by-birth-cohort fixed effects, and survey year fixed effects. Individual characteristics include indicators of whether the individual is Female, Black, Native American, and/or Hispanic, and whether he or she speaks English. Merit-based programs are indicators of whether and when the state of birth adopted strong or weak merit-based financial aid programs as described in Sjoquist and Winters (2015). We report robust standard errors clustered at the state of birth level in parentheses.

Table 6: Estimated Effects of NAFTA Trade Openness on Educational Attainment for Women

	High school+ (1)	Some college+ (2)	Associate's degree+ (3)	Bachelor's degree+ (4)
Panel A: Non-Hispanic White Women				
Lost protection	0.002	0.009***	0.003	0.006**
	(0.001)	(0.002)	(0.002)	(0.003)
N	2,240,800	2,240,800	2,240,800	2,240,800
Panel B: Racial and Ethnic Minority Women				
Lost protection	-0.008**	-0.006	-0.004	-0.001
	(0.004)	(0.005)	(0.004)	(0.004)
N	619,566	619,566	619,566	619,566
Individual characteristics	yes	yes	yes	yes
Merit-based scholarships	yes	yes	yes	yes
Birth cohort-by-survey year FE	yes	yes	yes	yes

Notes: Each column within each panel represents a different regression. All specifications include state of birth fixed effects, region-of-birth-by-birth-cohort fixed effects, and survey year fixed effects. Individual characteristics include indicators of whether the individual is Female, Black, Native American, and/or Hispanic, and whether he or she speaks English. Merit-based programs are indicators of whether and when the state of birth adopted strong or weak merit-based financial aid programs as described in Sjoquist and Winters (2015). We report robust standard errors clustered at the state of birth level in parentheses.