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Globalization, the Skill Premium, and Income Distribution: The Role of Selection into Entrepreneurship *

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Jan 2020

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This paper proposes a novel channel by which trade affects the skill premium and the house-hold income distribution: the selection-into-entrepreneurship mechanism. Trade liberalization intensifies competition for profit, discouraging less able educated workers from sorting into en-trepreneurship and increasing the skill supply. As a result, the return to college declines, leading college enrollment to decrease. We illustrate this mechanism with a simple trade model and show that while highly talented households optimally respond to export opportunities by engaging in entrepreneurial investment and moving up the income distribution, less able educated house-holds self-select downward along the income distribution, which gradually results in household income polarization. Using Chinese household survey data, we employ a Bartik-type instrument for export expansion to investigate how globalization affects the return to college, the selection into entrepreneurship, and the income distribution. The analysis shows that regions facing more export exposure are associated with a larger drop in the skill premium, a greater selection effect on household business ownership, and a stronger polarization pattern in the household income distribution. The entrepreneurship angle highlighted by this paper offers another lens through which to study the broader impact of trade shocks on workers' occupation sorting and the distri-bution of income.

Key Words: Trade, occupational choice, entrepreneurship, income polarization, China

JEL Classification: F11, F16, L2, I24, J24

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1 Introduction

Recent decades have witnessed rapid growth in international trade. Accompanying the fast pace of globalization is the trend of "income polarization", a term that is frequently associated with the disappearing middle-class population and that has become increasingly popular in both academic research and the media.[1] Business income is an important but often-overlooked driver of income polarization, both directly and because selection into entrepreneurship affects the supply of skilled workers in the "market" labor force.

In particular, since China's accession to the World Trade Organization (WTO) in 2001, business income and entrepreneurship have become more important than before and have greatly contributed to household income, as evident in Table 1. Business income as a share of total household income increased eightfold between 1995 and 2007, according to the survey data of the China Household Income Project (CHIP).[2] At the same time, there is a decreasing skill premium, and an income polarization pattern can be seen among Chinese households. A more polarized income distribution is one with relatively few middle-income and more low- and high-income households. Investigating the composition of household income, we find that business income is indeed a driving force, as its share has dramatically risen among the top earners and declined among the middle class. We describe this pattern as the selection of households into business activity – which we map onto *entrepreneurship.*

To guide our empirical analysis, we build a model that recognizes entrepreneurship as a key margin of worker decisions. The theory features heterogeneous agents and the endogenous education and occupation choices. A household member can choose to become a low-skilled worker, a high-skilled worker, or an entrepreneur based on his innate ability and the labor market conditions. An entrepreneur sets up a firm and can improve the firm's production efficiency by investing in managerial effort. Trade liberalization intensifies firm competition for profit and discourages less able educated-workers from sorting into entrepreneurship and increasing the skill supply, which we attribute to the *selection-into-entrepreneurship* mechanism because selection into entrepreneurship affects the supply of skilled workers in the "market" labor force. The rising skill supply leads to a drop in the return to college, which further decreases college enrollment and expands the population of low-skilled labor. On the firm side, rising export opportunities induce highly talented entrepreneurs to invest more managerial effort and to serve customers in the foreign market, which flattens the income profile of domestic entrepreneurs and steepens that of exporters. As the income of top earners is highly related to firm profit,[3] the household income distribution polarizes by squeezing the popu-

[1]For instance, International Labour Organization reports that the middle class in Europe shrank by 2.3% between 2004 and 2011, and the drop has continued since then (https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_535607/lang--en/index.htm). In the US, Valletta (2015) also finds polarization in the earning distribution, which can be partly explained by the flattened wage premium for individuals with high education. For policymakers, maintaining a prosperous middle-class population not only matters for sustainable economic growth (Jones (2014); Lucas (2015); Hanushek et al. (2017); Hendricks and Schoellman (2017); Blanchard and Olney (2017)), but is also related to keeping a healthy inequality level (Blanchard and Willmann (2016)).

