Economic Shifts and Educational Choices: The China Shock's Effect on STEM Enrollment*

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Abstract

This thesis investigates the impact of rising Chinese import competition in U.S. local labor markets from 1990 to 2007 on students' choices of college majors. Drawing on the recent literature on the effects of foreign import competition on domestic innovation activity, we empirically test whether this economic shift affects the supply of STEM graduates. The analysis reveals that, among cohorts born in the most affected states, exposure to higher import competition during high school years increases the likelihood of obtaining an engineering bachelor's degree, a field closely associated with most patent creations in the manufacturing sector. Additionally, in regions with high levels of human capital, an increase in import penetration leads to a higher share of STEM bachelor's degree completions. Evidence suggests that this shift might occur in response to the reallocation of activities by nearby manufacturing firms, which, moving away from production, have increasingly focused on research and product development.

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1 Introduction

The choice of college major is one of the most important channels for students to acquire skills and competencies to be signaled to future employers (Hemelt et al.; 2021). Indeed, research has extensively demonstrated that this decision has lasting effects and significant implications for students' careers. To convey the relevance of this choice, Altonji et al. (2012) have shown that differences in earnings across college majors can be as large as the overall wage gap between university and high school graduates.

Having established the importance of this decision, a growing body of the literature has increasingly focused on investigating its determinants. Thus, many researchers have examined whether and how labor market conditions and the surrounding economic environment influence students' decision-making processes.

Empirical evidence suggests that career prospects and expected earnings, especially in periods of economic downturns, are among the key determinants of this choice. For example, Blom et al. (2021) have shown that high school students who graduate during economic downturns are more likely to enroll in post-secondary programs with higher expected earnings. Similarly, Ersoy (2020) has shown that during the Great Recession, students in the hardest-hit regions tended to avoid degree programs associated with greater career risk and earnings losses.

Building on this foundation, this thesis explores the impact of rising Chinese import competition in U.S. local labor markets from 1990 to 2007 on students' choices of college majors. Drawing from the extensive research that studies how import competition influences domestic firms' innovation activities and R&D investments (Shu and Steinwender; 2019), and acknowledging the close link between these investments and the demand for STEM graduates (Bianchi and Giorcelli; 2020), we empirically examine whether these economic changes have led to a shift in the supply of STEM college graduates.

To answer this research question empirically, we use more than 5 million observations from the American Community Survey (ACS), which, since 2009, collects data on the field of study for all respondents with a bachelor's degree. Leveraging this information, along with age data for each respondent, we trace a detailed distribution of college majors among US-born degree holders for eleven cohorts, which experienced significant variations in labor market conditions due to the "China trade shock" during the ages when human capital decisions are typically made. Furthermore, due to the lack of information on individuals' residences at the time of their post-secondary program choices, we exploit the information on their state of birth to infer their geographic location at age 18, assuming that individuals do not migrate outside their state of birth until at least that age.[1] Therefore, using a cohort design and employing a shift-share instrumental variables method (Borusyak et al.; 2022), we test whether variation in exposure to import competition during the high school years (hereinafter referred to as "sensible years") has an impact on the probability of completing any bachelor's degree program, first, and a STEM major, subsequently.

Although we find evidence of a positive effect on the share of individuals with a bachelor's degree, confirming the findings of Ferriere et al. (2018), our initial results show no apparent reallocation towards STEM fields of study. Therefore, we examine some potential confounding factors that could explain this null result.

First, in order to minimize confounding factors arising from potential across-state unobserved heterogeneity, we limit our analysis to a more comparable subgroup of states while still leveraging the significant variation both within and across time. Specifically, we narrow the sample to the most affected states, defined as those whose cumulative import exposure measure is above median. By doing so, we find that cohorts more exposed to the "China trade shock" during the sensible years have a higher probability of completing an engineering bachelor's degree, a field generally associated

[1] Although this strategy does not account for internal migration of parents, this assumption does not appear to be very restrictive. In fact, according to the 1997 National Longitudinal Survey of Youth, less than 10% of adolescents leave their parents' homes before age 18.

with the design and development of manufacturing products. More specifically, moving from the 25th to the 75th percentile of the import penetration distribution of most affected states, the share of graduates with a bachelor's degree in engineering increases by an amount equal to 13 percent of its mean.

Second, even though this empirical strategy addresses almost all potential concerns related to students' mobility, it takes into account neither the scarce supply of STEM programs in the majority of U.S. commuting zones nor the within-state heterogeneity in our import exposure measure.

To address these issues, we employ a new dataset constructed from the raw data provided by the Integrated Postsecondary Education Data System (IPEDS), covering all bachelor's completions by 2-digit CIP code and total fall enrollment for the entire universe of Title IV U.S. post-secondary institutions in 1991, 2001, and 2007. Using the information on the ZIP code and the crosswalk provided by Chetty et al. (2014), we assign each university to the corresponding 1990 commuting zone. Due to the lack of information on total enrollment by major field, we proxy it with the median of total bachelor's completions in a given major field four and six years after the year in which we assign the treatment.[2]

Employing a stacked first-differences model based on Autor et al. (2013), we show that regions with higher import penetration measures exhibit a higher share of STEM completions. The results indicate that this effect is particularly strong and concentrated in commuting zones with high human capital, defined as those with an above median initial share of college graduates. This evidence aligns with the findings of Bloom et al. (2019). Indeed, using highly confidential data, the latter provide evidence of a reorganization of manufacturing firms' activities in regions with high human capital. In response to the increasing import competition, these firms shift their focus from producing machinery, electronics, and transportation equipment to product

[2]According to Denning et al. (2022), over 90% of students enrolled in 1993, 2000, and 2008 completed their bachelor's degree within six years. The percentage of students who graduate in just four years varies from 45% to 60%, depending on the year.

distribution, design, and development. Therefore, the results suggest that the reallocation towards STEM fields may occur in response to the growing demand for STEM graduates induced by this reorganization of nearby manufacturing firms' activities.

The thesis is organized as follows: Section 2 provides a detailed contextual background on the "China trade shock." Section 3 illustrates the contribution to the existing literature. Section 4 describes the data utilized in the analysis. Section 5 describes the empirical strategy applied to the ACS dataset and discusses the resulting findings. Section 6 covers the empirical approach for the IPEDS dataset, along with the related results. Finally, Section 7 concludes with a summary of the findings and their implications.

