How does globalization affect educational attainment? Evidence from China*

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This Draft: January 2018

Abstract

This paper investigates how changes in trade policy, both by China and its trading partners, affect rates of high school completion in Chinese prefectures between 1990 and 2004. I separate the effects of trade policy changes into: (1) reductions in tariffs and trade policy uncertainty abroad; and (2) reductions in Chinese tariffs on intermediate, final, and capital goods. Exploiting spatial variation across 324 Chinese prefectures and temporal variation across 15 age cohorts, I employ a difference-in-difference empirical specification and verify the results with semi-parametric methods. Robust empirical findings suggest that increases in high school completion were more pronounced in prefectures with larger reductions in Chinese tariffs on unskilled-labor-intensive inputs, and Chinese tariffs on foreign capital goods. At the same time, increases in high school completion were attenuated in prefectures facing larger reductions in tariff abroad as well as tariff uncertainty in the U.S. regarding unskilled-labor-intensive goods. Overall, about half of the total increase in high school completion from 1990 to 2004 can be explained by the net effect of these trade policy changes.

JEL classification: F16, F61, J24, J61.
Keywords: Human Capital; Globalization; Technology Adoption; Skill Premium; WTO.

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*First Draft: July 2015. I am grateful to Anna Maria Mayda for her continuous guidance and encouragement. I am also thankful for the insightful feedbacks from Giovanni Facchini, Rodney Ludema, and Caglar Ozden at various stages of this project. I also thank Jim Albrecht, Mary Ann Bronson, Caitlin Brown, Claire Brunel, Garance Genicot, Roger Lagunoff, Arik Levinson, Aaditya Mattoo, Ferdinando Monte, Martin Ravallion, Susan Vroman, and Mathis Wagner for their helpful discussions and comments. All errors are mine.

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1 Introduction

As many developing countries phased out import-substitution and opened up to trade, their relative demand for skilled workers has changed.[1] The associated impact on educational attainment bears lasting influence on economic development and poverty reduction. What is the long-run impact of trade policy changes on the educational attainment of young people in developing countries?

This question has been studied in a few recent empirical works that consider endogenous skill acquisition in response to trade shocks. Trade shocks can influence educational attainment through two main channels. First, trade shocks change returns to education, affecting the incentive to acquire education. Atkin (2016) finds the arrival of low-skill export jobs increased opportunity cost of schooling, and consequently increased school dropout rates in Mexico. Second, trade shocks change real income, affecting the affordability of education. Edmonds, Pavcnik, and Topalova (2010) associate attenuation in schooling attendance trends with unskilled workers' income loss due to trade liberalization in India. Mixed results from these studies indicate that the investigation is far from conclusive. More importantly, globalization in developing countries is often multi-faceted, yet the existing studies each focus on a few limited aspects of globalization and thus paint incomplete pictures of the potential impact on educational attainment. A full understanding of the overall educational impact of globalization requires evaluating a comprehensive set of trade policy changes – China offers one such ideal context.

In this paper, I examine the educational impacts of globalization in China using an series of trade barrier reductions by China and its trading partners from 1990 to 2004 – China's trade liberalization since 1992, the conclusion of the Uruguay Round in 1995, US granting China permanent Normal-Trade-Relations (PNTR) in 2000, and China's accession to the World Trade Organization (WTO) in November 2001. Figure 1a offers a timeline of these events. The changes in trade policies during this time period affected sectors with various levels of skill-intensity, giving rise to offsetting impacts on skill acquisition.[2] The combined effect on educational attainment could mask the underlying competing forces resulted from different trade policy changes. Thus, the goal of this paper is to decompose the trade policy

[1] See Goldberg and Pavcnik (2007) for survey.

[2] For example, *ceteris paribus*, export expansion in skilled sectors increases skill premium and skill acquisition, while export expansion in unskilled sectors has the opposite effect.

changes, empirically test their isolated impact on educational attainment, and identify the trade policy changes that encourage skill acquisition from the ones that suppress it.

To this end, I follow the "differential exposure approach" developed by Bartik (1991) and Topalova (2007), and examine, between 1990 and 2004, whether cohorts in prefectures exposed to bigger trade barrier reductions experienced more pronounced changes in high school completion rates than cohorts in prefectures less exposed.[3] I decompose the trade barrier reductions for both skilled and unskilled sectors into: 1) reduction in tariffs abroad; 2) reduction in trade policy uncertainty abroad; 3) lower Chinese tariffs on final and intermediate goods; and 4) lower Chinese tariffs on foreign capital goods.

The identification strategy is straightforward. Different prefectures had different industrial composition, and trade barriers for different industries were reduced by varying levels at varying times, inducing *both* geographical and temporal variations in exposure to trade policy changes across Chinese prefectures. I measure each prefecture's local exposure to trade shocks as a weighted average of industry-level changes in tariff rates, with weights based on the initial prefecture industry mix.[4] The interacted variations in pre-existing local industry mix and the wide variation in trade policy changes across industries makes it possible to identify the effect of reduction in trade barriers on educational attainment.

The empirical analysis uses prefecture-level data that covers 324 of Chinese prefectures and 15 age cohorts. It is constructed by combining census data, firm-level custom and production data, and product-level trade policy data. The pseudo panel allows me to associate changes in educational attainment with local exposure to changes in trade policy. In a difference-in-differences (DID) specification, the high school completion rate of an age cohort in a prefecture is regressed on prefecture-level time-varying measures of trade policy. The empirical design compares how changes in educational attainment across cohorts differ in prefectures with large changes in trade policy from prefectures with little changes in trade policy.

The causal interpretation of the estimated effect of local trade shocks on education relies on the exogeneity of trade policy changes to unobserved local economic influences that concurrently affected educational attainment. Fortunately, the usual concerns for the

[3]Prefectures are the relevant labor market units because of low rates of permanent mobility between prefectures. See permanent migration rates in 2000 in Table 11 and more in Facchini et al. (2017).

[4]By using pre-existing industry mix as fixed weights, the changes in prefecture trade policy only reflect industry-level statutory changes overtime, eliminating confounding factors from production and employment composition shifts due to trade shocks.

endogeneity of trade policy (Grossman and Helpman 1994; 2002) are mitigated by several features of the hereby investigated trade policy changes, by both China and its trading partners.[5]

The source of identification comes from both spatial and time variations: different cohorts across Chinese prefectures differ in their timing and degree of exposure to local trade shocks. Figure 1 provides a simplified visual representation of the concurrent trade barriers reductions and increasing high school completion rates. In the upper panel, Figure 1a plots the decrease in Chinese import tariff rates against the timeline of three major globalization events. In the lower panel, Figure 1b plots school completion rates among the native population (non-migrants plus out-migrants) across age cohorts. The deviation between prefectures facing bigger trade shocks and ones facing smaller trade shocks coincides with major globalization events. The pre-liberalization trends among the "treatment" and "control" prefectures track closely with each other, validating a DID empirical design. In Section 3, I further relax the common trend assumption with prefecture-specific time trends.

Robust empirical results show that, overall, trade policy changes from 1990 to 2004 in China are associated with increased high school completion rates among the younger generations. I find evidence of higher investment in human capital by cohorts in prefectures that were exposed to larger reductions of: a) Chinese tariffs on unskilled-labor-intensive inputs; b) Chinese tariffs on foreign capital goods, which embody skill-biased technology change; and c) tariffs abroad on skilled-labor-intensive goods. At the same time, increases in high school completion rates were attenuated (smaller increase) in prefectures facing larger reductions in trade policy uncertainty abroad regarding unskilled-labor-intensive goods.

From 1990 to 2004, in the average Chinese prefecture, high school completion rates among male 16-19 year-olds have increased 20 percentage points – from 26.3% to 46.5%. Positive changes associated with Chinese tariff reductions increased the share of high school educated individuals among the native cohorts by about 10-13%, while PNTR and China's accession to WTO decreased high school educational attainment by 3.5% since 2001. The combined effects of globalization translates to about half of the total increase in high school completion since China's trade reform. Interestingly, I find that globalization has not contributed to increases in college education in Chinese prefectures, possibly due to the limited number of seats in tertiary institutions and biased college admission policies during the

[5] See Section 2.3 for details.

time period examined. The contrast in results for high school and college completion rates suggests that provision of public education could be a binding effect in skill upgrading.

The paper proceeds as follows. I describe the data and context in Section 2, and present empirical specification in Section 3. Section 4 presents the main empirical results on the relationship between various trade policy changes and educational attainment, and Section 5 validates the main findings through a variety of robustness checks. Finally, in Section 6, I outline a simple model, and explore the mechanisms through which trade policy changes affect educational attainment. Section 7 concludes.

2 Data and Context

In this section, I describe the data sources used to create the prefecture-level panel dataset. I also provide the context for China's education system, and the trade policy changes that affected China between 1990-2004.

2.1 Data

To examine the effect of trade policy changes on educational attainment, I rely on China's considerable temporal and geographic variations in exposure to globalization, and link the school completion rate of each prefecture-cohort with the contemporaneous local trade barriers that cohort faced in their schooling years.

The data used in the empirical analysis come from several sources. I draw prefecture-level educational attainment measures from China's 2005 "mini" population census, conducted by the National Bureau of Statistics (NBS). The 2005 Chinese "Mini" Census is an individual-level survey data that cover 0.1% of the entire Chinese population in 2005. They covers 31 provincial regions, which include 27 provinces and 4 provincial municipalities, and 344 prefecture-level cities/municipalities.[6] The population census of China documents detailed individual-level information on age, education level, employment status, migration history, as well as other demographic and geographic information. I concord prefectures across census years, and aggregate the individual-level data to prefecture-by-cohort cells using age and locality information. High school completion rate of age cohort t in prefecture j

[6]The final sample used consists of 324 prefecture, because I exclude 20 prefectures due to missing data and extreme outliers.

calculates the share of individuals with high school degrees or above. Prefecture-by-cohort college completion rate is defined similarly.[7]

I also collect time-varying prefecture characteristics from the Chinese City Statistical Yearbooks (1991-2005) for additional analysis. These additional variables include Foreign Direct Investment (FDI) flows, number of teachers and number of schools.

The prefecture-level local industry mix comes from the 1997-1999 Chinese Custom Data, and 1998-2007 Chinese Annual Survey of Industrial Firms (CASIF). The Chinese Custom Data document firm-level import and export transactions at the product-level, and the Chinese Annual Survey of Industrial Firms document firm-level employment and production information. Using geo-referenced firm identification, I measure the aggregate industrial mix of each prefecture from the employment distribution, and the trade basket mix from the import/export distribution. To calculate the local exposure to trade barriers, I aggregate industry-level trade barriers to the prefecture-level using each prefecture's pre-existing industrial composition in employment/trade as weights.

This location-year specific measures of trade barriers allow me to match cohorts' educational outcomes with the local trade environment they faced in their schooling years, at their hometown prefectures. The constructed panel covers 324 prefectures spanning 15 age cohorts – aged 18 to 32 – who represent graduating classes from 1990 to 2004. Each observation – an age cohort in a prefecture – links contemporaneous local exposure to trade barriers with educational outcomes.

I differentiate types of trade policy changes by distinguishing industries with different skill intensities, and dividing trade policy changes into import shocks and export shocks. I categorize industries into skilled- and unskilled-labor-intensive ones in the context of China.[8] The skill intensity of each product can be calculated from the 2004 Chinese Annual Survey of Industrial Firms (CASIF), in which the number of skilled and unskilled workers used in producing various traded products are documented for each firm. The product-level skill intensity is thus calculated as the share of skilled workers used in the production of each product nationwide.

[7] Throughout the paper, I refer to secondary education, which includes academic high schools and secondary vocational schools, as "high school education"; and tertiary education, which includes 4-year academic universities and tertiary vocational schools, as "college education".

[8] Following the literature (Ge and Yang 2014), I identify as skilled workers those who have at least a high school degree when evaluating high school completion, and those who have at least a college degree when evaluating college completion.

The main trade policy changes considered in the empirical analysis are reductions in Chinese tariff rates, as well as reductions in tariff levels and uncertainty abroad. I gather tariff rates at the product level from the WITS-TRAINS database. The WITS-TRAINS database contains product-level (HS 6-digit) import tariff rates in China, as well as in China's 10 major export destinations.[9] I use nominal ad valorem tariff rates from 1990-2004 for about 6000 traded products.[10] NTR gaps measuring China's export tariff uncertainty at the U.S market are from Pierce and Schott (2016).

To aggregate product-level trade policies to the prefecture level, I rely on the crosswalk from product classification to geographic units made possible by the 1997-1999 Chinese Custom Data.[11] It is an annual HS-based transaction-level data compiled by the General Administration of Customs of China, who records information on all import/export transactions conducted by Chinese firms. Importantly, the product code (HS 6-digit), import/export type, transaction value, transaction type, partner country, and firm location are all recorded in the Chinese Custom Data. In addition to trade-basket-weighted trade policies, I also construct alternative weights based on local employment distribution, using sector employment information from 1998-2000 Chinese Annual Survey of Industrial Firms (CASIF). Section 3.1 contains more details of the construction of trade policy changes.

2.2 Education in China

In China, primary education take 6 years to complete, followed by 3 years of junior secondary education, and 3 years of senior secondary education provided by academic high schools or secondary vocational schools. Tertiary education are provided by 4-year colleges and universities and 3-year vocational schools. China's education is largely state-run. Prefecture-level and county-level governments are responsible for the delivery of primary and secondary education, whereas tertiary education falls under the jurisdiction of provincial and central authorities (OECD 2016).

I focus on the effect of trade policy changes on schooling at the high school and college

[9] China's top export destinations include HongKong, Japan, US, EU, Korea, Singapore, Taiwan, Russia, Canada and Australia. Chinese exports to these 10 destinations account for about 80% of total export during 1997-1999, i.e. before China's accession to the WTO.

[10] Goldberg and Pavcnik (2007) and Kovak (2013) both show that nominal tariff rates are positively and highly correlated to effective tariff rates, thus results from using nominal rates are robust to concerns of intermediate input linkages.

[11] Note that it is not possible to construct export baskets at the prefecture level for years before 1997 since data are not available before then at a disaggregate level.

levels for the following reason. In China, students must complete 9 years of compulsory schooling (Compulsory Education Law of the People's Republic of China, 1986). This means all children at eligible school ages (7 to 15 years old) have the right to, and must complete primary education and junior secondary education. After finishing compulsory education, students can decide whether to pursue high school education. In other words, during 1990-2004, primary and junior secondary education are unlikely to be directly affected by local trade-related factors, whereas attending high school and college remained a choice.

The trade policy changes considered in this paper took place around early 1990s through early 2000s, which was a time with arguably universal and effective implementation of 9-year compulsory education. Despite regional disparity in enforcement rates and government spending per student, the 9-year compulsory schooling law was successfully implemented overtime. By 1999, the gross enrollment ratio for primary education was 99.1% (compared to 97.2% in 1987), and the primary to junior secondary transition rate was 94.1% (compared to 69.1% in 1987).[12] For the 1990 cohort and onwards, most schooling age children would have completed junior high school by requirement, and they can move onto high school by choice, the cost of which is publicly subsidized and low.

Even though the gradual implementation of 9-year compulsory education has attributed to a larger base of junior high graduates who are eligible for high school education, high school education remained a personal choice. According to the National Bureau of Statistics of China, in 1999, only around 50% of junior secondary graduates attended senior secondary schools (compared to 39.1% in 1987). Table 1 shows that from 1990 to 2004, there has been a steady increase in national average high school completion/enrollment rates among schooling age cohorts.[13] Internal migration presents a possible confounding factor; that is, trade policy shocks may trigger accumulation of skill (through education) *as well as* reallocation of skill (through migration) as seen in Facchini et al. (2017). To tease out the changes in local skill endowment from reallocation of skill, I limit the prefecture-level local samples to include only the non-migrants and out-migrants. On average, the nationwide high school completion (and enrollment) rate among natives increased from 24.9 percent in

[12] Table 20-11: Proportion of students Entering into Schools of Higher Grade and Enrollment Rate of School-age Children, National Bureau of Statistics of China (2000).