[2]The business income share has increased from 0.7% in 1995 to 5.8% in 2007 in CHIP, and a similar trend can also be observed in the China Health Nutrition Survey (CHNS).

[3]This is also consistent with the findings of Gabaix and Landier (2008), who argue persuasively that market capitaliza-

lation and income share of skilled labor and small-median firm owners, which explains the widening gap between the wealthy and the have-nots, as found in the data.

Taking the model to Chinese data from 2000 to 2007, we find that export growth did indeed have a discernible effect on business activity, labor market selection (measured as the skill premium), and the distribution of household income. In the analysis, we construct an export exposure index to capture the growing export opportunities for Chinese producers. We further instrument this index with a Bartik-style export shock measure whose variation consists of both spatial and temporal components, where the spatial component stems from the initial difference in industry specialization across Chinese regions and the temporal component stems from the change in national exports. To isolate the change in external demand for Chinese goods from other factors that may also affect export growth, we predict the export expansion at the national level using the change in tariffs faced by Chinese exporters across sectors over time. We then allocate the national-level tariff-predicted export expansion to Chinese prefecture cities according to each city's initial sectoral employment shares.

In addition, we address some identification challenges that may bias our results. First, a common concern about using the Bartik approach is that the specialization pattern (i.e., the sectoral employment shares) could be correlated with outcome variables through predetermined economic trends or unobserved economic shocks. To alleviate this threat, we follow McCaig (2011) by including the initial or the lagged labor share of export-intensive industries at a more aggregate level in each regression.[4] Second, another caveat to using household surveys to identify business activity and to test the selection effect of trade on entrepreneurship is that we cannot tell whether a household business activity is in the tradable or non-tradable sector (e.g., service). Trade may also affect the return to entrepreneurship in the non-tradable sector via a mechanism that is independent of what is highlighted by this paper. Accordingly, we use data from manufacturing firms to corroborate our findings.

Consistent with the data evidence and economic theory, our empirical results suggest that entrepreneurship matters. What is the magnitude of these effects? We find that a \$1,000 increase in exports per worker decreases the skill premium by about 0.70%.[5] Likewise, a \$1,000 rise in exports per worker tends to decrease the probability of starting a household business by about 2.4% for high-income households and 2.5% for middle- and low-income households, respectively. While trade selects out the less able entrepreneurs, a shock of the same magnitude increases business income by 2.8% for the surviving entrepreneurs, and this effect is more pronounced for the business activity generated by a high-income household. A similar selection effect is found when we use Chinese manufacturing firm data. Last, a trade-induced household income polarization pattern is detected:

tion of large firms can fully explain changes in CEO pay.

[4]In each regression, we include not only the labor share of export-intensive industries but also an interaction term between the labor share and our variable of interest depending on the specification. Other robustness checks include controlling for the city (or city-year) fixed effect, as suggested in Li (2018), and constructing the Bartik IV using the employment weights calculated from the 1990 census. Detailed discussions are provided in section 4.

[5]Li (2018) also estimates the impact of a Bartik-style export shock on educational outcomes such as the skill premium. While she separates the trade shock into a low- and a high-skill component and evaluates their heterogeneous effects separately, she doesn't report an overall effect of the export shock. We complement her empirical findings, showing that the overall effect of a trade shock on the skill premium tends to be negative in the context of China.

a $1,000 rise in exports per worker raises the population (income) share of the high- and low-income group by 0.8% (1.3%) and 1.5% (1.2%) while decreasing the population (income) share of the middle-class by 0.7% (0.9%). All these figures imply that, up to 2007, China's WTO entry decreased the skill premium by about 11.7% to 15.0%. The welfare gains from trade are found to be polarized across the income distribution: trade liberalization is estimated to increase average household income by 7.3% for high-income households and to decrease that average by 4.0% and 3.8% for low- and middle-income households, respectively. Finally, we argue that the highlighted *selection-into-entrepreneurship* mechanism is key to understanding how rising exports have affected the income distribution and the sorting of individuals into occupations and skill levels. Models studying labor market responses should incorporate this under-explored margin of economic activity.