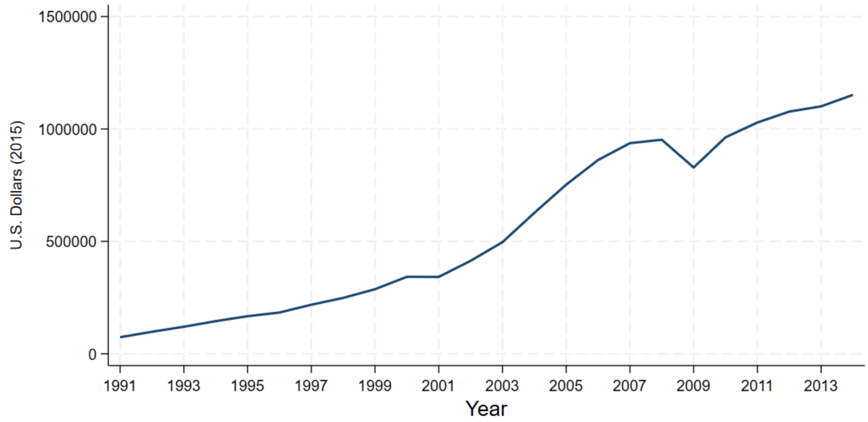
2 The "China Trade Shock"

The term "China trade shock" refers to the profound economic impact on global markets, particularly on the United States and other Western countries, resulting from the dramatic surge in China's exports, which started in the early 1990s and culminated at the end of the first decade of the 2000s.

To fully comprehend the reasons behind this shock, we must understand the massive transformation that the Chinese economy underwent following its decision to transition towards a market-oriented system.

Indeed, since the 1980s, China has experienced a dramatic economic evolution characterized by rapid growth, sustained capital accumulation, and significant shifts in the spatial and sectoral distribution of inputs and outputs. This period also witnessed increased urbanization and substantial investments in human capital (Caliendo and Parro; 2023). Nowadays, academic researchers agree that these factors, combined with the granting of Permanent Normal Trade Relations (PNTR) status by the U.S. Congress in 2000 and China's subsequent accession to the World Trade Organization (WTO) in 2001, are the main drivers of the "China trade shock."

Figure 1: Evolution of U.S. real imports from China. 1991-2014



Notes: Surge in U.S. real imports from China 1991-2014. Dollar amounts are inflated to dollar values in 2015 using the PCE deflator.

Given the profound and evident impact of this economic shock and the substantial political and media attention that globalization, in general, has received, economists have extensively studied its consequences.

In the last decade, it has been well-documented that local labor markets with higher exposure to Chinese imports experienced more severe declines in manufacturing employment. For instance, in the United States, Autor et al. (2013) quantified this impact, demonstrating that a $1,000 increase in import exposure per worker over a decade resulted in a 0.596 percentage point reduction in manufacturing employment in the most affected regions. This effect accounted for about 55 percent of the total decline in U.S. manufacturing employment from 2000 to 2007, approximately one million jobs.

Due to the scale and longevity of its effects, which persisted until 2019 - nine years after the peak in import growth - the "China trade shock" is widely considered a significant contributor to the United States' transition from a manufacturing-oriented economy to a service-oriented one. Indeed, more recent studies, such as Caliendo et al. (2019), indicate that the shock has led to an increase in employment in other sectors, such as construction, wholesale, retail, and services. A similar effect is found by Bloom et al. (2019), who showed that import competition positively affected employment in the service sector. Thus, recent evidence suggests that some of the labor force displaced from manufacturing was absorbed by non-manufacturing industries, partly mitigating the overall impact on employment.

Interestingly, the effects of import competition on innovation remain mixed, especially for the U.S., with varying results depending on the measures of innovation used, the data sources, and the time periods considered (Shu and Steinwender; 2019). These contrasting results underscore the historical complexity in relating product market structure and firms' innovation activity.

For the U.S., for instance, Autor et al. (2020) found that the "China trade shock" negatively affected patent production and R&D spending of the most exposed firms, especially those with initially weaker innovation performance. However, the results provided by Chakravorty et al. (2024) and Bloom et al. (2019) seem to suggest otherwise. The former, using a different reference period, did not find a significant impact of Chinese import competition on the number of U.S. patents but observed positive effects on citation-weighted patents. The latter, exploiting highly confidential data, provided evidence of a reorganization of activities in regions with high human capital, where more exposed manufacturing firms shifted their focus from producing machinery, electronics, and transportation equipment to product development, design, and distribution. This trend reflects a broader pattern seen in many developed countries, where manufacturing firms, facing competition from low-wage nations, have increasingly shifted their focus to research, innovation, and design while outsourcing production to countries with lower costs. A prominent example is the U.S. semiconductor industry. Indeed, although the U.S. has maintained its leadership in design and continues to conduct R&D domestically, its share of global semiconductor manufacturing capacity has dropped significantly, from 37 percent in 1990 to about 10 percent today (Manyika et al.; 2021).

Moreover, the results differ when considering other countries. For instance, in Europe, academic studies generally agree on the positive effect of the "China trade shock" on firms' innovation activity. For example, Bloom et al. (2016) reported that between 2000 and 2007, import competition from Chinese firms contributed to nearly 15 percent of the increase in patents, IT spending, and productivity in European countries.

In conclusion, the complex impacts of China's trade shock on global economies, particularly the effects on the domestic innovation process and long-term trends in the affected countries, still deserve further investigation.

3 Literature Review

This thesis contributes to multiple strands of the literature.

First, the analysis contributes to the broader literature on the determinants of the choice of college major field.[3] Specifically, it adds to the research that studies how labor market conditions influence individual preferences and decision-making regarding this choice. Starting with the seminal work by Berger (1988), economists have indeed sought to link labor market trends and earning prospects with students' choices of field of study (Long et al.; 2015; Altonji et al.; 2016; Choi et al.; 2017; Baker et al.; 2018; Blom et al.; 2021). Unlike most papers in this field, this thesis focuses on a single source of labor market shocks and, therefore, on a single reference period. Moreover, unlike the strand of research that examines the effect of economic recessions (Altonji et al.; 2016; Ersoy; 2020; Blom et al.; 2021) on the major field choice, our analysis considers a type of shock whose consequences could, at least in principle, have a greater impact on students' educational choices. Indeed, given the long-lasting effects of the choice of major field, it is reasonable to think that students would rationally incorporate the expected effects of a labor market shock into their decision-making process only if its consequences are perceived to be enduring enough to impact their future careers. In this sense, given the contribution of the "China trade shock" to the largest structural

[3]See Altonji et al. (2012; 2016) and Patnaik et al. (2021) for a comprehensive review of this literature.

change in the US economy in the last century - the transition from a manufacturing to a service-based economy (Bloom et al.; 2019; Caliendo et al.; 2019) - and given the duration of its consequences, which lasted more than two decades, it is indeed likely that this shock influenced educational choices more significantly than a typical economic recession would have.

Second, this thesis contributes to the literature on the impact of the rise in foreign competition on domestic innovation (Shu and Steinwender; 2019). Specifically, it speaks to the body of the literature that studies the effect of the surge in Chinese import competition on U.S. domestic firms' innovation activities (Bloom et al.; 2019; Autor et al.; 2020; Chakravorty et al.; 2024). Drawing on the findings of the latter literature, this thesis, by estimating the effect of the "China trade shock" on STEM enrollment, aims to shed light on the supply of potential future innovators.