[13] Due to wide variations in school starting age among different regions, some 18-21 year-olds are still enrolled in high school when surveyed by the 2005 census. To address this concern, I include enrolled students across all cohorts to minimize this compositional shifts across cohorts. I also confirm this is not an isolated issue with the only 2005 Census, I do the same calculation with 1990 and 2000 census waves, and find that a substantial share of 18-21 year-olds are still enrolled in high school.

1990 to 47.4 percent in 2004, and that of college education increased from 8.5 percent in 1990 to 14.1 percent in 2004. Similar patterns can be found in the summary statistics of the corresponding prefecture-level education levels in Table 2.

Figure 2a demonstrates the regional variation in educational attainment increases. Each polygon on the map stands for a prefecture, and the bold lines outline the provincial boundaries. I calculate for each prefecture, from 2000 to 2005, the increase in the share of high school educated among 18-27 year-old natives (non-migrants and out-migrants). I georeference the the changes in high school completion rates with prefecture locations, and the color gradients on the map indicate how much high school education has changed in each prefecture during this time period. Prefectures that saw increase in educational attainment among the 18-27 year-old cohorts are marked by red, and the ones that saw decreased are marked by blue. Increases in human capital accumulation are concentrated in the economically advanced regions: Yangtze River Delta region (Shanghai included), Pearl River Delta region in the southeast (Shenzhen included), and Bohai Economic Rim (Beijing included). These regions concurrently saw higher increases in trade volumes and larger reductions in trade barriers, as shown in Figure 2b and 2d. Certain regions even experienced decrease in educational attainment, suggesting opposing influence exerted by changes in different trade policies.

2.3 Trade Policy Changes

From 1990 to 2004, China experienced several trade policy changes, both internal and external, affecting both skilled and unskilled sectors: 1) average Chinese import tariff rates decreased from 38 percent to 8 percent for unskilled-labor-intensive goods, and from 27 percent to 7 percent for skilled-labor-intensive goods;[14] 2) tariffs rates Chinese exporters face with major trading partners decreased from 7.6 percent to 4.3 percent for unskilled-labor-intensive goods, and from 4.9 percent to 3 percent for skilled-labor-intensive goods; 3) foreign technology was adopted through foreign direct investment (FDI) and imports of capital goods, and the tariff rates on capital goods dropped from 24 percent to 7 percent; and 4) tariff uncertainty with the U.S. was eliminated when the U.S. granted China permanent NTR status in 2000, which improved the Chinese exporters' market access to the U.S market. I present descriptive statistics on each of these trade policy changes below.

[14]These imports include consumption goods, intermediate goods and capital goods

A: Tariff Rates in China (CHN)

Since early 1990s, the Chinese government lowered the levels and dispersion of tariffs across industries to more uniform levels that aimed to match tariff levels in the GATT/WTO. In fact, China chose to unilaterally liberalize to gain credibility with its negotiating partners that it was seriously committed to opening up its economy (Branstetter and Lardy 2006).

Import tariffs in China began to decrease in 1992 as part of a broad set of reforms to facilitate the conditions for WTO accession. The average statutory tariff rates fell from an average of 43 percent in 1992 to 15 percent in 2001 and 8 percent in 2005. Figure 1a plots the national average import tariffs on unskilled-labor-intensive goods across the globalization episodes. Each major globalization event is highlighted by a dramatic decrease in Chinese import tariff rates. More evidence at the product-level can be found in Figure 3a, which shows the scatterplot of HS 6-digit product level import tariff rates in different years. The initially dispersed Chinese tariff rates across products in 1992 were reduced to a uniformly low level in 2005.

B: Tariff Rates in Rest of the World (ROW)

I also considers changes in tariff rates by China's trading partners. Even though China was not part of the General Agreement on Tariffs and Trade (GATT), most of its major trading parters gave China the Most-Favored-Nation (MFN) status. EU granted China permanent MFN status in 1980; at the same time, US granted China MFN status subject to yearly renewal. As a result, when the agreements of Uruguay Round came into effect in 1995, the tariff rates Chinese exports faced in GATT countries also decreased. The tariff reductions in ROW affected Chinese exporters, and consequently, the skill prices faced by Chinese students. I gather product-level tariff rates of China's top trading partners for the years in 1990-2004. China's top 10 export destinations include Hong Kong, Japan, US, EU, Korea, Singapore, Taiwan, Russia, Canada and Australia. Chinese exports to these 10 destinations account for about 80% of total export before WTO accession. The average tariff rates imposed by these 10 countries declined from 9% in 1990 to 5.4% in 2004.

C: Trade Policy Uncertainty in the U.S.

In November 1995, China formally requested to accede to the World Trade Organization (WTO). After several years of arduous and lengthy negotiations, China became a member of the WTO in December 2001. A concurrent event closely leading up to China's WTO accession was the U.S. granting China permanent normal trade relations at the end of 2000.

Prior to that, U.S. gave China conditional MFN status, which was subject to congressional appeal every year. It was a contentious political process which created substantial uncertainty in the tariff rates Chinese exporters faced in the US market. If China's MFN status is revoked by the Congress, Chinese exporters would have faced the Smoot Hawley tariffs.[15] While China's normal trade relations with the US had never been revoked, and Chinese imports had enjoyed MFN tariff rates in the US between 1980 and 2000, the uncertainty imposed by China's conditional MFN status with the US was not trivial. In 2000, the average MFN tariff was 4%, whereas if China had lost MFN status, it would have faced a 31% average tariff.

The reduction of this uncertainty at the end of 2000, as U.S. granted China permanent MFN status, created sizable impacts on the U.S. employment, according to recent works (Handley and Limao 2013, Pierce and Schott 2016). Related, the elimination of U.S. tariff uncertainty reduction also had affected the demand for Chinese labor (Facchini et al. 2017), which can shift educational attainment through changes in demand for skill.

To capture this effect, I measure trade policy uncertainty – faced by Chinese exporters to the U.S. – using the product-specific Normal-Trade-Relations (NTR) gap measure developed by Handley and Limao (2013) and Pierce and Schott (2016). This measure is built by calculating the gap between the Most Favorite Nation (MFN) tariffs applied by the United States to WTO members and the threat tariffs that would have been implemented if MFN status was not renewed to China by the U.S. Congress (the so called column 2 tariffs of the Smoot-Hawley Trade Act). It measures the uncertainty faced by the Chinese exporters to the US.

Formally, the NTR gap for product i is defined as: $\text{NTR gap}_i = \text{non NTR rate}_i - \text{NTR rate}_i$. Summary statistics of NTR gaps of skilled- and unskilled-labor-intensive goods are presented in Table 3. The trade policy uncertainty faced by Chinese exporters prior to the 2001 WTO accession are non-trivial – 41 percentage points for unskilled-labor-intensive goods and 30 percentage points for skilled-labor-intensive goods. In Section 3.1, I discuss in detail the procedure to calculate the local (prefecture-level) exposure to U.S. trade policy uncertainty, the summary statistics of which is presented in Table 5. As an example,

[15] See more detailed description in Handley and Limao (2013) and Pierce and Schott (2016).

Figure 2c visualizes the geographic variation in NTR gaps of unskilled-labor-intensive goods.

D: Non-Tariff Barriers (NTB)

Non-tariff barriers imposed by China and other countries were also dramatically cut in the 1990s. For lack of available measures of NTB at detailed industry level over the time period examined in this paper, I control for two aspects of NTBs: Investment Barriers and MFA Quota.

China is a major destination of foreign direct investment, and several studies have emphasized the role that FDI has had in promoting local development (Chen, Chang, and Zhang 1995). I proxy barriers to investment using the *Contract Intensity* measure proposed by Nunn (2007). *Contract Intensity* describes the share of intermediate inputs used by a firm that require relationship-specific investments by the supplier. The higher is the contract intensity of a firm, the more pervasive is the effect of the presence of investment barriers in a prefecture. Upon China's accession to WTO, barriers to investment were eliminated, and as a result prefectures characterized by firms with higher contract intensity disproportionately benefited from trade liberalization. Similar to NTR gaps, contract intensity captures the size of reduction in investment barriers due to China's WTO accession.

From 1990 to 2004, an additional potential driver of increased labor demand was represented by the phasing out of quota restrictions on U.S. apparel and textile imports under the Multi-Fiber Agreement (MFA) and the Agreement on Textile and Clothing (ATC). Upon joining the WTO at the end of 2000, China became eligible for the elimination of these non-tariff barriers. Following Brambilla, Khandelwal, and Schott (2010), I calculate the share of China's clothing and textile exports which faced binding MFA quotas in the U.S. at the HS 6-digit level.[16] To measure the extent to which each Chinese prefecture was affected by the relaxation of MFA quotas, I aggregate the HS-level MFA Quota Bound to the prefecture level using each prefecture's export basket. The resulting prefecture-level variable *MFA Quota Bound* measures the share of textile exports that would have faced binding MFA quotas after 2001, were not for China's WTO accession. Prefectures with a larger textile export sector, which faced more stringent MFA quotas before 2001, saw bigger non-tariff-barrier reductions through this channel as China joined the WTO.

[16] Brambilla, Khandelwal, and Schott (2010) provide a crosswalk between 149 three-digit MFA product groups and HS codes.

E: Exogeneity of Trade Policy Changes

The causal interpretation of the local educational effect of globalization relies on the analyzed trade policy changes to vary exogenously across industries. That is, the trade policy changes experienced by industries in China must have not been endogenous to domestic political economy forces – such as certain industries lobby for more protection. Several features of the trade policy changes, by both China and its trading partners, mitigate the usual concern of endogeneity about trade openness (Grossman and Helpman 1994; 2002).

First, the reduction in trade barriers by China's trading partners – first in 1995 due to the Uruguay Round, and later in 2001 due to China's accession to the WTO – came from international multilateral negotiations that China was not a part of. These external trade policy changes were unlikely the outcome of a political process relevant to China.

One exception remains where the U.S. granting China permanent Normal-Trade-Relations (PNTR) in 2000 was the final result of bilateral negotiations between the U.S. and China. However, the size of the trade barrier reduction, measured by NTR gaps (Handley and Limao 2013; Pierce and Schott 2016) – the difference between Smoot-Hawley tariff rates and U.S. MFN tariff rates– was not influenced by economic conditions in China. More specifically, NTR gaps are a function of past and present U.S. policy, which is unlikely to be endogenous Chinese political-economy drivers.

Finally, the exogeneity of China's own liberalization effort – reductions in Chinese tariff rates – is equally crucial, and may require stronger but plausible assumptions. I provide contextual and quantitative arguments that support such assumptions.

The observation in Figure 3a – that the Chinese tariff liberalization was aimed to reduce the overall level *and* variation of existing tariffs – dissuades the concern that local economic and political factors of industries played a role in the magnitude of tariff reductions.

Previous studies on the labor market effects of liberalization have addressed this endogeneity concern by showing almost perfect correlation between pre-liberalization tariff levels and the ensued tariff declines, suggesting that policy makers reduced tariffs across the board to eliminate cross-industry variation in tariffs (Goldberg and Pavcnik 2005; Topalova 2010; Kovak 2013). In other words, industries with higher pre-liberalization tariffs experienced greater tariff reductions.[17]

[17] Goldberg and Pavcnik (2005) shows the exogeneity of tariff changes in the context of Columbian trade reform by showing the industries with higher protection also experience larger tariff cuts. Topalova (2010)

To quantitatively substantiate the support for the exogeneity of Chinese tariff cuts, I follow previous studies and show an almost perfect correlation between industry-level tariff reductions and initial tariff levels. In Figure 3b, I plot the industry-level tariff cuts against the initial tariff rates, which shows that industries with higher tariff before trade liberalization had bigger cuts (the correlation is 0.969). This reassures the exogeneity of Chinese tariff changes. That is, in the case of Chinese import tariff rates, the trade policy changes reflect mostly the pre-existing tariff protection structure, which was determined in the 1980s, and unlikely to be correlated with the magnitude of tariff reductions during 1990-2004.

3 Empirical Analysis

3.1 Measuring trade liberalization

To quantify local exposure to trade policy changes, I follow the literature that evaluates trade policy changes at subnational levels (Bartik 1991; Topalova 2007; Kovak 2013). These studies commonly use a weighted average of changes in trade policy, with weights based on the industrial or factor distributions in each (subnational) region, and explore the spatial variation in trade policy changes. Kovak (2013) builds a theoretical foundation for this empirical approach and shows that the appropriate measures of liberalization uses *only* the traded sectors in the weights. I follow this approach throughout the empirical analysis.

To quantify time-varying trade policies for each Chinese prefecture, I correlate industry trade policy with prefecture-specific local trade/employment compositions, constructing a weighted local exposure of trade policy changes. I carry out this construction with two approaches: with import and export trade baskets, and with industrial employment concentrations. In Section 5, I show the main findings persist through alternative weighting methods.

A: Weighting Trade Barriers with Local Industrial Composition

I first measure a prefecture's exposure to trade policy changes with its import and export baskets. These trade baskets are constructed from 1997-1999 Chinese Custom Data (CCD).

shows that industry tariff declines during India's 1991 trade reform are not correlated with baseline industry characteristics such as productivity, skill intensity, and capital intensity. In the case of Brazil, Kovak (2013) argues that the driving force for liberalization came from the government rather than from the private sectors, and he dissuades this concern following the approach by Goldberg and Pavcnik (2005).

The immediate advantage of using transaction-level trade data comes from the richness in details regarding traded goods type, trade regime, trading partners, and firm information. Each transaction in the data is tagged with the location of importer/exporter in China, which is what I use to aggregate total import and export baskets to the prefecture level. The trading regime of each transaction allows me to differentiate ordinary trade from processing trade. Since processing trade is not subject to import tariffs, I follow Fan, Li, and Yeaple (2015), and exclude processing trade imports. In addition, with the concordance between BEC and HS codes, I can further organize imports into consumption goods, intermediate goods, and capital goods. Specifically, I classify imports of equipments and capital goods as a separate category to measure the degree of foreign technology adoption by Chinese firms.

On the other hand, one drawback of using custom trade data is that, by focusing on the traded sector of the local economy, one necessarily omits the non-traded sectors, and could over-/understate the impact of trade policy changes on local labor markets. However, Kovak (2013) justifies using only information on traded goods as an appropriate measure, as non-traded prices move with traded prices. In fact, including the non-traded sectors while assuming non-traded prices are unaffected by trade policy changes will yield upward biased estimates.

Alternatively, I follow the local exposure literature (Topalova 2007; Autor, Dorn, and Hanson 2013; and Kovak 2013), and use the prefecture-specific sectoral employment distribution as weights to calculate local exposure to trade policy changes. To that end, I use the 1998-2000 Chinese Annual Survey of Industrial Firms (CASIF), where each firm falls into an industry according to its main products.[18] CASIF also reports the number of workers employed by each firm, which allows me to calculate the local employment distribution across industries. With the crosswalk between industries (Chinese Industry Code 2002 or ISIC- Rev3) and products (HS6), I calculate the prefecture-level trade barriers as an interaction of employment distribution across various industries and industry-level trade policy changes.

B: Prefectures-Specific Trade Barriers

With the trade and employment based weights, the average trade policy each prefecture j

[18]The ideal employment information should come from pre-treatment time periods, but due to data limitation, 1998-2000 is the earliest data on industrial employment I have access to. I normalize various variables in the production data following Brandt, Van Biesebroeck, and Zhang (2014) and Yu (2015).

faces at year t is aggregated as

$$\text{Trade Policy}_{jt} = \sum_i w_{ij} \cdot \text{Trade Policy}_{it}$$

where w_{ij} is the initial time-invariant weight that measures the importance of industry i at prefecture j, and Trade Policy_{it} measures the industry-level time-varying trade policy of industry i at time t. When using employment weights, $w_{ij} = \text{Emp}_{ij} / \sum_i \text{Emp}_{ij}$, where Emp_{ij} is the number of employed workers in industry i at prefecture j during a fixed time period, 1998-2000; and when using trade basket weights, $w_{ij} = \text{XM}_{ij} / \sum_i \text{XM}_{ij}$ where XM is the value of imports/exports of product i at prefecture j during a fixed time period, 1997-1999.