Table 1: Summary Statistics: Household Business Income

China Household Income Project (CHIP)						
Variable	Year: 1995			Year: 1999		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Income from Business Activity	6,931	83.22	1,003	4,008	329.4	1,306
Business Income Share	6,930	0.007	0.066	4,006	0.017	0.057
	Year: 2002			Year: 2007		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Income from Business Activity	6,835	811.8	3,929	4,999	4,366	21,517
Business Income Share	6,835	0.041	0.162	4,998	0.058	0.204
China Health Nutrition Survey (CHNS)						
Variable	Year: 1991			Year: 1993		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Income from Business Activity	667	2,481	2,697	622	4,303	5,824
Business Income Share	667	0.167	0.100	622	0.232	0.142
	Year: 1997			Year: 2000		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Income from Business Activity	833	8,023	8,743	864	8,236	8,407
Business Income Share	833	0.396	0.220	864	0.381	0.220
	Year: 2004			Year: 2006		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Income from Business Activity	871	9,516	10,539	809	13,314	21,235
Business Income Share	871	0.401	0.236	809	0.412	0.238

Notes: Income from Business Activity is measured in Chinese Yuan per year.

The paper is closely related to Li (2018), who analyzes the effect of trade liberalization on educational attainment in China. Li (2018) finds that the expansion of high (low) skill exports increases (decreases) high school and college enrollment by changing the relative demand for skilled labor. Unlike Li (2018), we highlight the role of business activity in accounting for the inequality patterns observed in Chinese data, which we link to entrepreneurship and labor market outcomes such as the equilibrium skill premium and the supply of skilled workers. To bring forward the new margin, we build a model in which trade liberalization intensifies firm competition for profit, discouraging less able educated-workers from sorting into entrepreneurship and increasing the skill supply. As a

result, both the skill premium and college enrollment decline. We then take the predictions to the data and find that entrepreneurship is indeed empirically important.

More broadly, our paper directly builds on the growing literature studying human capital adjustment to trade shocks.[6] Export expansion can alter the supply of skilled labor by changing relative wages. Similar to Li (2018), Atkin (2016) finds that an expansion in less-skilled manufacturing jobs increases the opportunity cost of schooling, leading to a higher school dropout rate for students in grade nine in Mexico. Likewise, Blanchard and Olney (2017) provide cross-country evidence confirming that growth in low (high) skill exports decreases (increases) average educational attainment.[7] Going beyond the static effect, Falvey et al. (2010), Harris and Robertson (2013), and Danziger (2017) study the dynamic features of workers' education acquisition in response to trade shocks. Echoing these studies, we focus on a skill-supply mechanism that highlights the occupational trade-off between entrepreneurship and skilled labor. The entrepreneurship angle offers another lens through which to study the broader impact of trade shocks on workers' occupation sorting and the distribution of income.[8]

Trade liberalization can also affect education attainment via the income channel. Edmonds et al. (2009), Topalova (2010), and Edmonds et al. (2010) find that high-import competition slows the reduction in poverty for households in regions with a larger tariff drop, leading households to spend less on their children's education. Similarly focusing on import, Greenland and Lopresti (2016) find that China's import competition encourages high school graduation for students in the United States, as the opportunity cost of employment becomes higher when labor market conditions deteriorate. Unlike these studies, we examine the role of expansion in export opportunities in influencing skill supply.

To analyze how trade shocks affect the labor market through the lens of entrepreneurship and education, we extend the framework of Dinopoulos and Unel (2015, 2017) to allow for a more flexible occupation choice.[9] The entrepreneurship angle is in line with recent studies on trade and en-

[6]Substantial research has been done on how trade or trade-induced technology change affects the skill premium. Examples include Matsuyama (2007), Verhoogen (2008), Costinot and Vogel (2010), Harrigan and Reshef (2011), Parro (2013), Burstein et al. (2013), Raveh and Reshef (2016), and Burstein and Vogel (2017). However, all these studies assume away the endogeneity of the skill supply.