Finally, this thesis adds to the literature that relates international trade and human capital investments. Specifically, it contributes to the new strand of this literature that has begun to focus on the effect of the "China trade shock" on educational choices (Greenland and Lopresti; 2016; Ferriere et al.; 2018). With respect to the latter, this thesis is the first work that, to the best of our knowledge, relates the "China trade shock" to the choice of field of study. By doing so, it seeks to provide valuable insights into the long-term consequences of globalization on the American socio-economic landscape.

4 Data

In order to empirically study the effect of the rise in Chinese import competition on the decision to obtain a STEM degree, data on international trade and on major field choices are clearly needed.

4.1 International trade data

Following Autor et al. (2013) and Acemoglu et al. (2016), we use as measure of exposure to the "China trade shock," the change in exposure to Chinese real imports per worker in a given region[4], where imports are attributed to the latter based on its share of employment in domestic industry. Thus, the measure of import penetration for region r over period t is given by:

$$\Delta IP_{rt}^{U} = \sum_{j} \frac{L_{jr(1990)}}{L_{r(1990)}} \times \frac{\Delta M_{jt}^{U}}{Y_{j,(1990)} + M_{j,(1990)} - X_{j,(1990)}} \tag{1}$$

where ΔM_{jt}^{U} is the growth of real Chinese imports to the U.S. over period t in industry j. The latter is normalized by the U.S. initial absorption (US industry shipments plus net imports, $Y_{j,(1990)} + M_{j,(1990)} - X_{j,(1990)}$).

Therefore, to allow for spatial heterogeneity in import exposure across different regions, it is multiplied by the start-of-period share of workers employed in industry j in region r.

Data on real industry-level imports from China, as well as U.S. absorption, are taken from the publicly available datasets provided by Autor et al. (2013). These are sourced from the UN Comtrade Database, which provides bilateral import information for six-digit HS products. To convert these data to four-digit SIC industries, the authors use a crosswalk method from Pierce and Schott (2012), which matches ten-digit HS products to four-digit SIC industries and then aggregate to six-digit HS products and four-digit SIC industries. Dollar amounts are adjusted to dollar values in 2015 using the PCE deflator.

Finally, data on U.S. employment by industry are obtained from the County Business Patterns, a database which track employment by county and industry from 1946

[4] In this thesis, we analyze data at both the commuting zones and state level. Therefore, for simplicity and consistency of the explanation, we will here refer to these areas collectively as "regions."

to the present.

4.2 Education data

To effectively answer this research question, we would ideally need a longitudinal dataset that follows students throughout their high school years, providing detailed information about their residency and post-secondary education decisions. Unfortunately, this type of data is generally highly confidential and therefore not publicly available. To address this limitation, we use two different datasets, each offering different insights and advantages.

The first dataset comes from the American Community Survey (ACS). The latter, administered by the U.S. Census Bureau and publicly available in the IPUMS database, is an ongoing survey that replaced the long-term decennial census to provide data on housing and socioeconomic status of the U.S. population every year instead of every 10 years. In fact, since 2001, the ACS has been collecting detailed demographic, social, economic, and housing data annually from a representative sample of U.S. households, providing information on their members such as age, sex, county of residence, place of birth, and educational attainment. In addition, starting from 2009 onward, the ACS, unlike previous U.S. Census Bureau surveys, also collected data on field of study for all respondents with a bachelor's degree. Leveraging this information plus that related to age, we are able to trace out a detailed distribution of college majors among US-born degree holders for eleven cohorts that experienced substantial variation in labor market conditions due to the "China trade shock" during the ages when human capital decisions are typically made. Table 1A shows main characteristics regarding all the eleven cohorts employed in the analysis.

Given the lack of precise information on individuals' residences at the time of their post-secondary decisions, we use their state of birth to infer their geographic location at age 18. By doing so, this approach assumes that individuals do not move out of their birth state before this age. Although this assumption does not account for state-to-state parental migration, it appears to be not overly restrictive, as few students relocate independently before graduating from high school.[5] Therefore, this dataset allow us to effectively address most concerns related to mobility.

However, it brings two primary limitations. First, due to constraints on data regarding students' geographical locations, we are forced to calculate the import penetration measure at the state level. This approach fails to account for significant within-state heterogeneity in exposure to Chinese import competition, potentially leading to inaccurate treatment assignment to individuals within the same cohort-state combination. Second, the data lacks information on the limited or non-existent availability of STEM degrees in many U.S. commuting zones, which, combined with well-documented frictions in student mobility, could influence educational decisions.

To mitigate these concerns and exploit a more granular unit of analysis, we employ a second dataset derived from the raw data provided by IPEDS, a system of interrelated surveys conducted by the National Center for Education Statistics that collects since 1980 institutional-level data from all U.S. post-secondary institutions participating in Title IV federal financial aid programs.[6] This data source provides detailed information on an institution's enrollment, expenditures, revenues, faculty and staff, and financial aid. It encompasses nearly the entire universe of U.S. post-secondary institutions, with the number of bachelor's degree-granting institutions increasing from 2,125 in 1991 to 2,530 in 2007, as shown in Table 1B.

However, since the only available information distinguishing between different major fields is the total number of completions, we proxy total enrollment by major field using the median number of completions four and six years after the year in which treatment is assigned. Then, using the exact location of each institution, retrieved from their ZIP code and the crosswalk provided by Chetty et al. (2014), we compute the share of STEM completions at the 1990 commuting zone level in 1991, 2001 and 2007.

[5] See footnote 2.

[6] Title IV eligibility is crucial for many institutions as it significantly impacts their ability to attract and support students through federal financial aid. Therefore, nearly all post-secondary institutions hold this status.

Table 1A — Summary Statistics. ACS data

Panel A: Cohorts 1978-1983

	1978	1979	1980	1981	1982	1983
N° obs	396,490	404,375	421,733	426,820	426,842	426,084
Female	0.500	0.499	0.498	0.498	0.498	0.498
White	0.830	0.828	0.825	0.825	0.822	0.822
Black	0.120	0.121	0.122	0.119	0.120	0.119
Asian	0.024	0.025	0.026	0.028	0.031	0.032
Graduated	0.375	0.374	0.374	0.377	0.379	0.378
Sciences and Engineering	0.160	0.159	0.158	0.160	0.161	0.162
Business	0.076	0.076	0.076	0.076	0.074	0.073
Education	0.040	0.039	0.038	0.037	0.037	0.036
Liberal Arts & Other	0.099	0.101	0.102	0.103	0.107	0.107
STEM	0.105	0.105	0.104	0.105	0.105	0.106
STEM (Narrow)	0.070	0.070	0.070	0.071	0.070	0.070