Note that the weights used in constructing prefecture-level tariff rates come from employment or trade structures that are determined before China's WTO accession. This approach follows the tradition in the literature to eliminate endogeneity concerns from the production and employment composition shifts due to tariff changes. As a result, the temporal variation in the weighted average prefecture level trade policy only reflects the variation in industry-level statutory changes overtime. The unlikely correlation between pre-liberalization local industry mix and industry-level tariff reductions makes the prefecture weighted average an exogenous measure of local exposure to trade policy changes, as discussed in Section 2.3.

Moreover, products are either skilled-labor-intensive or unskilled-labor-intensive, depending on the share of skilled labor used in the production process. I use L and H to denote unskilled- (low-skill) and skilled- (high-skill) labor-intensive products, respectively. At the prefecture-level, the skilled sector produces goods that are skilled-labor-intensive, and vice versa. Using the weighting approach described above, I calculate both import tariff rates and tariffs abroad faced by prefecture j at time t:

- Import tariff rates for unskilled (L) and skilled (H) goods: tariff^L_{CHN}; tariff^H_{CHN}
- Import tariff rates on capital goods: $\text{tariff}_{CHN-Tech}$
- Tariff rates abroad for unskilled (L) and skilled (H) goods: tariff^L_{ROW}; tariff^H_{ROW}

Table 4 shows the summary statistics of the prefecture-level tariff rates for each cohort. Since each age cohort spends three years in high school, I take a simple average of the tariffs rates in three consecutive years to construct the average trade policy change each cohort faced while studying in high school. For example, Class of 1994's average tariffs are averages of 1992, 1993, and 1994's tariff rates. The first 5 rows report the calculation based on trade basket weights, and the bottom 4 rows are based on employment weights. To illustrate visually the size of the tariff changes, Figure 4 plots the skill-specific tariff rates faced by each cohort at their schooling age. It similarly shows that both import tariff and tariff abroad faced by Chinese prefectures declined, and the decline in unskilled sectors is more drastic.

Moreover, since the prefecture-specific local exposure to trade policy changes reflects local industrial composition, the nationwide trend in declining trade barriers also varies by regions in China. As an example, Figure 2c and Figure 2d visualize respectively the substantial geographic variation in tariff cuts of foreign capital goods and in trade policy uncertainty levels in low-skilled products.

In addition to tariff barriers, I also control for non-tariff barriers that likely affect the overall trade environment in Chinese prefectures. These measures include U.S. tariff uncertainty measured by NTR gaps, investment barriers measure by *contract intensity*, and export restrictions on textile products measured by *MFA quota bound*. Table 5 gives a summary statistics of these measures.

3.2 Empirical Specification

Using constructed variables described above, I link the prefecture-by-cohort education outcomes with the contemporaneous local trade policy environment the corresponding cohorts faced in their schooling years at their schooling location. The resulting panel data consists of trade conditions and education outcomes of 15 age cohorts in 324 Chines prefectures.

I follow the "local exposure approach" (Bartik 1991; Topalova 2007; Kovak 2013), and estimate the educational effects of trade barrier reductions using an OLS difference-in-difference (DID) specification. The intuition of this approach is that, since the geographic distribution of sectors were initially uneven across Chinese prefectures, as tariffs and non-tariff barriers were reduced at the sectoral level by varying degrees at varying times, prefectures ended up experiencing differential exposure to these changes. The DID specification tests whether cohorts in prefectures exposed to bigger trade barrier reductions experiences more pronounced changes in educational attainment then cohorts in prefectures less exposed.

The specification exploits the spatial variation across Chinese prefectures in the degree of exposure to, and the temporal variation across cohorts in their timing of exposure to trade policy changes. In other words, the source of identification comes from the variation across Chinese prefectures in their degree of local exposure to the declining trade barriers over time.

This empirical design is a variation of the standard DID design (Autor 2003; Bertrand, Duflo, and Mullainathan 2004). Instead of having dichotomous treatment and control groups, the size of trade policy changes can be interpreted as continuous treatment. That is, prefectures with bigger changes in trade policies were *more* treated, while prefectures with smaller trade policy changes were *less* treated. Correspondingly, age-cohorts mimic time periods pre- and post- treatment, since younger cohorts's schooling years overlapped with or ensued trade barrier reductions, while older age cohorts had completed schooling prior to any changes in trade policies. Thus, for any given prefecture, the variation among younger and older cohorts in their timing of exposure to trade policy changes is analogous to the pre- and post- treatment periods of the said prefecture.[19]

The DID specification can be summarized in the following equation:

$$\overline{E_{jt}} = \beta_1 \textbf{tariff}^{CHN}_{jt} + \beta_2 \textbf{tariff}^{ROW}_{jt} + \beta_3 \text{Post WTO}_t \cdot \mathbf{NTR}_j + \gamma \mathbf{X}_{jt} + \delta(D_j \cdot t) + \lambda_t + \lambda_j + \epsilon_{jt}$$

$\overline{E_{jt}}$ is the share of natives among age cohort t in prefecture j who have completed or enrolled in high school. $\textbf{tariff}^{CHN}_{jt}$ is a vector of Chinese import tariff rates that reflect the local import barriers on the unskilled goods (tariff^{L}_{CHN}), the skilled goods (tariff^{H}_{CHN}), and access to foreign capital goods ($\text{tariff}^{Tech}_{CHN}$). Similarly, $\textbf{tariff}^{ROW}_{jt}$ is a vector of prefecture-level tariff rates Chinese exporters face abroad (ad valorem equivalent nominal rates), consisting of export barriers on the unskilled goods (tariff^{L}_{ROW}), and the skilled goods (tariff^{H}_{ROW}). $\mathbf{NTR}_j$ is a vector of time-invariant measures of the reduction in tariff uncertainty on unskilled- and skilled-labor intensive products (NTR^L and NTR^H). To capture the discrete changes in U.S. tariff uncertainty experienced by cohorts, I interact $\mathbf{NTR}_j$

[19] To interpret the cohort-prefecture DID specification in light of the standard DID design, one can think of each prefecture as the decision maker, choosing the skill composition of the schooling age cohort at each time period, and the choice of how many kids will grow up to be skilled labor is intrinsically a supply of skill response to the concurrent factor prices. As reduced trade barriers change the skill premium, prefectures change the share of skilled labor to supply.

with a time dummy, Post WTO_t, to indicate whether cohorts' schooling years postdated the U.S. conferral of China's permanent Normal-Trade-Relations and China's WTO accession. Finally, X_{jt} is a vector of cohort-specific prefecture characteristics, such as the skill composition of migrants and other non-tariff barriers including *Contract Intensity* and *MFA Quota Bound*. Cohort and prefecture fixed effects are captured by λ_t and λ_j. I also include prefecture-specific time trends $D_j * t$ to account for pre-existing trends in schooling in each prefecture.

The causal impacts of trade trade policy changes on educational attainment are embodied in β's. A negative sign of β_1 and β_2 tells us, compared to the national trend, a decrease in tariff rates are associated with increase in education completion rates of affected cohorts in exposed prefectures. The interpretation of β_3 is the opposite. A higher NTR gap means a bigger reduction in trade policy uncertainty overtime, and the interaction term, Post $\text{WTO}_t \cdot \mathbf{NTR}_j$, measures the size of uncertainty reduction (treatment). Thus a negative sign in β_3 means reduction in trade policy uncertainty decrease education, and vice versa.

To summarize the likely educational effect of trade policy changes that theory predicts, Table 6 lays out how average educational attainment would respond to reduction in various trade barriers, assuming no income effects.[20] For example, when the import tariff on unskilled-labor-intensive goods (tariff^L_{CHN}) decreases, the relative price of unskilled-labor-intensive goods decreases. The Stolper-Samuelson Theorem predicts that the skill premium will increase as a result. In other words, reduction in import tariff on unskilled-labor intensive goods can lead to rising returns to education, and consequently higher average educational attainment in the long run.[21] The opposite holds true for import tariff on skilled-labor-intensive goods (tariff^H_{CHN}). Similarly, when the tariff abroad on skilled-labor-intensive goods (tariff^H_{ROW}) decreases, the demand for Chinese skilled labor increases despite some offsetting impact from term of trade effects, which creates increased demand for education. The removal of trade policy uncertainty – measured by NTR gaps – has

[20]Edmonds, Pavcnik, and Topalova (2010) find that, in India, the loss in parental income due to the loss of protection after trade liberalization had contributed to children's reduced education. However, in the case of China, high school and college are subsidized, and the basic tuition and fees that do not take up big shares in the average household's income. Thus, I expect the poverty-schooling link (Edmonds, Pavcnik, and Topalova 2010) will not likely play an important role in the context of China. Section 6.1 has more discussion on the income effects.

[21]In this example, term of trade effect increases the relative return to the unskilled-labor-intensive sectors, causing the skill premium in China to increase. But the term of trade effect will never offset the effect of tariff reduction.

similar impacts as reduction in tariffs abroad, as uncertainty in U.S. tariff rates on Chinese exported goods can be interpreted as higher expected tariff rates abroad.

4 Results

4.1 Estimation Results of High School Completion

A: Baseline results

Table 7 presents the baseline findings on average high school completion (and enrollment) among native male cohorts. It shows that, during 1990-2004, high school education increased by more in prefectures that experienced larger import tariff declines in unskilled-labor-intensive goods, the reverse is true for prefectures that saw larger declines in tariffs abroad and U.S. tariff uncertainty on unskilled-labor-intensive exports.

The outcome variable is the share (in percentage points) of high school educated (and enrolled) among the native male cohort, which include non-migrants and out-migrants. For members of each cohort that are out of school and in the labor force, I count the ones with a high school degree or higher as "completed high school". However, due to wide variations in school starting age among different regions, some members of the said cohort are still enrolled in high school when surveyed by the 2005 census. To address this concern, I also include the enrolled students in each cohort and count them as "enrolled in high school". In other words, high school completion and enrollment rate is calculated as (completed high school + enrolled in high school)/total count in cohort.

Column (1) shows the coefficients on prefecture-specific tariff rates on goods imported by Chinese prefectures (CHN), and tariff rates abroad on exported goods from Chinese prefectures (ROW), where L and H denotes low-skill and high-skill labor intensive industries respectively. Column (2) shows coefficients on prefecture-specific reduction in trade policy uncertainty, measured by NTR gaps. Column (3) reports all coefficients, and column (4) adds additional control variables, including the skill composition of in-migrants, relaxations in investment barriers measured by *Contract Intensity*, and relaxation on textile export quotas measured by *MFA Quota Bound*. In columns (5) and (6), I restrict the sample to prefectures that have nonzero in-migrants. These prefectures are arguably those that are more impacted by trade policy changes, since they sought to adjust to the increase in labor demand by bringing migrant labors.[22] In all specifications, robust standard errors are clustered by prefecture, and prefecture-specific time trend are included.

All estimates show that larger declines in China's import tariff on unskilled goods are associated with higher high school completion rates of the natives relative to the national trends, suggesting that increased access to import competition in the unskilled sectors decreased the demand for Chinese unskilled labor. Specifically, everything else equal, for each percentage point decrease in tariff^L_{CHN}, the high school completion rate among the appropriate schooling aged cohort is higher by 0.27% relative to the national trend.

On the other hand, two other trade policy changes related to expansion in unskilled-labor-intensive manufacturing sectors have attenuated the increasing trend in high school education. Reduction in tariff uncertainty of the unskilled goods (measured by NTR^L) and decrease in tariff rates on exported unskilled goods (measured by tariff^L_{ROW}) are both associated with sizable negative impact on schooling. Everything else equal, one percentage point decrease in tariff^L_{ROW} and NTR^L are respectively associated with a 0.17 percentage point a 0.11 percentage point decrease in high school completion rate, relative to the national trend. These results suggest that as the unskilled sectors enjoyed improved market access to the rest of the world, the expanded employment opportunity in the unskilled sectors increased the opportunity cost of schooling, and consequently reduced the incentive of schooling. These findings are similar but bigger in magnitude in prefectures with in-migration flows, as seen in columns (4) – (7).

B: Disaggregated import tariff rates

The proceeding results presented in Table 7 treat all imports the same, and do not differentiate between imported inputs for ordinary trade, processing trade, or imported capital goods such as equipments or machineries.[23] In Table 8, I disaggregate the import basket into imports of intermediate goods used for ordinary trade and imports of capital goods, measuring them separately using tariff^L_{CHN-o}, tariff^H_{CHN-o}, and $\text{tariff}_{CHN-Tech}$.

[22] Facchini et al. (2017) offer a detailed analysis of the impact of trade policy changes on internal migration.

[23] Processing trade is not subject to tariffs on inputs. Foreign firms and joint ventures are exempt from import tariffs on these capital goods, as a result $\text{tariff}_{CHN-Tech}$ may correlate with FDI activities, which also demanded relatively more skilled labor. On the other hand, domestic firms are subject to paying import tariffs on capital goods, and the decline in these tariff rates may provide domestic firms an improved access to foreign technology. Not accounting for various types of imports may bias the results.

The structure of the table follows Table 7, and similar patterns hold. Among various reductions in trade barriers, declines in the Chinese import tariffs on unskilled-labor-intensive intermediate goods are associated with higher high school completion rates relative to the national trend. For each percentage point decrease in tariff^L_{CHN}, about 0.17% more high-school aged children complete high school. Comparing Column (1) and (2), when the Chinese tariffs on capital goods are controlled for, the estimated effect of import tariff rates on education becomes much smaller . Adopting foreign technology through importing capital goods has an even bigger positive impact on education – one percentage point decrease in $\text{tariff}_{CHN-Tech}$ leads to 0.48 percentage point increase in high school completion rates. One possible explanation for this finding is that, the imported foreign technology complements skill and increases the skill premium and human capital accumulation. This empirical finding for the Chinese labor market is consistent with the increased relative demand for skill in Mexico and other Latin America countries, as documented in relevant studies (Pavcnik 2003, Bustos 2011).

Similar to results in Table 7, two other trade policy changes related to expansion in unskilled labor intensive manufacturing sectors suppressed high school education: reduction in tariff uncertainty of the unskilled goods, measured by NTR^L, and decrease in tariff rates on exported unskilled goods, measured by tariff^L_{ROW}. Everything else equal, the one percentage point decrease in tariff^L_{ROW} and NTR^L are respetively associated with a 0.15 percentage point and 0.11 percentage point decrease in high school completion, relative to the national trend. These effects are stronger for prefectures with non-zero in-migrant flows.

4.2 Estimation Results of College Education

I then turn to college completion (and enrollment) rates, and examine whether trade policy changes have had similar effects at the college level in Table 9. Even though college completion (and enrollment) rates have increased from 8.5 % in 1990 to 14 % in 2004, these increases seem to be unrelated to trade policy changes. A few possible reasons may explain this finding. First, tertiary institutions all have limited number of seats. Each year a "National College Entrance Examination" (*gaokao*) is held in early June, when high school seniors were ranked by their test performance which determines their eligibility to move on to college. Second, most tertiary institutions rely on provincial and federal funding, and adopt an "affirmative action" style college admission policies that aim to even out the education inequality among regions. As a result, college education, a highly competitive product mostly funded at the federal level, has a strictly limited supply, and the share of college education of each cohort reflects the equilibrium outcome of demand and supply of college education. More specifically, trade policy changes may have affected the demand for college education, but this increased incentive may not translate perfectly in the presence of inelastic supply of college education and distortive admission policies.

5 Robustness Checks

5.1 Industrial employment weights

Most studies that evaluate the impact of trade shocks on labor market outcomes focus on the impact through employment. To quantify the local trade shocks, they interact industry-level measures of trade policy with the geographic concentration of industries (Topalova 2007, Autor, Dorn, and Hanson 2013, and Kovak 2013). This approach emphasizes the impact of trade policy changes that work through employment. The empirical analyses presented in Section 4 instead use trade baskets as the local industry mix. To check if my main findings are robust to using employment weights, I weight the local exposure to trade policy changes using prefecture-level employment distribution, and present the regression results in Table 10.