[7]Li (2018) separately constructs export shocks to skilled and unskilled labor and directly evaluates their heterogeneous impacts on individual educational attainment. The main mechanism is in line with the finding of Atkin (2016) and Blanchard and Olney (2017) that the expansion in skill-demand embodied exports changes the demand for skilled labor and the skill premium, which in turn affects educational choice. Li (2018) also investigates the impact of import shocks and finds the opposite pattern. Taking an entrepreneurship angle, we empirically study the overall effect of export shocks on the skill premium, household business activity, and the income distribution in China. Because of data limitations, we cannot directly test the effects of export shocks on schooling decisions.

[8]Davidson and Sly (2014) study how informational asymmetries affect the interaction between globalization and skill acquisition. Research investigating educational effects resulting from a certain shock or event (other than trade) that change local production patterns includes Foster and Rosenzweig (1996), Shastry (2012), and Cascio and Narayan (2015) for studying technology; Black et al. (2005), Emery et al. (2012), and Morissette et al. (2015) for natural resources; Munshi and Rosenzweig (2006) for institutions; Aggarwal (2018) for road infrastructure; and others (Jaworski (2014); Muralidharan and Prakash (2017)).

[9]Occupational choice in Dinopoulos and Unel (2015) and Dinopoulos and Unel (2017) consists of only one type of labor and entrepreneurship, which is not a suitable way to study any policy effect on the skill premium. In the extended framework, we model education as a signaling device similar to Davidson and Sly (2014).

trepreneurship. Dinopoulos and Unel (2015, 2017) find that globalization leads to more entrepreneurs and a wider inequality between entrepreneurs and employed workers. Similarly, trade liberalization tends to raise the compensation of top executives (Keller and Olney (2017) and Chakraborty and Raveh (2018)), and leads entrepreneurs to invest more managerial effort in operating firms (Bloom et al. (2018) and Chen and Steinwender (2019)).[10] We contribute to this important literature by investigating how entrepreneurship responds to trade shocks, and how the response affects the skill premium and overall inequality.

Our implications for income redistribution also echo studies on trade and inequality. Substantial work has been done on between-group inequality (i.e., the change in the skill premium), which relies on the Heckscher-Ohlin mechanism, the Stolper-Samuelson mechanism, skill-biased technical change, or a combination.[11] We complement these studies by providing a new channel through which trade affects the skill premium and by studying the role of entrepreneurship in shaping the household income distribution. Firm heterogeneity is crucial for generating the differential return to entrepreneurship and the polarization pattern, and the spirit of this feature is similar to the literature that emphasizes between-firm wage heterogeneity as a mechanism by which trade affects inequality, such as Helpman et al. (2010), Akerman et al. (2013), and Helpman et al. (2017). It should be noted that instead of looking at inequality directly, we study a positively correlated phenomenon (i.e., household income polarization). However, we differ from the literature investigating the pattern of employment / job polarization, such as Goos et al. (2009), David and Dorn (2013), Goos et al. (2014), Blanchard and Willmann (2016), and Keller and Olney (2017).

Last but not least, we also fit into the growing literature that empirically investigates the impact of trade shocks on the local economies within a country. Our empirical strategy is based on the Bartik-type measure that follows the traditional literature, such as Topalova (2010), Edmonds et al. (2010), David et al. (2013), Kovak (2013), Dix-Carneiro and Kovak (2015), Bombardini and Li (2016), and Li (2018). As pointed out by McCaig (2011), one identification challenge among these studies is that the weighting industrial composition in Bartik-type IV can be correlated with the outcome variable through predetermined economic trends. Accordingly, we follow McCaig (2011) to address this issue by explicitly controlling for the employment share of export-intensive industries. Finally, as notably mentioned by Li (2018), we are among the few early papers studying the trade effect on the local labor market in the context of China.