Panel B: Cohorts 1984-1989

	1984	1985	1986	1987	1988	1989
N° obs	419,804	428,426	432,454	429,517	437,363	450,617
Female	0.497	0.496	0.495	0.494	0.493	0.490
White	0.819	0.818	0.813	0.807	0.801	0.794
Black	0.120	0.120	0.122	0.127	0.129	0.133
Asian	0.033	0.034	0.035	0.036	0.039	0.040
Graduated	0.376	0.374	0.363	0.351	0.327	0.296
Sciences and Engineering	0.162	0.163	0.160	0.157	0.147	0.136
Business	0.071	0.070	0.067	0.065	0.059	0.053
Education	0.035	0.033	0.031	0.029	0.027	0.023
Liberal Arts & Other	0.108	0.107	0.105	0.100	0.093	0.084
STEM	0.106	0.106	0.104	0.102	0.097	0.090
STEM (Narrow)	0.070	0.070	0.069	0.068	0.065	0.060

Notes: Sample summary statistics for cohorts born between 1978 and 1989 are provided. The data are sourced from the American Community Survey (ACS) spanning 2009 to 2022. These statistics are derived from yearly datasets, each representing a cross-section of the population. The table includes the number of observations, gender distribution, racial demographics, graduation rates, and the proportions of various fields of study. Sciences and Engineering is a broad category that includes natural and physical sciences, engineering, computer and information systems, agriculture, environmental and biological sciences, social sciences, and psychology. Business covers business management, accounting, finance, marketing, human resources, international business, and administration. Education encompasses educational administration, teacher education, school counseling, special education, and physical and health education. Liberal Arts and Other encompasses linguistics, foreign languages, law, humanities, philosophy, religious studies, history, fine arts, drama, music, communication, and interdisciplinary studies. The variable STEM includes all major fields as defined by the U.S. Department of Homeland Security in 2016. Finally, STEM (Narrow) excludes certain majors from this definition, such as Psychology and Medicine Studies (Deming and Noray; 2020).

Table 1B - Summary Statistics. IPEDS Data

	1991	2001	2007
Public Institutions	28%	29%	27%
For-Profit Institutions	4%	11%	19%
Nonprofit Independent Institutions	26%	26%	23%
Nonprofit Religious Institutions	42%	34%	31%
Master's Degree Granting	59%	64%	65%
Doctorate Granting	22%	26%	27%
Total n° of institutions	2125	2309	2530

Notes: Summary statistics of Title IV post-secondary institutions offering bachelor's degrees, as recorded in the IPEDS database for the years 1991, 2001, and 2007. The table categorizes institutions by type (public, for-profit, nonprofit independent and religious) and by degree-granting status (master's degree and Ph.D. granting), along with the total number of institutions.

4.3 Definition of STEM fields

STEM fields are traditionally defined to encompass majors within science, technology, engineering, and mathematics. These areas are crucial for fostering innovation, driving economic growth, and sustaining competitive advantage in the global market. However, the specific criteria for including majors within STEM can vary depending on the context and purpose of the classification.

In this thesis, given the different classifications of major fields in the two data sources utilized and the absence of an official crosswalk between them, we employ slightly different definitions of STEM fields depending on the dataset. Despite these variations, we endeavor to maintain as much consistency as possible to ensure the robustness and comparability of our analysis.

4.3.1 STEM definiton - ACS data

Regarding the ACS data, we utilize two distinct definitions of STEM majors.

The first definition aligns with the one used in 2016 by the U.S. Department of Homeland Security (DHS) to determine eligibility for the F-1 Optional Practical Training (OPT) extension (Peri et al.; 2015). This comprehensive classification encompasses a broad array of disciplines, including studies in agriculture, psychology, medicine, and natural resources.

The second definition is a narrower one derived from the DHS criteria, excluding certain majors such as medicine and psychology, as suggested by Deming and Noray (2020).[7] As illustrated in Table 1A, the sample share of STEM graduates in each cohort from the ACS data is approximately 0.10 when using the first definition, whereas it drops to about 0.065 with the second definition.

Employing these two definitions allows for a comprehensive analysis of the data while also providing a more targeted examination of core STEM fields. The broader DHS definition captures a wide spectrum of STEM-related disciplines, ensuring that no relevant field is overlooked. Meanwhile, the narrower definition focuses on the specific areas most pertinent to technological innovation and industrial application, thus offering a more precise understanding of shifts in student major choices in response to changes in the labor market.

4.3.2 STEM definition - IPEDS data

The NCES classifies various major fields using CIP codes. Due to the difficulty of tracking changes in the 6-digit CIP codes over time, we employ a definition of STEM based on the 2-digit classification, which has remained relatively stable.

Therefore, the STEM definition utilized in this analysis includes engineering (CIP code 14), biological sciences (CIP code 26), mathematics (CIP code 27), and physical sciences (CIP code 40). Consequently, it is closer to the narrower definition applied to the ACS data.

5 Analysis - ACS Data

5.1 Empirical strategy

Given the restrictions on data on educational attainment described above, we perform the analysis at the cohort-by-state level. Therefore, we study the effect of a five-

[7] For a detailed list of the degrees excluded from this definition, see Table A1 in the appendix.

year change in import penetration during the sensible years[8], $\Delta \bar{IP}^U_{cs}$, on the share of graduates or individuals with a major field m within cohort c born in state s, y_{msc}, by using the following model:

$$y_{msc} = \alpha_c + \gamma_s + \beta \Delta \bar{IP}^U_{cs} + \delta X_{s(1990)} * \theta_c + \epsilon_{sc} \tag{2}$$

where α_c and γ_s represent respectively cohort and state fixed-effect, and $X_{s(1990)} * \theta_c$ include state-specific start of period controls, such as the share of foreign born, college educated, and female and manufacturing employment, all interacted with cohort dummies. Standard errors are clustered at the state level to account for correlation across cohorts born in the same state, and all regressions are weighted by the number of individuals within each cohort-state combination.

An issue in the estimation process is that realized U.S. real imports from China, used in our import penetration measure, might be correlated with U.S. industry-specific import-demand shocks. Consequently, OLS estimates of the coefficient associated with $\Delta \bar{IP}^U_{cs}$ might be biased.

To identify the causal effect of increased Chinese import exposure, we employ a shift-share instrumental variables strategy to address the potential endogeneity of U.S. trade exposure. Following Autor et al. (2013), we leverage the fact that, as described in Section 3, much of the growth in Chinese imports during our reference period is attributable to the rising competitiveness of Chinese manufacturers, which constitutes a supply shock from the perspective of U.S. producers.

Therefore, to identify the supply-driven component of Chinese imports, we instrument $\Delta \bar{IP}^U_{cs}$ with the contemporaneous growth in imports from China in eight other

[8] In this context, as discussed in the introduction, "sensible years" are defined as the high school years, corresponding to the 13-18 age group.

developed countries[9] using the following formula:

$$\textbf{SS-IV} \hookrightarrow \Delta \bar{IP}^{O}_{cs} = \sum_{j} \underbrace{\frac{L_{js(1988)}}{L_{s(1988)}}}_{share} \times \underbrace{\frac{\Delta M^{O}{}_{j(\text{sensible years})_c}}{Y_{j,(1988)} + M_{j,(1988)} - X_{j,(1988)}}}_{shift} \tag{3}$$

This shift-share instrumental variables strategy aims to identify the causal effect under the assumption that the common within-industry component of the increase in Chinese imports between the U.S. and the other developed countries arises from China's productivity growth and its growing comparative advantage. As argued by Borusyak et al. (2022), this specification likely leverages quasi-random shocks, given the high number of shocks (industries) which all appear to be mutually uncorrelated, allowing exposure shares to be endogenous. Finally, the main assumption behind our strategy is that import demand shocks are uncorrelated across developed countries. Given the robustness checks conducted by Autor et al. (2013),[10] this assumption appears to be reasonable.