Specifically, I rely on the 1998-2000 Chinese Annual Survey of Industrial Firms (CASIF), an annual firm-level census that reports the location, main products, and employment information of all firms with more than 5 million RMB in annual revenue. The detailed production information allows me to identify the low-skill (L) and high-skill (H) labor intensive industries in each prefecture, and distribution of workers employed in these industries. Industry level trade barriers are then aggregated to the prefecture level, following the approach described in Section 3.1.

Columns (1)-(2) in Table 10 report results using prefecture tariffs weighted at the ISIC-Rev3 level, and columns (3)-(4) report results using weights at the CIC 2002 level. The estimation is robust to alternative weighting methods, as results in Table 10 – column (4) and Table 7 – column (4) are of similar magnitude. Under the employment-weighted specification, reduction in Chinese import tariffs on unskilled goods, measured by tariff^{L}_{CHN}, has positive impacts on schooling, while expanded export market of unskilled labor intensive goods (tariff^L_{ROW}, NTR^L) has negative impacts on schooling. Surprisingly, decrease in tariff rates on exported skilled goods, measured by tariff^H_{ROW}, seem to discourage schooling, which contradicts the Stolper-Samuelson prediction.

5.2 Migration

The local labor market adjustments to skill price changes may take place through relocation of skills in the short run, i.e., internal migration, and acquisition of skill in the medium-to-long run, i.e., educational attainment. In this section, I address the possible confounding effects of internal migration by providing institutional background and robustness checks.

Internal migration can contaminate the empirical analysis in two important ways. First, internal migration attenuates the local exposure to trade shocks through movement of skills (Borjas 2006). Facchini et al. (2017) show that, when the trade policy uncertainty with the U.S. was eliminated as China joined the WTO, skilled labor responded to increased demand of labor by migrating towards the job opportunities while the unskilled labor responded by working longer hours. The dampening effect of internal migration, however, does not completely mitigate the trade-induced changes in skill prices, as China's *Hukou* system remains fairly protective of local residents and restrictive to labor mobility until today.[24] The remaining labor mobility friction preserves the geographic difference between prefectures in their exposure to trade shocks, justifying treating prefectures as individual labor markets in a difference-in-differences framework.

Second, relocation of skills changes a prefecture's skill endowment through compositional shifts. Thus, merely observing the changes in skill endowment of all observed residents could overstate the impacts of trade policy changes on education acquisition. I tease out the skill relocation response from the skill acquisition response by considering the educational outcomes of only prefecture *natives.* Specifically, I focus on residents of a prefecture who are either non-migrants (born, educated and live there) or out-migrants (born, educated and moved away). This approach is justified by the fact that most schooling age children

[24] Internal migration in China has been tightly controlled by the *hukou* (Household Registration) System. *Hukou* is a resident permit issued by a prefecture on a family basis, and one of the most important features of the system is that *hukou* entitles its holder to local social welfare programs, such as public education and public health. For this reason, it limits internal migration since it precludes access to public services to those migrants who cannot acquire a local *hukou.* Since the late 1990s, *hukou* policy has been relaxed to facilitate temporary labor mobility as well as to help address urban prefectures' increased demand for labor. Nevertheless, restrictions on long-term migration remain, and permanent migration between prefectures remain very low, as shown in Table 11.

in China receive their primary and secondary education in their hometowns, as entitlement to public education is predicated by the *hukou* system.[25] Assuming schooling age children do not make migration and schooling decisions simultaneously, the hometown exposure to trade policy changes is what have affected their educational attainment.

To fully address possible confounding effects from increased internal migration, I carry out robustness checks with alternative samples in Table 12. Column (2) replicates the results in the main specification where the native sample of each prefecture includes non-migrants and out-migrants. Column (1) uses the entire population observed at prefectures, i.e., non-migrants and in-migrants. Column (3) restricts to only non-migrants. Results are similar across these three alternative samples. Interestingly, all the significant coefficients have larger magnitude in the regression in column (1) than in column (3), which suggests that trade policy changes had altered the relative demand for skill, and part of the adjustment took place through internal migration. Columns (4) and (5) show results for the female samples, and the results suggest that trade policy changes had different impacts on females than males.

5.3 Placebo Tests

In Table 13, I run a Granger test on older cohorts to make sure the results were not driven by reverse causality. Reverse causality arises if, before China experienced any trade policy changes, prefectures' initial skill endowment predicated future trade shocks, that is, the pre-liberalization education disparity determined the subsequent size of trade policy changes in each region. To rule out reverse causality, I test the effects of trade policy changes during 1990 - 2004 on cohorts who finished high school prior to the trade policy changes. They are Classes of 1980 to 1994, and their high school years were not overlapped with the upcoming trade events in China. All specifications report insignificant results on all coefficients, confirming that individuals between 28 years old (Class of 1994) and 42 years old (Class of 1980) didn't exhibit anticipatory response to the later trade liberalizations that took place after these older cohorts finished high school education.

By construction, the skill-specific trade policy changes should only affect the skill premia at the high school and college levels, and leave the schooling incentive at lower grades unchanged. However, the observed educational response to trade shocks could come from

[25] This restriction wasn't relaxed in selected regions of China until 2016 (OECD 2016).

a increased pool of high-school eligible students, if the primary and junior school quality and supply are vastly improved by trade-related factors. The Placebo test in Table 13 show that this is not the case.

5.4 Semiparametric Evidence

The results presented in Section 4 only focuses on how trade policy changes affect the *mean* of the educational attainment. The linear regression approach overlooks the nuanced changes along the entire distribution of educational outcomes. In this section, I use a semi-parametric approach to compare the education distribution of more exposed prefectures to that of less exposed ones.

DiNardo, Fortin, and Lemieux (1996) devise a semi-parametric procedure to analyze changes in the distribution of wages. Pavcnik (2003) applied this methodology to Chilean plant-level data, and observed difference in the density of wagebill share of skilled workers between plants that adopted technology and plants that did not. Chiquiar and Hanson (2005) applied this method to test the negative selection hypothesis of Mexican migrants in the U.S. By comparing the wage distribution of Mexican natives and of emigrants, they show that Mexican immigrants in the U.S are more educated than non-migrants in Mexico. I apply this semi-parametric method to test whether the educational effect of improved access to foreign technology adoption and imported intermediate goods differ for prefectures with different skill endowment.

Figure 5 plot the actual densities of education for prefectures that did not adopt technology (in dashed green line) and prefectures that did (in maroon line). The difference in education distributions could be due to technology adoption or other underlying prefecture characteristics that could also influence skill endowment. To isolate the causal effect of foreign technology on schooling, I match prefectures that did adopt foreign technology to ones that did not based on their characteristics , and plot the *counterfactual* skill density of the tech-adopting prefectures if they did not adopt foreign technology (red solid line). The remaining difference between the actual and counterfactual skill densities are not driven by sample selection, and thus can be attributed to the adoption of foreign technology. For the tech-adopting prefectures, they would have ended up with a lower skill endowment if they had not had reductions in Chinese tariff on imported capital goods. One should be cautious to make causal inference with the results shown above. Acemoglu (2003) argues that, as the supply of skill increased in the 1970, the speed of skill-biased technological change increased to exploit and increased amount of skill on the labor market, thus raised the skill premium in the 1980's and 1990's. What I find in this section can be a version of endogenous foreign technology adoption, that is, prefectures better endowed with skilled workers had stronger incentives to import foreign technology.

I repeat the same exercise for improved access to imported low-skill intermediate goods in Figure 6. There is a visible difference between the actual and counterfactual education densities of prefectures with large decrease in unskilled intermediate goods, suggesting decrease in import tariffs on unskilled products has lead to higher average schooling. This result further confirms the regression results that improved access to cheaper imports of low-skill intermediate goods decreased demand for Chinese unskilled labor.

6 Mechanisms

There are two main channels through which trade policy changes can influence educational attainment. First, changes in return to education affect the incentive to acquire education. Second, changes in real income affect the affordability of education. I outline the intuition of these channels in a simple model of education decision in subsection 6.1, and substantiate the model prediction with supplementary empirical evidence in in the remainder of this section.

In the first channel, trade of both final and intermediate goods changes the skill premium through Stolper-Samuelson effects (Findlay and Kierzkowski 1983, Blanchard and Olney 2017). China's increasing economic involvement with the rest of the world has come from reductions in tariff and non-tariff barriers, as well as the elimination of trade policy uncertainty with the U.S. Freer trade influences the relative demand for factors of production, and consequently shifts the payouts to skilled and unskilled workers. Increases (decreases) in skilled wages translate directly into increases (decreases) in return to education, while increases in unskilled wages have an additional effect on the opportunity cost of education. The latter mechanism, often ignored, is confirmed by Atkin (2016), who shows the case of Mexico, the arrival of low-skill export-manufacturing jobs raised the opportunity cost of schooling and increased drop-out rates. Moreover, trade-induced technology upgrading also affects returns to education.[26] Globalization has fastened the speed at which developing countries acquired access to skill-biased technologies (Pavcnik 2003; Bustos 2011). As a result, the increased wage gap across skill levels in developing countries cab also been partially attributed to skill-biased technological change.

In the second channel, trade changes the affordability of education through income effects. Trade policy changes can decrease (increase) household real income for workers in the import-competing (export-oriented) sectors, and hence decrease (increase) their ability to pay for education. In many developing countries, unskilled-labor-intensive sectors were more protected prior to liberalization, contrary to the trade protection patterns assumed in classical trade models (Attanasio, Goldberg, and Pavcnik 2004; Topalova 2004; Goldberg and Pavcnik 2005; Goldberg and Pavcnik 2007). Not surprisingly, the costs of globalization were often borne by unskilled workers in developing countries. Edmonds, Pavcnik, and Topalova (2010) find that, Indian districts with concentrated employment in industries losing tariff protection saw a relative rise in poverty, and families facing this negative income effect demanded more child labor and reduced schooling of their children.

The combined effect of the skill premium and income channels could mask the underlying competing forces resulted from different trade policy changes. For example, *ceteris paribus*, a decrease in import tariffs on unskilled labor intensive goods lowers unskilled wages. This could lead to an increase in the returns to education (skill premium), a decrease in the opportunity cost of education, and thus an increase the incentive for schooling. At the same time, lower unskilled wages make education less affordable for households who become too budget constrained. In this case, the combined effect of trade policy changes on education depends on whether the substitution effect or the income effect dominates. This explains why existing studies that examine aggregate educational outcomes have found mixed results despite overwhelming evidence of increases of skill premium in developing countries.[27] For example, both facing increased skill premium brought by globalization, unskilled workers in the U.S. responded by upgrading their skills (Hickman and Olney 2011), while unskilled workers in India responded by downgrading their children's education to cope with trade-

[26] Acemoglu (1998, 2003) have shown that the technological advancement since the 1970's complements skilled labor.

[27] Increased wage inequality across skill types has been consistently documented for many countries. For Mexico, see Feenstra and Hanson (1996), Feenstra and Hanson (1997), Revenga (1997), and Harrison and Hanson (1999). See Attanasio, Goldberg, and Pavcnik (2004) for Colombia, Pavcnik (2003) for Chile, Bustos (2005) for Argentina, Bustos (2011) for Brazil, and Topalova (2007) for India.

induced poverty (Edmonds, Pavcnik, and Topalova 2010).

6.1 Conceptual Framework

Consider an individual making schooling decision at the beginning of entering the labor market. Schooling takes 1 period of time, and tuition costs c. Denote w^0 and w^s as the real income of unskilled and skilled workers, respectively.

The value function for unskilled workers is:

$$V^0 = \sum_{t=0}^{\infty} \beta^t w^0 = \frac{w^0}{1-\beta}$$

The value function for for skilled workers is:

$$V^s = -c + \sum_{t=1}^{\infty} \beta^t w^s = -c + \frac{\beta}{1-\beta} w^s$$

Individuals acquires education if the expected utility of going to school is higher:

$$V^s + e^s > V^0 + e^0$$

Thus, the probability that we observe an individual as a skilled worker is:

$$Pr(s = 1) = Pr(e^0 - e^s < \frac{\beta}{1-\beta}[w^s - w^0] - w^0 - c) \tag{1}$$

The first term, $\frac{\beta}{1-\beta}[w^s - w^0]$, embodies skill premium channel, ask skill premium increases, either due to rising w^s or falling w^0, educational attainment increase. The second term, w^0, represents the opportunity cost of going to school, and the third term, c, for the tuition cost.[28]

Define $u = e^0 - e^s$, which is mean zero with *cdf* $F(u)$ and strictly positive density $f(u)$. To analyze the determinants of changes in schooling, I differentiate Equation 1 with respect

[28] In this paper, I ignore the tariff's effect on the real income through the consumption channel. There are two justifications. As long as consumption bundles are not correlated with sectoral composition of employment across prefectures, the omission of the consumption exposure to trade policy changes will not bias the effects from the income channels. In addition, if there is no significant variation in consumption bundles across areas in China, the impact through consumption is captured in the time trends.

to tariff changes, $d\tau$.

$$dPr(s=1) = f(u) \cdot [\frac{\beta}{1-\beta} \cdot \frac{\partial w^s}{\partial \tau} d\tau - \frac{1}{1-\beta} \cdot \frac{\partial w^0}{\partial \tau} d\tau - \frac{\partial c}{\partial \tau} d\tau] \quad (2)$$

From Equation 2, trade policy changes ($d\tau$) can affect individual education decision through 1) changing the skill premium, i.e. the substitution effect, and 2) changing the relative cost of education, i.e. the income effect. The interaction between the type of trade policy change and the skill-intensity of the sector it affects determines how skill acquisition is impacted.[29]

In some cases, these two channels can counteract with each other. For example, when import tariffs on unskilled-labor-intensive goods decline, whether these goods are used for final consumption by households or as inputs by industries, they replace domestic unskilled labor and increase the relative demand for skilled labor. As a result, higher return to education will increase the incentive for skill upgrading. However, unskilled workers may suffer income declines due to the loss of tariff protection, and may not be able to afford to invest in education. The converse holds true for decreases in tariffs abroad on unskilled-labor-intensive goods. The rise in relative demand for domestic unskilled labor not only decreases the skill premium, but also increases the opportunity cost of schooling. But education becomes more affordable as unskilled workers' income rises. As a result, some individuals may respond more to the skill-premium channel, while other budget-constrained ones may respond more to the income effects.

The conceptual motivation outlined above offers three possible explanations to the main empirical findings in this paper: 1) return to education increased in response to trade policy changes; 2) arrival of low-skill jobs increased the opportunity cost of education; 3) cost of education decreased in high school but not in college. I explore each of these channels in the following subsections and present empirical evidence supporting each claim.

[29] Note that none of the terms in Equation 2 explain the income effects directly. In an individual decision's problem, without specifying parents' income, the income channel can only be indirectly modeled through the real cost of education, c. For example, let the local economy as a whole be the provider of credit for education expense, and the nominal tuition expense is set at the national level. Depending on the industry mix of this local economy, a trade shock could increase or decrease its overall GDP relative to the national standard. This affects the local economy's ability to provide education credit to its resident students, regardless of how skill premium changes.

6.2 Return to Education

The main results imply that trade policy changes increase the relative demand for skill. Given that the unemployment rate in China stayed at a very low level for both skill types (Facchini et al. 2017), shifts in demand for labor should exhibit more through wage changes. In other words, the positive effects on education from foreign technology adoption and imports of unskilled-labor-intensive products should also have positive impacts on the skill premium. Consequently, the higher return to education prompts stronger incentives to acquire schooling. For this mechanism to be valid, skill premium and education should both increase.