The rest of the paper is organized as follows. In the next section, we present several pieces of empirical evidence for the Chinese household income distribution. Section 3 describes the elements of the model and derives its solution in the context of a general equilibrium. Section 4 analyzes the empirical results. Section 5 concludes.

[10] Early work by Chesnokova (2007) finds that trade liberalization can potentially lead entrepreneurs to under-invest in industry under credit constraints, possibly decreasing welfare.

[11] See the references listed in footnote 6 and Burstein and Vogel (2017) for detailed information on each aspect.

2 Motivational Evidence

We start by describing some empirical evidence documenting the decline in the skill premium and the polarization pattern for Chinese households. The findings in this section motivate our subsequent theoretical and empirical analysis.

Skill Premium

Our first variable of interest is the skill premium (i.e., the return to college education). To estimate the skill premium, we employ the micro-survey data of the China Household Income Project (CHIP) and the China Health Nutrition Survey (CHNS), and the specification adopted is provided as[12]

$$lnw_{ir} = \beta_0 + \beta_1 College_{ir} + \beta_2 Exp_{ir} + \beta_3 Exp_{ir}^2 + \gamma X_{ir} + e_r + u_{ir}, \tag{1}$$

where w_{ir} is the wage of individual i who lives in region r, $College_{ir}$ is a dummy variable indicating that individual i has a tertiary education degree (four-year college or above), and Exp_{ir} denotes the work experience of i. We also control for marital status, gender, ethnicity, and employed sectors, which are included in vector X_{ir}. Regional fixed effects are used to control for other geographic-related factors that can affect the skill premium. The estimated skill premium using CHIP data is presented in Figure 1. According to the figure, the skill premium increased before China joined the WTO (1995-2002), reaching its maximum value of 50% around 2002. It then decreased after China joined the WTO. [13]

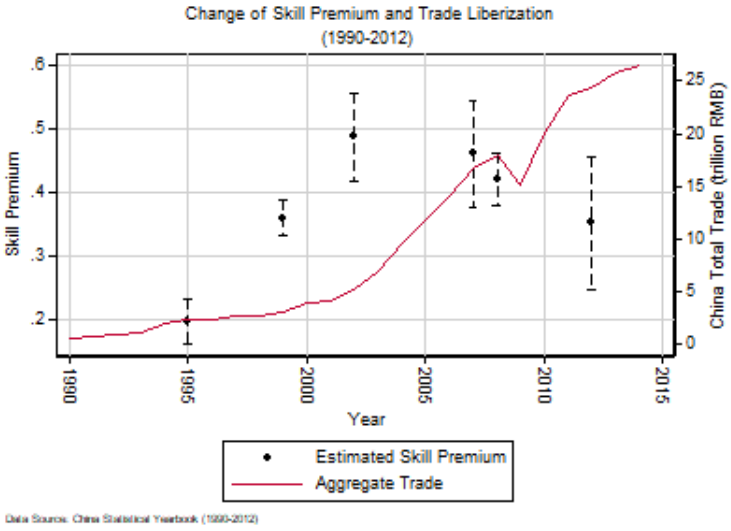


Figure 1: Change in the Skill Premium with Trade Liberalization

[12]Detailed information on CHIP and CHNS is provided in Appendix C1. Note that we also use the China Household Financial Survey (CHFS) for the year 2012.

[13]The pattern remains similar when we use the CHNS sample, which is shown in Figure A.5 of Appendix D.