5.2 Results

We begin our analysis by empirically testing whether increased exposure to the "China trade shock" during the sensible years affects the probability of obtaining a bachelor's degree. Utilizing the empirical strategy described in the previous section, Table 2 demonstrates that moving from the 25th to the 75th percentile of the import penetration distribution results in approximately one percentage point increase in the share of college graduates. This finding corroborates the results of Ferriere et al. (2018), who, using a different empirical strategy and dataset, found evidence of increased college enrollment among young people in regions more exposed to the "China trade shock."

Building on this result, we further examine whether this shock induced a realloca-

[9] Japan, Germany, Spain, Australia, Finland, Denmark, New Zealand, and Switzerland.

[10] In particular, the authors use a gravity model to analyze the growth of Chinese exports, accounting for supply and trade cost factors while filtering out import demand influences. The fact that their gravity model estimates are consistent with their instrumental variable estimates suggests that correlated import demand shocks across countries do not significantly influence the results.

Table 2 — Effect on Bachelor's Completions

	Graduates share	Graduates share	Graduates share
	(1)	(2)	(3)
Import Penetration	0.739	0.273	1.846***
	(0.471)	(0.459)	(0.715)
Observations	576	576	576
IV	No	No	Yes
First Stage F-stat	No	No	539.505
Mean Dep. Var.	0.34	0.34	0.34
Controls X Cohort	No	Yes	Yes
Cohort FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

Notes: Standard errors clustered at the state level. Each regression is weighted by the number of observations in each cohort-state combination. The outcome in all three columns is the share of individuals within a cohort-state combination who completed a bachelor's degree. All columns show the results from equation (2). Controls include state-specific start-of-period female employment, the share of foreign-born, share of graduates, and share of employment in manufacturing sectors, all interacted with cohort dummies. The interquartile range of the Import Penetration is equal to 0,005. *** p<0.01, ** p<0.05, * p<0.1

tion among graduate students toward STEM major fields. While column 3 and 4 of Table 5 show a positive and significant effect on the share of STEM graduates within all observations in a given cohort-state combination, columns 5 and 6 indicate that, once we restrict our sample to bachelor's degree holders, the effect on STEM bachelor's completions disappears. This suggests that exposure to the "China trade shock" during the sensible years had no significant impact on the reallocation of graduates towards STEM major fields.[11] However, various confounding factors may account for this null result.

First, as outlined in the previous sections, the potential heterogeneity across states in terms of unobserved characteristics could introduce noise into our estimates. To address this issue, we restrict our analysis to "high import penetration" states (hereinafter referred to as HIP states), which we define as those with a cumulative import exposure above the median for the period 1991-2007. By doing so, we aim to at least

[11]The results remain consistent if we use different reference periods, as illustrated in Figure A2 in the appendix.

partially address the concern, enhancing the comparability of our sample, while still exploiting the within- and across-time variation in our import penetration measure. Although columns 7 and 8 of Table 3 suggest no effect on reallocation toward STEM majors also for cohorts born in these states, Table 4 provides a more nuanced analysis by examining the impact on each individual STEM field category as defined by the U.S. Department of Homeland Security (DHS).

Table 3 — Effect on STEM 1996-2007

	STEM	STEM	STEM	STEM (N)	STEM †	STEM (N) †	STEM †	STEM (N) †
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Penetration	0.284*	0.0613	0.522**	0.471*	0.108	0.331	0.680	1.22
	(0.166)	(0.193)	(0.265)	(0.276)	(0.602)	(0.601)	(0.796)	(0.855)
Observations	576	576	576	576	576	576	288	288
IV	No	No	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F-stat	No	No	539.505	539.505	565.070	565.070	193.89	193.89
Mean Dep. Var.	0.09	0.09	0.09	0.06	0.28	0.19	0.28	0.18
Controls X Cohort	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Median Import Pen.	-	-	-	-	-	-	Above	Above

Notes: Standard errors are clustered at the state level. Each regression is weighted by the number of observations in each cohort-state combination. The outcome variable in all columns is the share of individuals who graduated with a STEM major within a cohort-state combination. The outcome variable in the last four columns, marked with a dagger, narrow the sample to bachelor's graduates. The first three, the fifth and seventh columns employ used by the U.S. Department of Homeland Security in 2016. Column 4, 6 and 8 use a narrower definition, indicated by the capital N, which excludes some majors, such as Psychology and Medicine Studies (Deming and Noray; 2020). Column 7 and 8 restrict the sample to the HIP states, i.e. those whose cumulative import penetration from 1991 to 2007 is above median. Column 1 includes only cohort and state fixed effects. All subsequent columns include also state-specific start-of-period share of female employment, share of foreign-born, share of graduates, and share of employment in manufacturing sectors, all interacted with cohort dummies. Columns 3, 4, 5, 6 and 7 show the results from the IV estimation of equation (2). The interquartile range of the Import Penetration is equal to 0,005 for the first six columns and 0.006 for the last two. *** p<0.01, ** p<0.05, * p<0.1

Specifically, column 3 of the latter table reveals a positive and significant effect on the proportion of engineering graduates, who are typically the most closely associated with patent creation and innovation processes in the manufacturing industry.[12]

[12]The results are stable if we consider different time periods. As shown in Figure A3 in the appendix, the positive and significant effect on the probability of obtaining a bachelor's degree in engineering or related fields persists until we do not include cohorts graduating from high school after 2010. When we include them, the effect remains positive but become insignificant. This suggests that the effect of the rise in import competition might have vanished in the second decade of the 2000s,

Surprisingly, while the coefficients associated to all other categories appears to be not significant, column 4 shows a negative and significant effect on the share of graduates with a biology bachelor's degree. While this may explain the non-significant effect on our STEM variables, observed in the last two columns of Table 3, we do not have a specific explanation for the negative effect associated with biology degrees. Further investigations would be required to totally understand this result.