Ge and Yang (2014) document significant increase in average wage as well as schooling premia between 1992 and 2007 in China. They find that capital accumulation and SBTC among the main explanations for higher returns to education. I replicate the schooling premium trend in Ge and Yang (2014) with firm-level manufacturing census data from 1998-2007. According to the skill intensity of industries and firm ownership types, I consider four average wage points: the average wage in 1) domestic and 2) foreign firms in the unskilled-labor-intensive industries; 3)domestic and 4) foreign firms in the skilled-labor-intensive industries. I plot the annual average wages of these 4 types between 1998 and 2007 in Figure 7. The skilled sectors are in diamonds, and the unskilled sectors are in circles. I denote domestic firms with red and solid markers, and foreign firms with blue hollow markers. Several patterns emerge from Figure 7. First, foreign firms pay higher wages than domestic firms. Second, skilled sectors pay higher wages than unskilled sectors, and the gap between them increases overtime, for both domestic and foreign firms. This confirms the increasing trend in skill premium.

I next check whether the increases in demand for skill are caused by trade policy changes. I relate the share of skilled employees to the local trade policies at the prefecture level, and carry out a standard DID regression using firm-level employment data in 1995 and 2004.[30] The regression results are presented in the coefficient plot in Figure 8. Consistent with the changes in educational attainment, the average wages increase relatively more in prefectures with more imports of unskilled products. However, the effect from imports of capital goods are not significant.

[30]Due to data limitation, I cannot measure skill premium form the firm-level data. Thus, I use the prefecture-level average wages.

6.3 Arrival of Low-skill Manufacturing Jobs

To check whether the second channel –arrival of low-skill jobs increased the opportunity cost of education– may have been at work to drive the main findings, I document the increase in low-skill manufacturing employment using firm-level employment data from 1998 to 2007 in Figure 9. It shows that the overall number of jobs in unskilled sectors increased overtime, but the job growth in foreign firms is much faster, suggesting faster job creations associated with better integration with foreign markets as China acceded to WTO.

I then relate NTR gaps to the increase of unskilled jobs using an industry panel dataset I constructed from CASIF 1998-2007, with which I estimate the impact of trade policy uncertainty reduction on unskilled job growth. The results are reported in Table 15. U.S. granting China PNTR is positively associated with job growth in the unskilled sectors. Both domestic and foreign firms expanded and hired unskilled workers. However, if these new jobs are taken by internal migrants, then internal migration will attenuate the increased demand for unskilled labor, leaving little change in opportunity cost of schooling for local youth. I address this concern in Table 16, which shows that, increased internal migration (Table 11) was not sufficient to satiate the increased demand for unskilled labor, leaving native unskilled workers working longer hours.

The negative impact on educational attainment from the elimination os U.S. tariff uncertainty in unskilled sectors came from increased availability of jobs that do not acquire skills. In other words, the unskilled job expansion since 2000 likely created opportunities outside the school, and increased the opportunity cost of acquiring education.

6.4 Provision of Public Education

Finally, the increase in schooling among younger Chinese cohorts would not have been possible without the third channel – expansion in education facilities. To confirm the increasing availability of education resources during 1990-2004, I plot the total number of teachers and student-teacher ratios in Figure 10. Overall, the number of teachers in all education levels increased since 1990, however, the increase in primary and secondary schools are much more rapid than in colleges. In fact, the increase in number of teachers in primary and secondary schools kept the student-teacher ratio about steady, while the sharp increase in college student-teacher ratio suggest insufficient education resources at the tertiary education institutions. This may help explain the contrasting result I find for high school and college education.

To test whether the local governments at prefectures that experience more skill-increasing trade shocks also expanded education facilities accordingly, I run a DID regression similar to the main specification for number of teachers and number of teachers per school in Table 17. Local education resources did respond to trade policy changes, responding in the same direction as children's incentive for schooling. For high school education, which is funded by prefecture-level local governments, imports of capital goods and unskilled products increased the number of teachers. For college education, which is funded by provincial and central governments, I find mixed results.

7 Conclusion

Recent empirical research has emphasized the distributional impacts of globalization, as many developing countries have forgone the import-substitution policy and opened up to trade in the past few decades (Goldberg and Pavcnik, 2004; 2007). Whether the inequality in *income* will translate to inequality in *education* in the long run requires careful and comprehensive assessment of the possible channels through which trade can affect educational attainment. I examine this question in the context of China's trade liberalization since early 1990 which culminated in the WTO accession in 2001. I assess a wide range of trade policy changes, and decompose the differential impact of each component. My findings can be summarized to four parts.

First, despite the fact that internal migration also responded to shifting demand for labor caused by trade policy changes (Facchini et al. 2017), skill reallocation was not sufficient to arbitrage away the skill price changes, and the overall low endowment of skill left remaining incentive for skill acquisition.

Second, I find that completion and enrollment rates of high school education have increased in China since the early 1990s. These trends are more pronounced in prefectures where industries benefitted more from falling tariff on foreign technology, and in prefectures where industries substituted imported intermediate goods for domestic unskilled labor due to falling tariff protection on these inputs. On the other hand, expansion of export opportunities in unskilled sectors, due to the elimination of U.S. trade policy uncertainty (i.e., US granting China permanent Normal-Trade-Relations) has increased the opportunity cost of schooling and decreased high school education completion. Overall, trade-related factors help explain half of the increase in high school completion rates from cohorts in 1990 to cohorts in 2004. Furthermore, these findings are robust to a variety of alternative methods to account for potential endogeneity of the baseline specification.

Third, interestingly, trade policy changes seem to have no effect on college education, possibly due to the limited seats tertiary institutions, as well as distortive college admission policies that aim to even out the education inequality among regions.

Lastly, I provide evidence for three channels through which changes in trade policy affected educational attainment: return to education, opportunity cost of schooling, and supply of education resources. More detailed examinations suggest that increased schooling premium and local government's increased provision of public education may have facilitated increased schooling. At the same time, export expansion of manufacturing goods due to better access to foreign markets has increased the demand for unskilled labor and reduced schooling.

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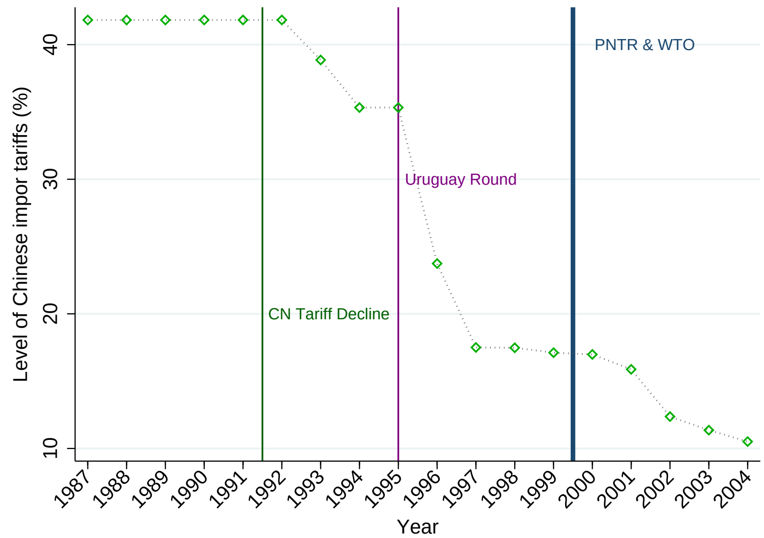
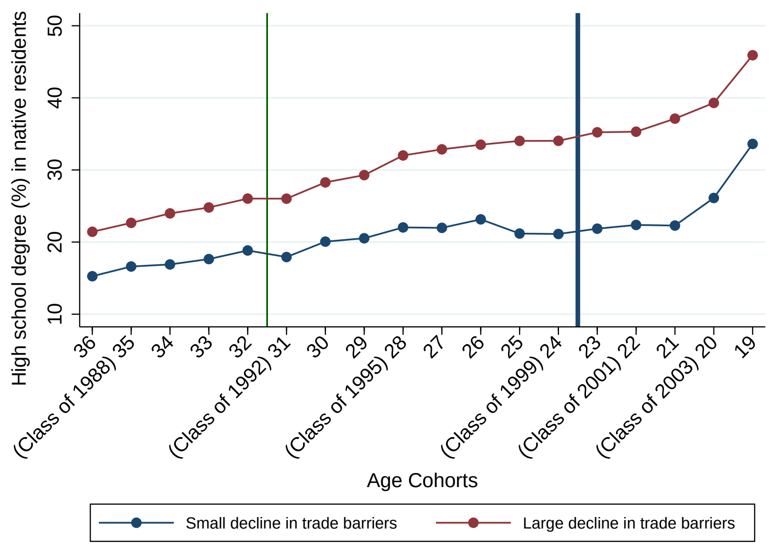
Figures and Tables

Figure 1: Trade policy changes and educational attainment



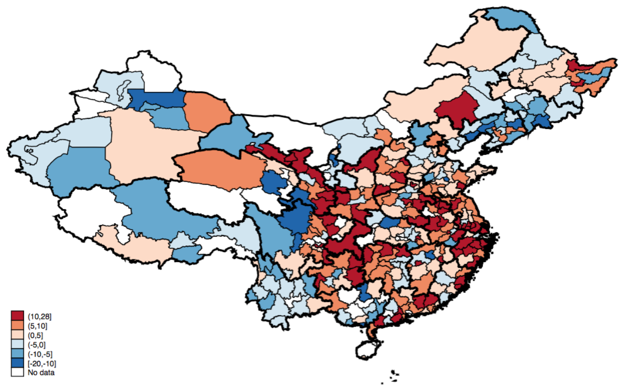
(a) Average Chinese import tariff rates, annually



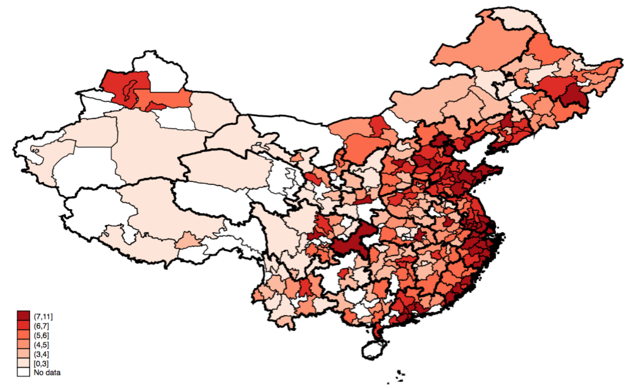
(b) Share of high school educated residents

Notes: (a) plots the average Chinese import tariffs against the timeline of major trade policy changes China experienced: China's beginning of lowering import tariff in 1992; conclusion of the Uruguay Round in 1995, and China's accession to the WTO in 2001. Age cohorts around these lines were most exposed to globalization. (b) plots, from older cohorts to younger cohorts, the share of high school educated individuals among the native population (non-migrants and out-migrants). The blue line denotes cities that were "less-treated" (that is, exposed to smaller changes in trade policy), and the red line denotes cities that were "more-treated" (that is, exposed to bigger changes in trade policy). The vertical lines corresponds to the major trade policy changes timeline in (a).

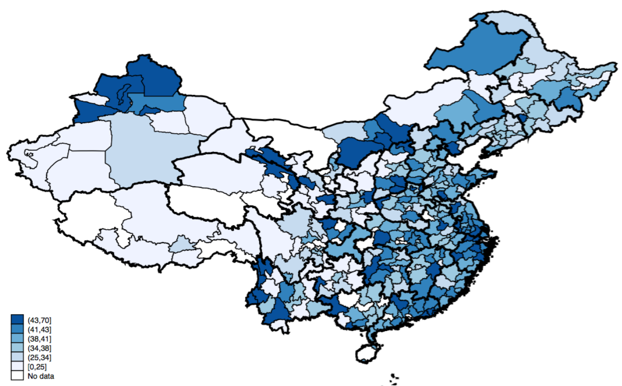
Figure 2: Geographic Variation Among Chinese Prefectures



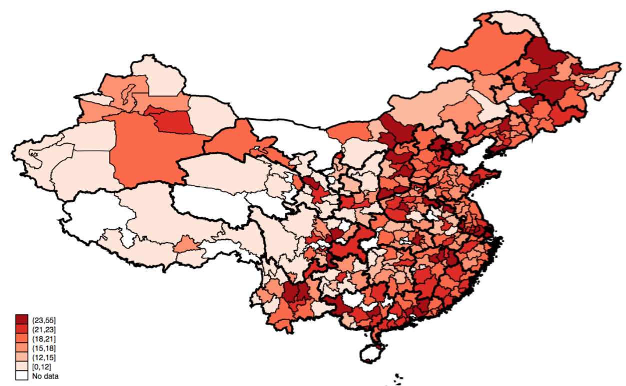
(a) Changes from 2000 to 2005 in High School Educated (%) among 18-27 Year-old Natives



(b) Log of Changes in Export Values from 2000 to 2005



(c) Trade Uncertainty Levels (NTR Gaps) in Low-skill Products

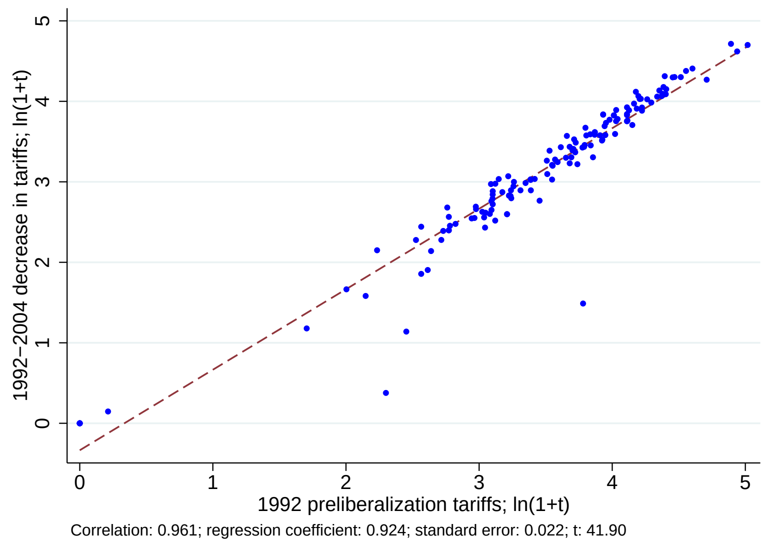


(d) Change in Tariff Rates on Capital Goods from 1992 to 2004

Notes: The geographic boundaries outline administrative division at the prefecture level. Bold lines mark provincial boundaries. (a) shows the increase in share of at least high school educated among the native 18-27 year-olds. (b) plots the geographic variation in prefecture-level increase in export values. (c) plots the geographic variation in prefecture-level NTR gaps of low-skilled exports. (d) plots the geographic variation in prefecture-level import tariff rates on capital goods.

Figure 3: Exogeneity of Chinese tariff reductions

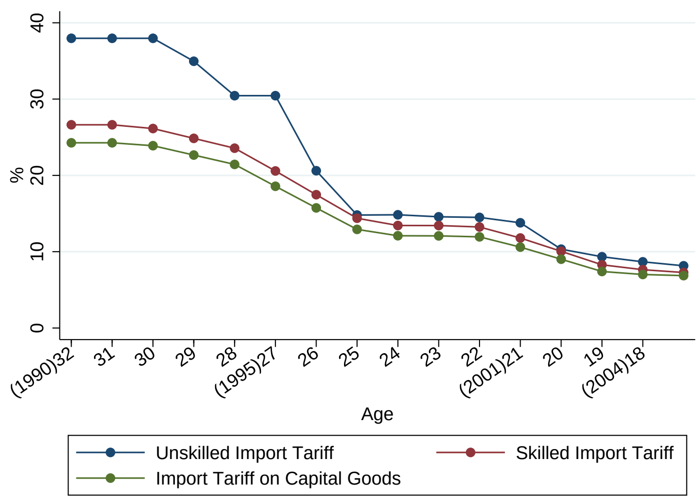
(a) Chinese import tariff rates at product level



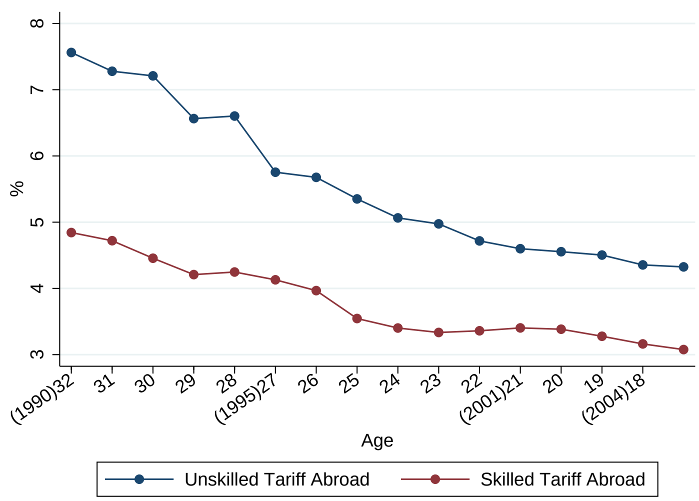
(b) Relationship between tariff reductions and pre-liberalization tariff levels at industry level

Notes: (a) This figures plots the distributions of Chinese import tariff rates at the HS 6-digit product level at various years. The leftward shift in the density over time shows gradual overall import tariff reductions. (b) Industry tariff rates are aggregated from HS 6-digit level to ISIC 4-digit level by taking unweighted averages.

Figure 4: Tariff rates across years and cohorts



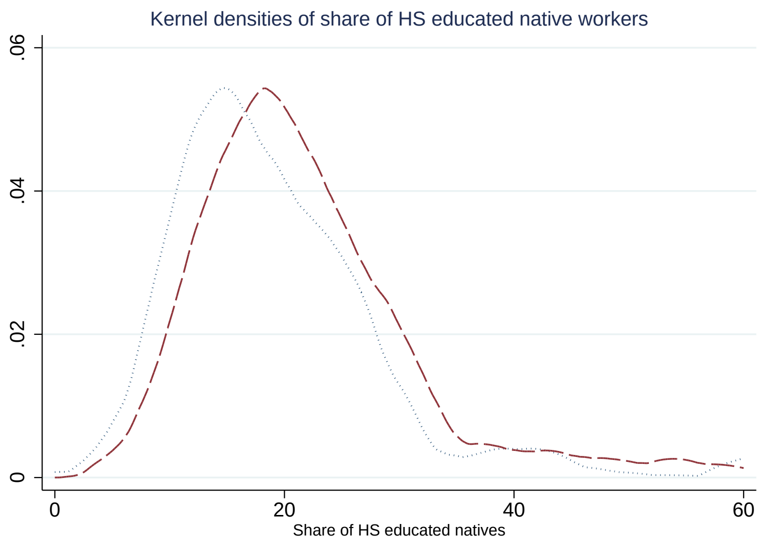
(a) Import Tariff



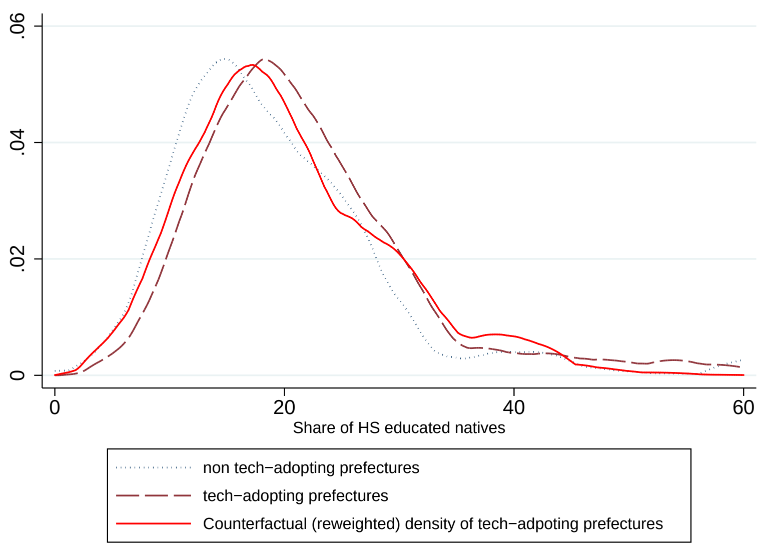
(b) Tariff Abroad

Notes: This figure plots the progression of prefecture-level tariff rates across time/cohorts. HS 6-digit product level tariff rates from the WTIS-TRAINS database are aggregated to prefecture level tariff rates by taking simple averages using import and export baskets of each prefecture. The Chinese import tariff rates use are MFN rates, not including VAT or general duty. Prefecture-level tariff rates are aggregated by taking simple averages of the tariff rates associated with the local trade basket.

Figure 5: Kernel densities of share of HS educated native workers



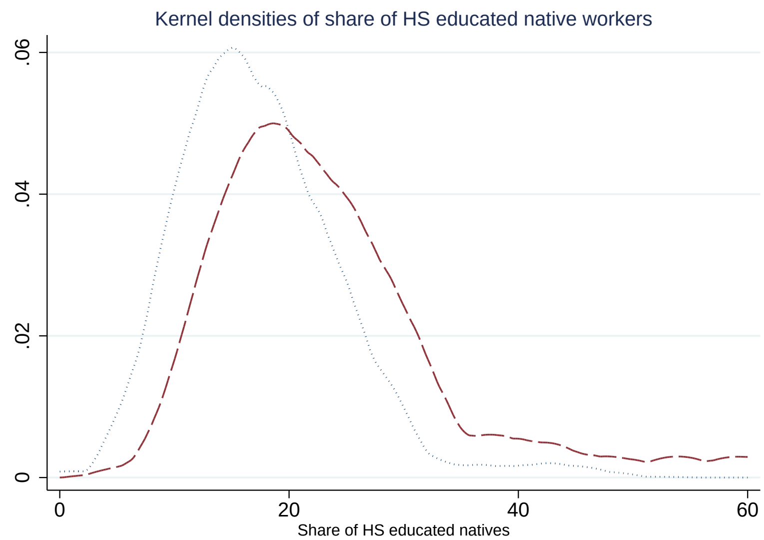
(a)



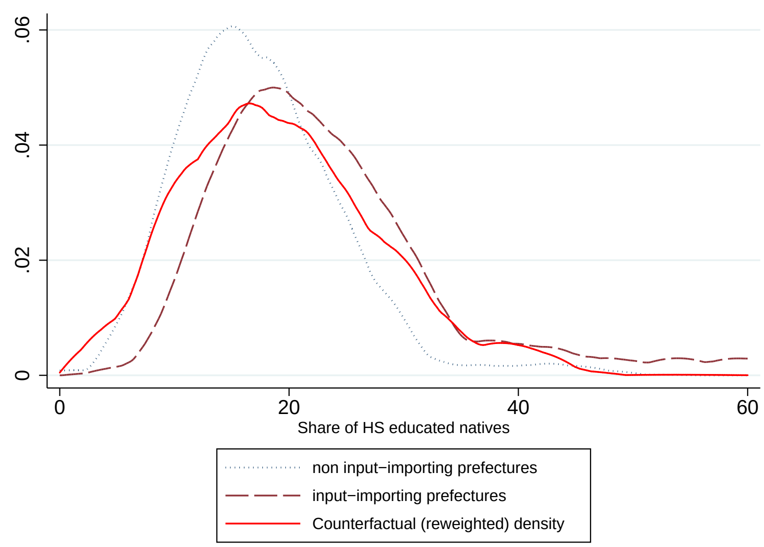
(b)

Notes: (a) plots the actual densities of education for prefectures that did not adopt technology (in dashed green line) and prefectures that did (in maroon line). In (b), I match prefectures that did adopt foreign technology to ones that did not by their characteristics such as labor market condition, geographic location, age composition etc, and plot the counterfactual skill density if they did not adopt foreign technology (red solid line).

Figure 6: Kernel densities of share of HS educated native workers



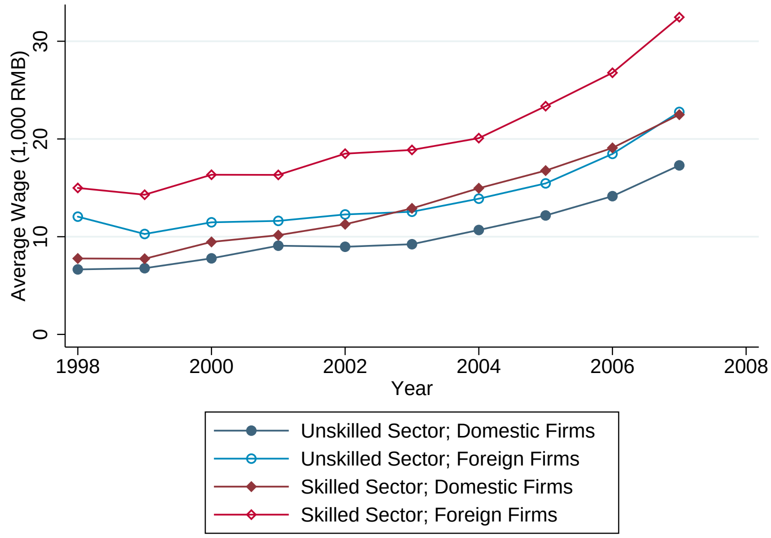
(a)



(b)

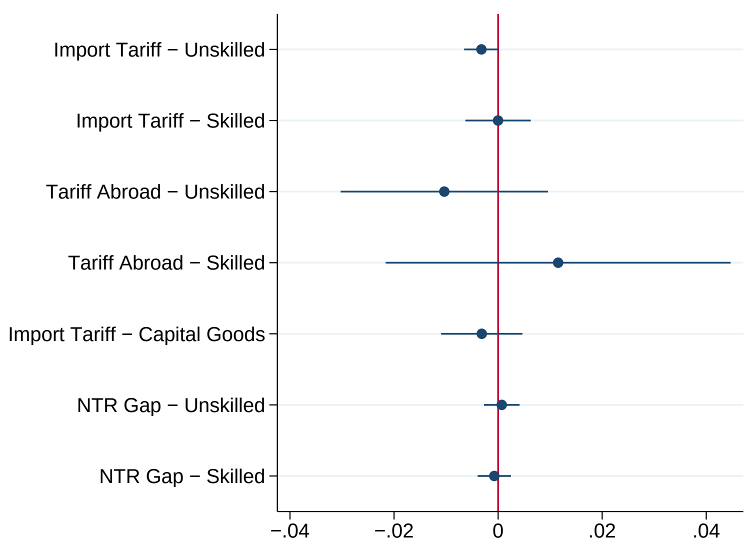
Notes: (a) plots the actual densities of education for prefectures that did not import low-skill intermediate goods (in dashed green line) and prefectures that did (in maroon line). In (b), I match prefectures that did import low-skill intermediate goods to ones that did not by their characteristics such as labor market condition, geographic location, age composition etc, and plot the counterfactual skill density if they did not import low-skill intermediate goods (red solid line).

Figure 7: Average wage in skilled and unskilled sectors



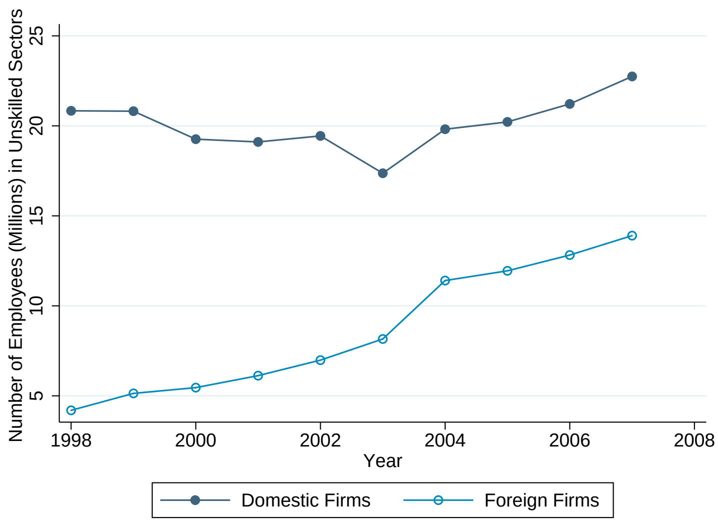
Notes: Average wages are calculated from 1998–2007 Chinese Annual Survey Industrial Firms, which is an annual survey conducted by the Chinese National Bureau of Statistics to collect information on all large-scale firms (annual sales over 5 million RMB). By skill intensity of industries and firm ownership types, 4 types of average wages are calculated for each year in the sample. I denote domestic firms with red and solid markers, and foreign firms with blue hollow markers. The skilled sectors are in diamonds, and the unskilled sectors are in circles.

Figure 8: Estimated Effects of Tariff Rates on Mean Log Wages



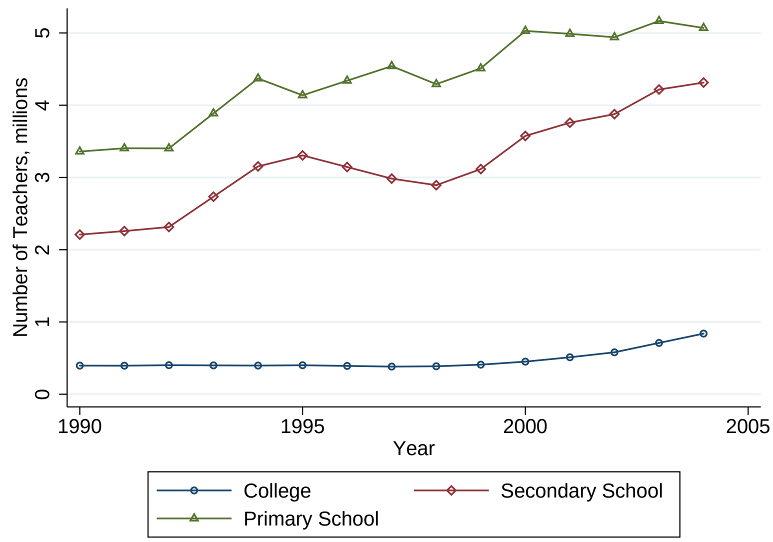
Notes: This figure plots the DID regression coefficients of trade policy changes. The dependent variable is mean log wage in a prefecture during a year. Measures of trade policy changes follow the main empirical analysis in Section 3. 95% confidence internal is plotted around the point estimates using robust standard errors. Prefecture and year fixed effects are included in the regression.

Figure 9: Level of Employment in Unskilled Sectors

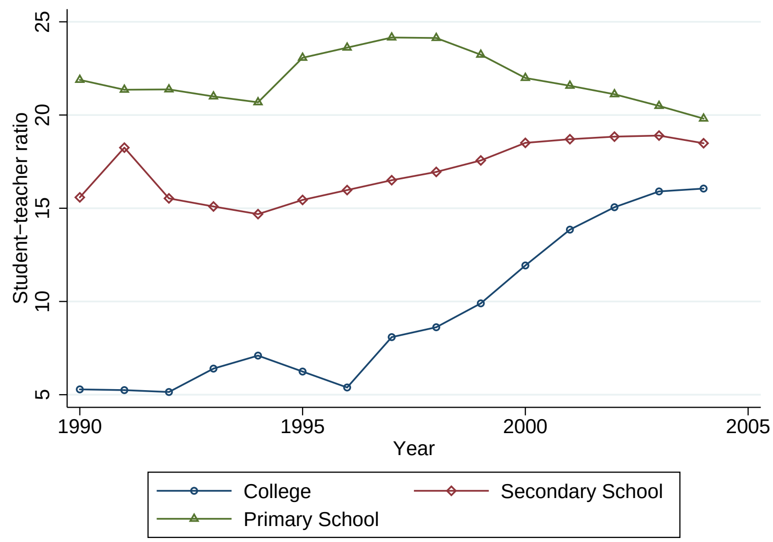


Notes: This figure plots the total number of jobs in the unskilled sectors from 1998 to 2007. Two lines each indicate domestic and foreign forms.

Figure 10: Education Resources, 1990-2004



(a) Total number of teachers



(b) Average student teacher rations

Notes: For three education levels, primary school (grade 1 to 6), secondary school (grade 7 to 12), and tertiary education, (a) plots the national total number of full-time teachers in China from 1990 to 2004, and (b) plots the student teacher ratios.