Table 4 — Effect on STEM fields 1996-2007. HIP States

	Agriculture	Computer Sci.	Engineering	Biology	Physical Sci.	Health	Math	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Penetration	-0.0311	0.321	1.300**	-1.459***	0.426	-0.312	0.238	0.141
	(0.116)	(0.436)	(0.505)	(0.496)	(0.262)	(0.569)	(0.222)	(0.352)
Observations	288	288	288	288	288	288	288	288
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F-stat	193.8	193.8	193.8	193.8	193.8	193.8	193.8	193.8
Mean Dep. Var.	0.006	0.022	0.059	0.053	0.023	0.087	0.009	0.017
Controls X Cohort	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the state level. Each regression is weighted by the number of observations in each cohort-state combination. HIP (High Import Penetration) states are defined as those states whose cumulative import penetration measure for the period 1991-2007 is above the median. The major field categories reported are aggregations of STEM fields based on the definition used by the U.S. Department of Homeland Security in 2016. "Other" category includes library science, consumer sciences, military technologies, transportation sciences, and environmental science. The outcome variable is the share of individuals who graduated with one of these STEM categories within a cohort-state combination. All columns show the results from the IV estimation of equation (2). Therefore, each column include cohort and state fixed effects and state-specific start-of-period share of female employment, share of foreign-born, share of graduates, and share of employment in manufacturing sectors, all interacted with cohort dummies. The interquartile range of the Import Penetration is equal to 0,006. *** p<0.01, ** p<0.05, * p<0.1

The second potential confounding factor that could explain the null results presented in Table 3 might stem from the fact that the empirical strategy employed in this section does not account neither for the within-state heterogeneity in import exposure nor for the limited availability of STEM degrees across most U.S. commuting zones. For instance, given the presence of mobility frictions among students, the nonexistence of a STEM program in nearby post-secondary institutions could potentially play an important role in the decisions of the major field. To address these issues, the next

as the growth in Chinese imports plateaued.

section will utilize a dataset at the post-secondary institution level. This approach will not only enable us to control for the limited supply of STEM programs but also employ a more granular measure of import penetration.

6 Analysis - IPEDS Data

6.1 Empirical Strategy

Having the information on the exact location of each Title IV post-secondary institution, we can exploit a more granular geographical unit than the one we employed in the previous analysis: the 1990 commuting zones. Therefore, we employ the following two period (1991-2001 and 2001-2007) stacked first differences model:

$$\Delta y_{mtc} = \alpha_t + \gamma_c + \beta \Delta IP^U_{tc} + \epsilon_{tc} \tag{4}$$

where Δy_{mtc} is the change in the share of median bachelor's completions in major field m in years $\tau + 4$ and $\tau + 6$, where τ is the year in which IP is measured, in commuting zone c over period t. To allow for differential trends across different commuting zones and to control for the decennial changes in education outcomes, we include α_t and γ_c, which are fixed effects at the period and commuting zone level, respectively. Our measure of exposure to the "China trade shock," ΔIP^U_{tc}, is defined as in equation (1). Standard errors are clustered at the commuting zone level and each regression is weighted by the initial share of bachelor's completions.

The main difference with the model presented by Autor et al. (2013) is that we substituted their start-of-period controls and Census divisions fixed effects with commuting zones fixed effects. The latter not only includes the former controls but also account for all unobserved differential trends across various commuting zones that might affect regional education outcomes. Consequently, we believe this specification to be more accurate for the purposes of our analysis

As done in the previous analysis, to identify the supply driven component of the change in import penetration, we instrument ΔIP^{U}_{tc} with the contemporaneous composition and growth of Chinese imports in the same eight other developed countries (Autor et al.; 2013).

It is important to note that, apart from technical advantages of this dataset, the exercise conducted in this section conceptually differs from the one done using the ACS data. Indeed, instead of examining the effect of being exposed to the "China trade shock" during the sensible years on the probability of obtaining a bachelor's degree in a STEM major field, this analysis directly investigates the relationship between import penetration in each commuting zone and bachelor's degree completions and enrollments within the region. Given student mobility across commuting zones, especially during college years, and the limited supply of degrees in many regions, these two analyses provide distinct perspectives on the same phenomenon. The results presented in the next section offer insights not only into changes in student preferences and decision-making but also into potential shifts in the behavior of post-secondary institutions in their efforts to attract more students to specific major fields and to accommodate changes in neighboring local labor market.

6.2 Results

Similarly to the analysis in the previous section, we begin with examining the impact of a change in exposure to Chinese import competition on the change in total bachelor's enrollments and completions. As shown in Table 5, increased exposure to the "China trade shock" did not significantly affect enrollments and completions within the same commuting zones. Although this finding at first sight appears to contradict earlier results, it can be reconciled by considering the high mobility across different commuting zones of students during their college years. If the "China trade shock" influenced bachelor's enrollments by prompting students to enroll in programs outside the commuting zones where they are located at the moment of the post-secondary decision, this effect would only be captured by the ACS data, which, under the assumption discussed before, allow us to account almost entirely for mobility.

Table 5 — Effect on Total Bachelor's Enrollment & Completions

	Δ Enroll.	Δ Enroll.	Δ Enroll.	Δ Compl.
	(1)	(2)	(3)	(4)
Import Penetration	982.1	2,776	6,801	162.77
	(1,504)	(4,756)	(6,789)	(561.656)
Observations	855	855	855	870
IV	No	No	Yes	Yes
Mean Dep. Var	2329.35	2329.35	2329.35	764.54
First Stage F-stat	No	No	338.71	415.01
CZ FE	No	Yes	Yes	Yes
Period FE	No	Yes	Yes	Yes

Notes: Standard errors are clustered at the commuting zone level. Each regression is weighted by the initial share of bachelor's degree completions. The outcome variable in the first three columns is the change in the total enrollment, while in the last is the change in total completions. To mimic enrollment, the latter is calculated by taking the median of total completions, measured four and six years after the year in which the import penetration is measured. All columns report results from equation (4). Column 1 includes only the independent variable. Columns 2 and onwards also include period and CZ fixed effects. Column 3 and 4 presents the results from the IV estimation of equation (4). Import Penetration is multiplied by 100 so that the interquartile range is approximately equal to 0.97. Statistical significance is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

However, as depicted in column 3 of Table 6[13], when examining the effect on the share of completions in STEM major fields, we find a positive and significant impact. Specifically, moving from the 25th to the 75th percentile of the import penetration measure results in a 1 percentage point increase in the share of STEM bachelor's completions, an amount equal to 10 percent of its mean.[14] Furthermore, as shown in column 4 and 5 of the latter table, while there is no significant effect in commuting

[13]The results are robust if we cluster the standard errors at the state level, allowing for within-state spatial correlation. For a replication of Table 6, see Table A2 in the appendix.

[14]As indicated in Table A3 in the appendix, this result is primarily driven by the positive effect on Biology and Biomedical Sciences (CIP code 26). At first glance, this appears to contrast with the findings presented in Table 4. However, the divergence in results may be attributed to the broader classification of CIP code 26, which includes both traditional biological sciences and biomedical sciences, while IPUMS tends to categorize biomedical and interdisciplinary fields separately. Although this may explain the discrepancy, we believe these findings should be interpreted with caution, and further investigation is required to fully identify the underlying factors contributing to these differences.

zones with a start-of-period share of college graduates below the median (hereinafter referred to as LHC), a stronger and significant effect is observed in commuting zones with a share above the median (hereinafter referred to as HHC).