Table 1: National Average Education Levels by Year

High School Class	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Age in 2005	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
Natives (million)	9.266	8.704	7.947	7.402	6.436	6.730	6.708	6.080	6.251	6.816	5.801	5.640	5.996	7.170	9.422
High School Educated Natives (million)	2.304	2.109	2.109	1.994	1.858	1.954	1.979	1.765	1.872	2.093	1.815	1.860	2.192	3.116	4.462
Share of High School Educated in Natives (%)	24.87	24.23	26.54	26.95	28.87	29.04	29.50	29.03	29.94	30.71	31.30	32.98	36.55	43.45	47.36
Internal Migrants (million)	1.424	1.473	1.448	1.333	1.230	1.287	1.378	1.317	1.367	1.535	1.301	1.304	1.258	1.220	1.204
High School Educated Migrants (million)	0.420	0.449	0.460	0.477	0.472	0.521	0.577	0.560	0.579	0.652	0.540	0.522	0.430	0.361	0.343
Share of High School Educated (%) in Migrants	29.52	30.45	31.77	35.81	38.40	40.47	41.89	42.49	42.37	42.47	41.52	40.03	34.20	29.61	28.51
College Class	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Age in 2005	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
Natives (million)	10.72	11.49	10.44	9.686	9.266	8.704	7.947	7.402	6.436	6.730	6.708	6.080	6.251	6.816	5.801
College Educated Natives (million)	0.911	1.047	1.015	0.967	0.985	0.926	0.907	0.857	0.780	0.804	0.776	0.718	0.780	0.918	0.817
Share of College Educated in Natives (%)	8.503	9.112	9.718	9.979	10.63	10.64	11.41	11.58	12.11	11.95	11.57	11.81	12.47	13.48	14.08
Internal Migrants (million)	1.187	1.410	1.376	1.428	1.424	1.473	1.448	1.333	1.230	1.287	1.378	1.317	1.367	1.535	1.301
College Educated Migrants (million)	0.107	0.138	0.148	0.171	0.165	0.172	0.180	0.185	0.196	0.218	0.248	0.234	0.265	0.302	0.238
Share of College Educated (%) in Migrants	9.015	9.777	10.72	11.97	11.59	11.66	12.45	13.90	15.95	16.98	18.00	17.75	19.37	19.69	18.26

Notes: This table summarizes the nation-wide school completion (enrollment included) rates of the cohorts representing graduating classes from 1990 to 2004. Sample include males aged 18-36. "Natives" refers to non-migrants. Each cohorts' age in 2005 was listed below their class years for reference.

Table 2: Educational attainment of natives and migrants in 2005, by 5-year cohorts

High School Class	1990-1994	1995-1999	2000-2004
Age in 2005	28-32	23-27	18-22
% in population	27.81	31.37	37.35
	(12.71)	(14.36)	(17.92)
% in non-migrants	28.72	31.79	39.84
	(15.46)	(17.12)	(21.26)
% in out-migrants	32.91	43.86	37.51
	(38.47)	(41.01)	(41.24)
% in in-migrants	31.34	40.86	36.86
	(30.13)	(33.88)	(34.69)
College Class	1990-1994	1995-1999	2000-2004
Age in 2005	32-36	27-31	22-26
% in population	11.03	11.67	13.04
	(7.390)	(7.638)	(10.45)
% in non-migrants	11.91	12.47	13.47
	(9.617)	(10.06)	(12.52)
% in out-migrants	12.44	14.84	21.51
	(26.40)	(28.84)	(33.43)
% in in-migrants	11.13	13.01	18.59
	(20.65)	(20.84)	(26.81)

Notes: This table summarizes the prefecture-level school completion (enrollment included) rates of the male cohorts representing graduating classes from 1990 to 2004, grouped into 5-year age cohorts. Sample include males aged 18-36 in 324 prefectures. Each cohort's age in 2005 was listed below their class years for reference. Standard deviations are in parentheses. Each observation is a cohort in a prefecture. I consider 4 demographic groups: current residing population (non-migrants and in-migrants), non-migrants, out-migrants, and in-migrants.

Table 3: Product Level NTR gaps by skill group, 1999

	Unskilled	Skilled	Total
Non-NTR rate	41.0	29.8	34.9
	(25.9)	(20.4)	(23.7)
NTR rate	5.40	2.99	4.11
	(6.88)	(5.33)	(6.21)
NTR gap	35.6	26.8	30.8
	(22.7)	(18.7)	(21.1)

Notes: This table shows the summary statistics of product-level NTR gaps. The first two columns are unskilled and skilled products, respectively. Skill groups are determined by skill intensity information drawn from the 2004 Chinese Annual Survey of Industrial Firms (CASIF). Non-NTR rates are Smoot-Hawley rates, NTR rates are MFN rates, and NTR gaps are the difference between non-NTR rates and NTR rates.

Table 4: Summary Statistics of Trade Barriers (3 year average matched to each cohort)

Trade Basket Weighted	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
tariff^L_{CHN-O}	37.97	37.97	37.97	34.96	30.45	30.45	20.61	14.80	14.84	14.58	14.50	13.79	10.33	9.339	8.672	8.153
	(14.46)	(14.46)	(14.46)	(13.20)	(12.06)	(12.06)	(7.881)	(5.299)	(5.298)	(5.213)	(5.202)	(4.935)	(3.752)	(3.384)	(3.141)	(2.669)
tariff^H_{CHN-O}	26.63	26.63	26.63	25.17	22.76	22.76	16.21	13.44	13.51	13.35	13.42	12.95	9.019	8.180	7.656	7.082
	(9.161)	(9.161)	(9.161)	(8.904)	(8.904)	(8.904)	(5.408)	(4.563)	(4.585)	(4.577)	(4.594)	(4.359)	(4.228)	(4.040)	(3.891)	(2.700)
$\text{tariff}_{CHN-Tech}$	24.27	24.27	24.27	23.13	20.59	20.59	14.53	12.09	12.15	12.03	12.04	11.77	7.994	7.282	6.940	6.825
	(10.49)	(10.49)	(10.49)	(9.923)	(8.981)	(8.981)	(5.999)	(4.921)	(4.939)	(4.901)	(4.901)	(4.745)	(3.282)	(3.019)	(2.883)	(2.820)
tariff^L_{ROW}	7.562	7.279	7.209	6.564	6.602	5.754	5.677	5.351	5.065	4.974	4.717	4.599	4.554	4.503	4.355	4.325
	(5.232)	(5.306)	(5.865)	(5.085)	(5.412)	(2.790)	(3.246)	(2.809)	(2.660)	(3.024)	(2.654)	(2.635)	(2.536)	(2.638)	(2.483)	(2.492)
tariff^H_{ROW}	4.859	4.811	4.491	4.065	4.069	4.608	3.712	3.580	3.344	3.281	3.379	3.420	3.412	3.320	3.100	3.065
	(4.784)	(4.773)	(4.765)	(2.525)	(2.527)	(6.218)	(3.139)	(3.006)	(2.891)	(3.790)	(5.543)	(5.417)	(5.091)	(3.473)	(3.097)	(3.562)
Employment Weighted	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
tariff^L_{CHN}	49.84	49.81	48.25	45.60	42.73	36.73	29.49	22.34	19.69	19.71	19.43	18.02	15.85	13.61	12.16	11.44
	(11.57)	(11.58)	(11.14)	(10.31)	(9.423)	(7.867)	(6.136)	(4.592)	(3.916)	(3.989)	(4.401)	(4.686)	(4.067)	(3.457)	(2.894)	(2.764)
tariff^H_{CHN}	36.72	36.82	36.20	35.06	33.73	29.60	24.67	19.82	18.39	18.39	17.83	15.68	12.99	10.47	9.341	8.614
	(15.22)	(15.35)	(15.28)	(15.24)	(15.04)	(12.57)	(9.922)	(7.529)	(7.235)	(7.228)	(6.902)	(5.815)	(4.488)	(3.293)	(2.643)	(2.306)
tariff^L_{ROW}	9.355	9.370	8.967	8.609	8.003	7.580	7.040	6.602	6.382	6.261	6.226	6.306	6.435	6.501	6.208	4.016
	(4.745)	(4.734)	(3.628)	(2.690)	(1.997)	(1.911)	(1.849)	(1.626)	(1.592)	(1.605)	(1.737)	(2.065)	(2.316)	(2.450)	(2.045)	(1.276)
tariff^H_{ROW}	24.51	24.38	20.04	15.73	10.58	9.436	8.330	7.889	9.234	9.238	8.199	5.404	4.092	3.803	4.443	3.001
	(27.45)	(27.42)	(21.62)	(15.85)	(8.548)	(7.008)	(5.853)	(5.545)	(7.387)	(7.495)	(6.501)	(3.318)	(2.341)	(2.274)	(2.821)	(2.072)

Notes: This table summarizes the prefecture-level tariff rates across time/cohorts. HS 6-digit product level tariff rates from the WTIS-TRAINS database are aggregated to prefecture level tariff rates by using trade basket weights (first 5 rows) and industrial employment weights (last 4 rows). Each yeah corresponds to an age cohort.

Table 5: Summary tatistics of non-tariff barriers

%	mean	sd	min	max
NTR_L	32.66	14.846	0	70
NTR_H	24.95	14.089	0	80.97
Contract Intensity	41.74	10.518	0	85.62
MFA Quota Bound	9.845	11.920	0	100

Notes: This table summarized the prefecture-level non-tariff trade barriers, including unskilled and skilled U.S. tariff uncertainty measured by NTR gaps, investment barriers measure by contract intensity, and MFA quota. See Facchini et al. (2017) for a detailed description of these measures

Table 6: Stolper-Samuelson Theorem Predictions: Impact of Trade Barrier Reductions on Education

	Import tariffs			Tariffs abroad		NTR gaps	
	tariff_{Tech}	tariff^H_{CHN}	tariff^L_{CHN}	tariff^H_{ROW}	tariff^L_{ROW}	NTR^H	NTR^L
$\partial(w^s - w^0)/\partial\tau$; β	< 0	> 0	< 0	< 0	> 0	> 0	< 0
Skill Premium	$\uparrow$	$\downarrow$	$\uparrow$	$\uparrow$	$\downarrow$	$\uparrow$	$\downarrow$
Education	$E\uparrow$	$E\downarrow$	$E\uparrow$	$E\uparrow$	$E\downarrow$	$E\uparrow$	$E\downarrow$

Notes: For brevity, I do not differentiate import tariffs on consumption goods from intermediate goods. The economic intuition for the tariff changes are the same, i.e. they change the demand for the domestic factor used, thus the theoretical prediction in educational outcomes are the same. I ignore the income effect from trade policy changes on education for now.

Table 7: High School Completion and Enrollment of Native (non-migrant plus out-migrants) Males

	All prefectures				Prefectures with in-migrants	
	(1)	(2)	(3)	(4)	(5)	(6)
tariff^L_{CHN}	-0.305		-0.271	-0.271	-0.461	-0.473
	(0.108)***		(0.103)***	(0.103)***	(0.144)***	(0.140)***
tariff^H_{CHN}	-0.127		-0.089	-0.108	-0.059	-0.081
	(0.146)		(0.129)	(0.127)	(0.156)	(0.144)
tariff^L_{ROW}	0.169		0.178	0.174	0.190	0.186
	(0.085)**		(0.085)**	(0.085)**	(0.088)**	(0.086)**
tariff^H_{ROW}	-0.108		-0.115	-0.105	-0.018	-0.010
	(0.073)		(0.075)	(0.074)	(0.059)	(0.063)
Post WTO $*$ NTR^L		-0.120	-0.116	-0.114	-0.150	-0.141
		(0.046)**	(0.046)**	(0.047)**	(0.059)**	(0.060)**
Post WTO $*$ NTR^H		-0.033	-0.017	-0.015	0.011	0.014
		(0.055)	(0.055)	(0.056)	(0.064)	(0.061)
R^2	0.81	0.81	0.81	0.81	0.84	0.84
N	4,860	4,860	4,860	4,860	3,390	3,390
Other Controls	No	No	No	Yes	No	Yes
Pref FE; Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the regression DID results of the baseline specification. Outcome is the share (in percentage points) of high school educated workers in the native male cohorts. Unit of observation is by prefecture and age cohort, where 324 prefecture and 15 cohorts (18 to 32 years old) are included in the 2005 Census. The native sample consists of non-migrants and out-migrants of a prefecture. Columns (1)-(4) covers all 324 prefectures, while columns (5)-(6) include only 226 prefectures with non-zero in-migrants. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. Trade policies are weighted with skill-specific trade baskets (during 1997-1999) of each prefecture, where L and H denotes below-high-school and high-school-educated labor intensive industries respectively. tariff^L_{CHN} and tariff^H_{CHN} are aggregated tariff rates on imported goods by a prefecture at each cohort's schooling years, and these include inputs for both ordinary and processing trade, and capital goods such as equipments and machineries. tariff^L_{ROW} and tariff^H_{ROW} are levels of tariff rates charged by Rest of the World on exported goods from a prefecture during the each cohort's schooling years. Trade policy uncertainty is measure by NTR gaps, Post WTO $*$ NTR^L and Post WTO $*$ NTR^H, which are interactions of time-invariant NTR gaps with a time dummy indicating cohorts' schooling years were after China's WTO accession. Other controls include skill composition of in-migrants, relaxations in investment barriers measured by *Contract Intensity* and *MFA Quota bound*.

Table 8: High School Completion and Enrollment of Native (non-migrant plus out-migrants) Males

	All prefectures				Prefectures with in-migrants		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{tariff}^{L}_{CHN-O}$	-0.233	-0.185		-0.170	-0.235		-0.237
	(0.084)***	(0.078)**		(0.075)**	(0.107)**		(0.094)**
$\text{tariff}^{H}_{CHN-O}$	-0.218	-0.163		-0.148	-0.118		-0.095
	(0.152)	(0.133)		(0.120)	(0.194)		(0.177)
tariff^{L}_{ROW}	0.153	0.144		0.151	0.159		0.161
	(0.088)*	(0.092)		(0.091)*	(0.100)		(0.097)*
tariff^{H}_{ROW}	-0.113	-0.092		-0.093	0.003		0.004
	(0.074)	(0.070)		(0.073)	(0.060)		(0.069)
$\text{tariff}_{CHN-Tech}$		-0.548		-0.478	-0.676		-0.620
		(0.211)***		(0.202)**	(0.295)**		(0.281)**
Post WTO $*$ NTR^{L}			-0.120	-0.109		-0.152	-0.131
			(0.046)**	(0.046)**		(0.061)**	(0.058)**
Post WTO $*$ NTR^{H}			-0.033	-0.001		-0.022	0.025
			(0.055)	(0.056)		(0.066)	(0.061)
R^2	0.81	0.81	0.81	0.81	0.84	0.84	0.84
N	4,860	4,860	4,860	4,860	3,390	3,390	3,390
Other Controls	No	No	No	Yes	No	No	Yes
Pref FE; Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the regression results of the main specification with disaggregated import tariffs. Outcome is the share (in percentage points) of high school educated (and enrolled) workers in the native male cohorts. Unit of observation is by prefecture and age cohort, where 324 prefecture and 15 cohorts (18 to 32 years old) are included in the 2005 Census. The native sample consists of non-migrants and out-migrants of a prefecture. Columns (1)-(4) covers all 324 prefectures, while columns (5)-(7) include only 226 prefectures with non-zero in-migrants. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. Trade policies are weighted with skill-specific trade baskets (during 1997-1999) of each prefecture, where L and H denotes below-high-school and high-school-educated labor intensive industries respectively. $\text{tariff}^{L}_{CHN-O}$ and $\text{tariff}^{H}_{CHN-O}$ are aggregated tariff rates on imported inputs for ordinary trade by a prefecture at each cohort's schooling years. $\text{tariff}_{CHN-Tech}$ is the average tariff rates on the machinery and equipments imported by manufacturing firms in a prefecture. tariff^{L}_{ROW} and tariff^{H}_{ROW} are levels of tariff rates charged by Rest of the World on exported goods from a prefecture during the each cohort's schooling years. Trade policy uncertainty is measure by NTR gaps, Post WTO $*$ NTR^{L} and Post WTO $*$ NTR^{H}, which are interactions of time-invariant NTR gaps with a time dummy indicating cohorts' schooling years were after China's WTO accession. Other controls include skill composition of in-migrants, relaxations in investment barriers measured by *Contract Intensity* and *MFA Quota bound*.