Table 6 — Effect on STEM Bachelor's Completions

	Δ STEM	Δ STEM	Δ STEM	Δ STEM	Δ STEM
	(1)	(2)	(3)	(4)	(5)
Import Penetration	0.963***	0.596	1.156**	0.349	1.374**
	(0.130)	(0.524)	(0.519)	(0.845)	(0.615)
Observations	856	856	856	416	440
IV	No	No	Yes	Yes	Yes
First Stage F-stat	No	No	414.40	36.57	609.82
Mean Dep. Var.	-0.001	-0.001	-0.001	-0.001	-0.001
Period FE	No	Yes	Yes	Yes	Yes
CZ FE	No	Yes	Yes	Yes	Yes
Median Share Grad.	-	-	-	Below	Above

Notes: Standard errors are clustered at the commuting zone level. Each regression is weighted by the initial share of bachelor's degree completions. The outcome variable in all columns is the change in the share of STEM bachelor's completions. To mimic STEM enrollment, this is calculated by taking the ratio of median STEM completions to median total completions, measured four and six years after the year in which the import penetration is measured. The STEM definition corresponds to the 2-digit CIP code definition used by the U.S. Department of Homeland Security, which includes Biology, Mathematics, Statistics, Engineering, and Physical Sciences. All columns report results from equation (4). Column 1 includes only the independent variable. Columns 2 and onwards also include period and CZ fixed effects. Column 3 and onwards present the results from the IV estimation of equation (4). Columns 4 and 5 restrict the sample to CZs with low human capital (LHC) and high human capital (HHC), respectively. HHC/LHC CZs are defined as those with an initial share of graduates above/below the median. The interquartile range of Import Penetration is approximately 0.01 for the first three columns, 0.013 and 0.007 for the fourth and fifth column, respectively. Statistical significance is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

This finding aligns with the evidence provided by Bloom et al. (2019), who, using highly confidential data, demonstrated that manufacturing firms in HHC regions reorganize their activities in response to import competition, shifting from the production of machinery, electronics, and transportation equipment to focusing solely on product distribution, design, and development. Therefore, the results suggest that the reallocation of major fields towards STEM fields may occur in response to manufacturing firms transitioning from production activities to innovation-focused processes. One possible explanation for this result is that students, by observing the shifts in manufacturing firms' activities, gained better information on STEM careers prospects in the region and consequently enrolled in nearby STEM degree programs. Alternatively, this shift might also be attributed to the increased efforts of post-secondary institutions which, in response to the growing demand for STEM graduates driven by local manufacturing firms' transition towards innovation and design activities, intensified their efforts to attract students to STEM fields and accommodate changes in the local labor market. Although we are unable to distinguish between these "supply" and "demand" stories, we believe that these results significantly contribute to understanding the impact of foreign import competition on domestic innovation activity.

7 Conclusion

This thesis provides a comprehensive analysis of the impact of rising Chinese import competition from 1990 to 2007 on U.S. students' choices of college major fields. Building on existing literature that examines the relationship between foreign import competition and domestic innovation and given the pivotal role of STEM graduates in firms' R&D activities, we empirically assess whether the so-called "China trade shock" has influenced the supply of college graduates with STEM majors.

Utilizing over 5 million observations from the American Community Survey (ACS), our findings reveal a positive and significant effect on the overall share of individuals obtaining bachelor's degrees, consistent with prior research by Ferriere et al. (2018). However, our first results suggest that greater exposure to import competition during the sensible years does not induce a reallocation of majors towards STEM fields. This null result can be partly attributed to the potential across-state heterogeneity in terms of unobserved characteristics, the high within-state heterogeneity in import competition exposure and the limited availability of STEM programs in many U.S. commuting zones.

Therefore, in order to minimize potential noise attributable to unobserved across-state heterogeneity, we refine our analysis to focus on a more comparable subgroup of state, the "high import penetration" states. By doing so, we observe a statistically and economically significant positive effect on the decision of completing an engineering bachelor's degree, a major typically regarded as the main pool of future inventors.

Similarly, to account for the limited supply of STEM programs and exploit a more granular unit of analysis, we use data at the post-secondary institution level from the Integrated Postsecondary Education Data System (IPEDS). Consequently, we find that more affected commuting zones exhibit a higher share of STEM bachelor's degree completions, with stronger and more concentrated effects in regions with high human capital. Drawing on evidence provided by Bloom et al. (2019), the results suggest that this shift is likely driven by increased demand for STEM graduates by nearby manufacturing firms, which, in response to import competition, have transitioned from production to the design and development of products.

In conclusion, this thesis aims to improve the understanding of how labor market shocks affect human capital decisions by highlighting the significant interaction between economic shocks and college major field choice. Focusing on the effect of the "Chinese trade shock" on the U.S. supply of STEM graduates, this study seeks to shed light on the long-term consequences of increased import competition, thereby contributing to the understanding of its impact on U.S. innovation activity.

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8 Appendix

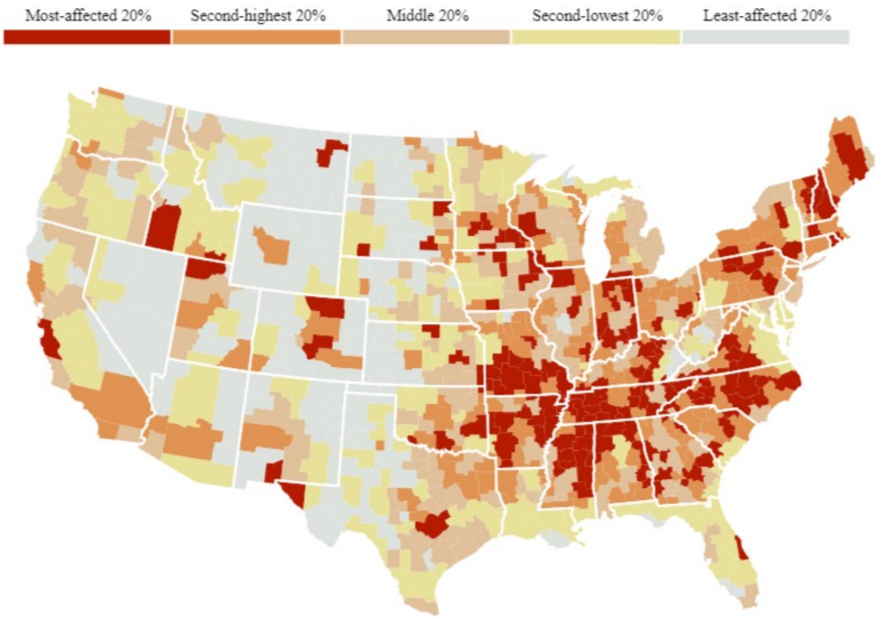
8.1 Appendix: Data Description

Table A1 - bachelor's Degrees included in STEM but not in STEM (Narrow)