Table 9: College Completion of Native Males

	NM+EM	NM+EM	NM+EM	NM	NM+IM	ALL NM+IM (isic)	ALL NM+IM (cic)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tariff^L_{CHN}	-0.082		-0.091	-0.091	-0.098	-0.048	-0.034
	(0.067)		(0.068)	(0.068)	(0.064)	(0.053)	(0.043)
tariff^H_{CHN}	-0.113		-0.112	-0.113	-0.112	0.093	0.010
	(0.091)		(0.092)	(0.092)	(0.079)	(0.049)*	(0.046)
tariff^L_{ROW}	-0.006		-0.006	-0.006	-0.005	-0.006	0.006
	(0.058)		(0.059)	(0.059)	(0.050)	(0.023)	(0.018)
tariff^H_{ROW}	0.063		0.061	0.062	0.090	0.004	-0.013
	(0.074)		(0.076)	(0.076)	(0.073)	(0.027)	(0.028)
Post WTO $*$ NTR^L		0.020	0.021	0.021	0.029	-0.037	-0.044
		(0.023)	(0.022)	(0.022)	(0.022)	(0.044)	(0.039)
Post WTO $*$ NTR^H		-0.013	-0.011	-0.010	0.001	0.091	0.106
		(0.029)	(0.028)	(0.028)	(0.029)	(0.071)	(0.060)*
R^2	0.73	0.73	0.73	0.73	0.73	0.85	0.85
N	4,860	4,860	4,860	4,860	4,860	4,860	4,860
Other Controls	No	No	Yes	Yes	Yes	No	No
Pref FE; Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: Outcome is the share (in percentage points) of college educated (and enrolled) workers in the native male cohorts. Unit of observation is by prefecture and age cohort, where 324 prefecture and 15 cohorts (22 to 36 years old) are included in the 2005 Census. Samples include, in columns (1)-(3): male non-migrants and out-migrants in a prefecture; in column (4): male non-migrants; in (5): male non-migrants and in-migrants; and in columns (6)-(7): male plus female non-migrants and in-migrants. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. Trade policies are weighted with skill-specific trade baskets (during 1997-1999) in columns (1)-(5), and with skill-specific industrial employment (during 1998-2000) in columns (6)-(7), where L and H denotes non-college-education and college-education labor intensive industries respectively. tariff^L_{CHN} and tariff^H_{CHN} are aggregated tariff rates on imported goods by a prefecture at each cohort's schooling years, and these include inputs for both ordinary and processing trade, and capital goods such as equipments and machineries. tariff^L_{ROW} and tariff^H_{ROW} are levels of tariff rates charged by Rest of the World on exported goods from a prefecture during the each cohort's schooling years. Trade policy uncertainty is measure by NTR gaps, Post WTO $*$ NTR^L and Post WTO $*$ NTR^H, which are interactions of time-invariant NTR gaps with a time dummy indicating cohorts' schooling years were after China's WTO accession. Other controls include skill composition of in-migrants, relaxations in investment barriers measured by *Contract Intensity* and *MFA Quota bound*.

Table 10: Robustness Checks: High School Completion of Native Cohorts (Male plus Female), with sectoral employment weights

	ISIC Rev3		CIC 2002	
	(1)	(2)	(3)	(4)
tariff^L_{CHN}	-0.316	-0.331	-0.241	-0.247
	(0.125)**	(0.121)***	(0.098)**	(0.095)**
tariff^H_{CHN}	0.181	0.204	-0.011	-0.000
	(0.098)*	(0.093)**	(0.073)	(0.073)
tariff^L_{ROW}	0.519	0.458	0.145	0.120
	(0.307)*	(0.305)	(0.068)**	(0.065)*
tariff^H_{ROW}	0.173	0.169	0.116	0.115
	(0.033)***	(0.033)***	(0.025)***	(0.026)***
Post WTO $*$ NTR^L	-0.433	-0.414	-0.265	-0.252
	(0.091)***	(0.089)***	(0.077)***	(0.077)***
Post WTO $*$ NTR^H	-0.111	-0.123	-0.166	-0.175
	(0.152)	(0.153)	(0.119)	(0.119)
R^2	0.87	0.88	0.87	0.88
N	5,085	5,085	5,085	5,085
Other Controls	No	Yes	No	Yes
Pref FE; Cohort FE	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: This table shows the robustness check of using sectoral employments as weights. Outcome is the share (in percentage points) of high school educated (and enrolled) workers in the observed native cohorts (non-migrants and in-migrants). Unit of observation is by prefecture and age cohort, where 339 prefecture and 15 cohorts (18 to 32 years old) are included in the 2005 Census. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. Columns (1)-(2) in Table 10 report results using prefecture tariffs weighted at the ISIC-Rev3 level, and columns (3)-(4) report results using prefecture tariffs weighted at the CIC 2002 level. Definitions of trade policy follows Table 7. See text for more description of the construction of trade policy changes.

Table 11: Internal migration in China (employed workers), 2000

	Temporary Migration		Permanent Migration	
Males	Skilled	Unskilled	Skilled	Unskilled
Flow (in millions)	6.07	21.46	3.08	2.18
Share (%)	8.6	7.6	4.4	0.7
Females	Skilled	Unskilled	Skilled	Unskilled
Flow (in millions)	5.02	24.24	3.59	5.36
Share (%)	8.6	7.6	7.8	2.0

Notes: Based on author's calculation using Chinese Census 2000. The sample use is 16-65 year-old employed workers in China during 2000.

Table 12: Robustness Checks: High School Completion of Native Cohorts

	NM + IM	NM + EM	NM	female NM + IM	female NM + EM
	(1)	(2)	(3)	(4)	(5)
tariff^L_{CHN-O}	-0.195	-0.176	-0.183	-0.115	-0.077
	(0.068)***	(0.074)**	(0.073)**	(0.079)	(0.075)
tariff^H_{CHN-O}	-0.239	-0.151	-0.185	-0.172	-0.120
	(0.124)*	(0.122)	(0.115)	(0.123)	(0.113)
tariff^L_{ROW}	0.117	0.154	0.158	-0.209	-0.157
	(0.097)	(0.091)*	(0.092)*	(0.065)***	(0.061)**
tariff^H_{ROW}	-0.106	-0.096	-0.095	0.047	0.053
	(0.080)	(0.072)	(0.072)	(0.114)	(0.097)
$\text{tariff}_{CHN-Tech}$	-0.789	-0.467	-0.460	-0.526	-0.337
	(0.267)***	(0.200)**	(0.202)**	(0.226)**	(0.201)*
Post WTO $*$ NTR^L	-0.125	-0.110	-0.109	-0.060	-0.015
	(0.051)**	(0.045)**	(0.047)**	(0.045)	(0.044)
Post WTO $*$ NTR^H	-0.047	-0.003	-0.032	-0.060	-0.046
	(0.056)	(0.056)	(0.056)	(0.055)	(0.054)
R^2	0.80	0.81	0.81	0.78	0.82
N	4,856	4,856	4,856	4,855	4,855
Other Controls	Yes	Yes	Yes	Yes	Yes
Pref FE; Cohort FE	Yes	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the robustness check of the main specification by using alternative samples of "natives". Outcome is the share (in percentage points) of high school educated (and enrolled) workers in the male cohorts. Unit of observation is by prefecture and age cohort, where 324 prefecture and 15 cohorts (18 to 32 years old) are included in the 2005 Census. Samples include, in column (1): non-migrants and in-migrants in a prefecture; in column (2): non-migrants and out-migrants; in column (3): only non-migrants; in (4): female non-migrants and in-migrants; and in (5): female non-migrants and out-migrants. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. The right-hand-side trade policy variables are the same as in Table 8.

Table 13: Granger Test: High School completion of older cohorts (Class of 1980 - Class of 1994)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tariff^L_{CHN-O}	0.014	0.025		0.020	0.042		0.038
	(0.048)	(0.050)		(0.051)	(0.064)		(0.063)
tariff^H_{CHN-O}	0.038	0.052		0.041	-0.005		-0.021
	(0.095)	(0.092)		(0.090)	(0.116)		(0.115)
tariff^L_{ROW}	0.039	0.037		0.038	0.029		0.031
	(0.089)	(0.089)		(0.089)	(0.092)		(0.094)
tariff^H_{ROW}	-0.093	-0.090		-0.083	-0.120		-0.114
	(0.084)	(0.085)		(0.088)	(0.086)		(0.088)
$\text{tariff}_{CHN-Tech}$		-0.118		-0.130	0.030		0.031
		(0.147)		(0.146)	(0.184)		(0.182)
Post WTO $*$ NTR^L			0.049	0.052		0.039	0.037
			(0.041)	(0.043)		(0.054)	(0.056)
Post WTO $*$ NTR^H			-0.019	-0.014		-0.010	-0.006
			(0.045)	(0.046)		(0.062)	(0.063)
R^2	0.79	0.79	0.79	0.79	0.82	0.81	0.82
N	4,212	4,212	4,212	4,212	3,352	3,352	3,352
Other Controls	No	No	No	Yes	No	No	Yes
Pref FE; Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: This table shows the granger test of the main specification by using older cohorts that shouldn't have anticipated the trade policy changes. The cohorts used in this regression are 28 to 42 years old when surveyed in 2005, and they are Classes of 1980 to 1994, whose high school years were not overlapped with China's trade liberalization. Outcome is the share (in percentage points) of high school educated (and enrolled) workers in the male cohorts. Unit of observation is by prefecture and age cohort. Samples include, in columns (1)-(4): all prefecture, and in columns (5)-(7): prefectures with nonzero in-migrants in 2005. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. The right-hand-side trade policy variables are the same as in Table 8.

Table 14: Placebo Test: Junior High School completion

	All prefectures				Prefectures with in-migrants		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tariff^L_{CHN-O}	0.007	0.008		0.017	-0.034		-0.012
	(0.070)	(0.076)		(0.076)	(0.103)		(0.106)
tariff^H_{CHN-O}	-0.131	-0.131		-0.129	-0.107		-0.094
	(0.149)	(0.143)		(0.141)	(0.278)		(0.283)
tariff^L_{ROW}	0.051	0.051		0.057	0.015		0.020
	(0.110)	(0.110)		(0.110)	(0.155)		(0.156)
tariff^H_{ROW}	-0.247	-0.247		-0.242	-0.263		-0.261
	(0.145)*	(0.144)*		(0.146)*	(0.159)*		(0.154)*
$\text{tariff}_{CHN-Tech}$		-0.002		0.012	-0.001		-0.008
		(0.205)		(0.207)	(0.268)		(0.273)
Post WTO $*$ NTR^L			0.026	0.019		0.024	0.013
			(0.042)	(0.042)		(0.058)	(0.058)
Post WTO $*$ NTR^H			-0.056	-0.054		-0.071	-0.056
			(0.053)	(0.052)		(0.080)	(0.081)
R^2	0.87	0.87	0.87	0.87	0.90	0.89	0.90
N	4,799	4,799	4,799	4,799	3,116	3,116	3,116
Other Controls	No	No	No	Yes	No	No	Yes
Pref FE; Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the placebo test of the main specification using junior high school completion rates. The cohorts used in this regression are 15 to 29 years old in 2005 – Classes of 1990 to 2004 of junior high school. Outcome is the share (in percentage points) of junior high school educated workers in the native males. Unit of observation is by prefecture and age cohort. Samples include, in columns (1)-(4): all prefecture, and in columns (5)-(7): prefectures with nonzero in-migrants in 2005. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. The right-hand-side trade policy variables are the same as in Table 8.

Table 15: Estimated effect of PNTR on low-skill job growth

	Unskilled Industries			Skilled Industries
	All firms	Chinese Firms	Foreign Firms	All Firms
Post x NTR Gap	0.872	0.584	0.303	-0.023
	(0.312)***	(0.239)**	(0.141)**	(0.331)
R^2	0.85	0.83	0.86	0.68
N	2,081	2,018	1,960	2,128
Other Controls	Yes	Yes	Yes	Yes
Industry FE; Year FE	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the estimated effect of reduction in trade policy uncertainty on the job growth. The first heading indicates unskilled and skilled sectors, and the second heading indicates firm types. Trade policy uncertainty is measured by NTR gaps, Post WTO $*$ NTR, which is the interaction of time-invariant NTR gaps with a time dummy indicating years after China's WTO accession. Other controls include tariff changes, relaxations in investment barriers measured by *Contract Intensity* and *MFA Quota bounds*. See text for more details. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification.

Table 16: Increase in Labor Demand in Chinese Prefectures, 2000–2005

	Migration		Native Working Hours	
	Unskilled	Skilled	Unskilled	Skilled
Post x NTR Gap	0.032	0.093	0.56	-0.000
	(0.019)*	(0.032)**	(0.015)***	(0.012)
R^2	0.96	0.88	0.72	0.73
N	666	666	666	666
Other Controls	Yes	Yes	Yes	Yes
Prefecture FE; Year FE	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the estimated effect of reduction in trade policy uncertainty on demand for skill, through internal migration flows and working hours. The first heading indicates measure of labor supply, and the second heading indicates skill types. Trade policy uncertainty is measured by NTR gaps, Post WTO $*$ NTR, which is the interaction of time-invariant NTR gaps with a time dummy indicating years after China's WTO accession. Other controls include tariff changes, relaxations in investment barriers measured by *Contract Intensity* and *MFA Quota bounds*. See text for more details. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification.

Table 17: Trade and Education Resources at Secondary School and Colleges

	Secondary Schools		Colleges	
	No. teacher	teachers per school	No. teacher	teachers per school
tariff^L_{CHN-O}	-0.018	-0.016	-0.073	-0.069
	(0.006)***	(0.009)*	(0.028)***	(0.029)**
tariff^H_{CHN-O}	0.002	-0.001	-0.021	-0.027
	(0.007)	(0.007)	(0.040)	(0.041)
tariff^L_{ROW}	-0.012	-0.017	0.021	0.012
	(0.007)*	(0.010)*	(0.024)	(0.021)
tariff^H_{ROW}	-0.002	0.002	0.011	0.012
	(0.009)	(0.022)	(0.020)	(0.023)
$\text{tariff}_{CHN-Tech}$	-0.034	-0.067	-0.090	-0.120
	(0.013)**	(0.023)***	(0.070)	(0.075)
Post WTO $*$ NTR^L	-0.002	-0.021	-0.010	-0.017
	(0.004)	(0.007)***	(0.019)	(0.018)
Post WTO $*$ NTR^H	-0.005	-0.014	-0.046	-0.047
	(0.004)	(0.007)**	(0.017)***	(0.017)***
R^2	0.97	0.97	0.87	0.81
N	4,045	4,045	3,175	3,175
Other Controls	No	No	No	No
Pref FE; Cohort FE	Yes	Yes	Yes	Yes
Pref x cohort trend	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The table shows the estimated results of trade policy changes on education resources at both the secondary and college levels. I use two measures of teaching resources: 1) number of teachers, and 2) number of teachers per school. Unit of observation is by prefecture and year, with 324 prefecture and 15 years covering 1990 to 2004. Huber-White robust SEs in parentheses are clustered at the prefecture level to correct for serial correlation. Prefecture-specific cohort trends are added to all specification. Trade policies are weighted with skill-specific trade baskets (during 1997-1999) of each prefecture, where L and H denotes low-skill and high-skill labor intensive industries respectively. tariff^L_{CHN-O} and tariff^H_{CHN-O} are aggregated tariff rates on imported inputs for ordinary trade by a prefecture at each year. $\text{tariff}_{CHN-Tech}$ is the average tariff rates on the machinery and equipments imported by manufacturing firms in a prefecture. tariff^L_{ROW} and tariff^H_{ROW} are levels of tariff rates charged by Rest of the World on exported goods from a prefecture during each year. Trade policy uncertainty is measure by NTR gaps, Post WTO $*$ NTR^L and Post WTO $*$ NTR^H, which are interactions of time-invariant NTR gaps with a time dummy indicating post WTO accession years.