Degree Name	**STEM**	**STEM (Narrow)**
Animal Sciences	✓	×
Food Science	✓	×
Plant Science and Agronomy	✓	×
Soil Science	✓	×
Library Science	✓	×
Pharmacology	✓	×
Physiology	✓	×
Psychology	✓	×
Educational Psychology	✓	×
Clinical Psychology	✓	×
Counseling Psychology	✓	×
Industrial and Organizational Psychology	✓	×
Social Psychology	✓	×
Miscellaneous Psychology	✓	×
Transportation Sciences and Technologies	✓	×
General Medical and Health Services	✓	×
Communication Disorders Science and Services	✓	×
Medical Technologies Technicians	✓	×
Pharmacy, Pharmaceutical Science, and Admin.	✓	×
Treatment Therapy Professions	✓	×
Miscellaneous Health Medical Professions	✓	×

Notes: This table lists the degrees classified as STEM according to the U.S. Department of Homeland Security's 2016 criteria, but which are excluded in the narrower STEM definition used in the analysis of the ACS data, following Deming and Noray (2020).

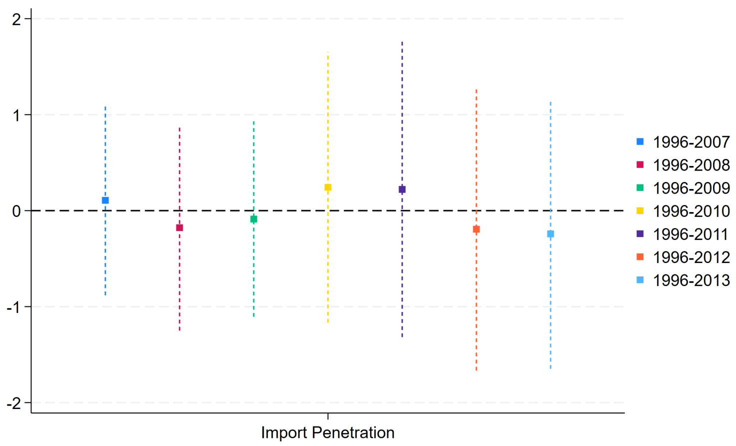
Figure A1: Within-state heterogeneity in import competition



Notes: Colors show which areas were most affected by the rise in Chinese import competition, based on the increase in Chinese imports per worker in each area from 1990 to 2007. Source: https://chinashock.info/.

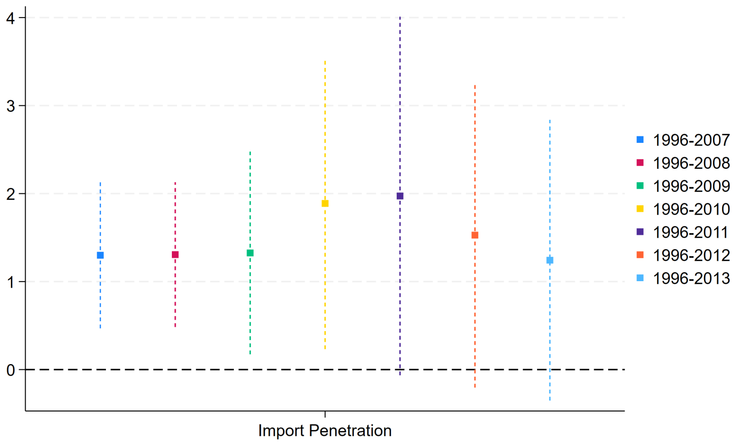
8.2 Appendix: Robustness of Key Results

Figure A2: Robustness of results in Table 3



Notes: Plot of coefficients on STEM showed in column 5 in Table 3 considering different sample periods. CI: 90%

Figure A3: Robustness of results in Table 4



Notes: Plot of coefficients on Engineering showed in Table 4 considering different sample periods. CI: 90%

Table A2 — Effect on STEM Bachelor's Completions

	Δ STEM	Δ STEM	Δ STEM	Δ STEM	Δ STEM
	(1)	(2)	(3)	(4)	(5)
Import Penetration	0.963***	0.596	1.156**	0.349	1.374**
	(0.150)	(0.537)	(0.535)	(0.761)	(0.682)
Observations	856	856	856	416	440
IV	No	No	Yes	Yes	Yes
First Stage F-stat	No	No	414.40	36.57	609.82
Mean Dep. Var.	-0.001	-0.001	-0.001	-0.001	-0.001
Period FE	No	Yes	Yes	Yes	Yes
CZ FE	No	Yes	Yes	Yes	Yes
Median Share Grad.	-	-	-	Below	Above

Notes: Standard errors are clustered at the state level. Each regression is weighted by the initial share of bachelor's degree completions. The outcome variable in all columns is the change in the share of STEM bachelor's completions. To mimic STEM enrollment, this is calculated by taking the ratio of median STEM completions to median total completions, measured four and six years after the year in which the import penetration is measured. The STEM definition corresponds to the 2-digit CIP code definition used by the U.S. Department of Homeland Security, which includes Biology, Mathematics, Statistics, Engineering, and Physical Sciences. All columns report results from equation (4). Column (1) includes only the independent variable. Columns (2) and onwards also include period and CZ fixed effects. Column (3) and onwards present the results from the IV estimation of equation (4). Columns (4) and (5) restrict the sample to CZs with low human capital (LHC) and high human capital (HHC), respectively. HHC/LHC CZs are defined as those with an initial share of graduates above/below the median. The interquartile range of Import Penetration is approximately 0.01 for the first three columns, 0.013 and 0.007 for the fourth and fifth columns, respectively. Statistical significance is indicated as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A3 — Effect on STEM Bachelor's Completions by Major Field

	Δ Engineering	Δ Biomedical Sci.	Δ Math. & Stat.	Δ Physical Sci.
	(1)	(2)	(3)	(4)
Import Penetration	0.191	0.858***	0.0282	0.1106
	(0.348)	(0.266)	(0.101)	(0.0711)
Observations	556	840	828	788
IV	Yes	Yes	Yes	Yes
F-stat	313.116	401.858	396.127	385.586
Mean Dep. Var	-0.002	0.001	-0.0003	-0.0006
Period FE	Yes	Yes	Yes	Yes
CZ FE	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the commuting zone level. Each regression is weighted by the initial share of bachelor's degree completions. The outcome variable in all columns is the change in the share of STEM bachelor's completions by decomposed by each of its 2-digit CIP code components. To mimic enrollment, these are calculated by taking the ratio of median STEM completions to median total completions, measured four and six years after the year in which the import penetration is measured. The STEM definition corresponds to the 2-digit CIP code definition used by the U.S. Department of Homeland Security, which includes Biology, Mathematics, Statistics, Engineering, and Physical Sciences. All columns report results from the IV estimation of equation (4). Therefore, they include also period and CZ fixed effects. The interquartile range of Import Penetration is approximately 0.01. Statistical significance is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.