Household Income Polarization

Next, we follow the International Monetary Fund to classify households into three groups: high-, middle-, and low-income groups.[14] Specifically, the high-income group refers to households with more than 150 % of the median income; the middle-income group refers to households with income between 50% to 150% of the median; and the low-income group corresponds to households with less than 50% of the median income. Figure 2 displays the change in population (left panel) and income (right panel) shares for the three household groups. Population share is calculated as the number of households as a percentage of the total, and income share is computed as gross group income as a share of the total income across all households. For instance, in 2006, the gross population and income shares for the middle class are roughly 42% and 30%, respectively.

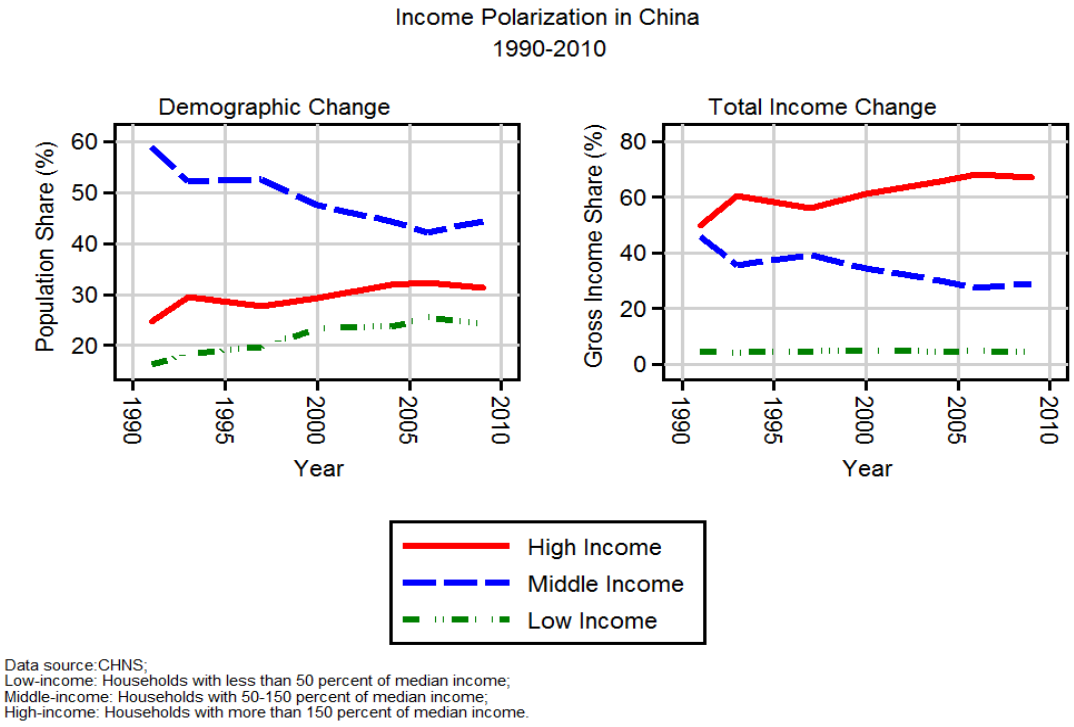


Figure 2: Income Polarization between 1990 and 2010

As shown in the right panel of Figure 2, the income share for low-income households has stagnated since 1990. In contrast, the income share for middle- and high-income households has undergone two different phases. Between 1990 and 2000, we observe a parallel trend in the gross income share between the middle- and high-income groups. After 2000, the income proportion of high-income households rose sharply, accompanied by a notable drop in that for the middle class. Synchronically, the population of the middle class as a share of the total population also declined from

[14]See Alichi et al. (2016) for details.

60% in 1991 to about 45% in 2009. Both the income distribution and the demographic composition exhibit a polarization pattern.[15]

The Rise of Business Income

To investigate the underlying factors affecting the change in the skill premium and income distribution, we study the income composition for Chinese households, where we focus on two main income sources, namely, labor and business income.[16] Business income makes up a much larger proportion of the total income among the top earners than the other groups. The rising entrepreneurship return for the rich could contribute to the widening inequality, which, in fact, is very likely to happen in the phase when China benefits from fast economic growth after joining the WTO.

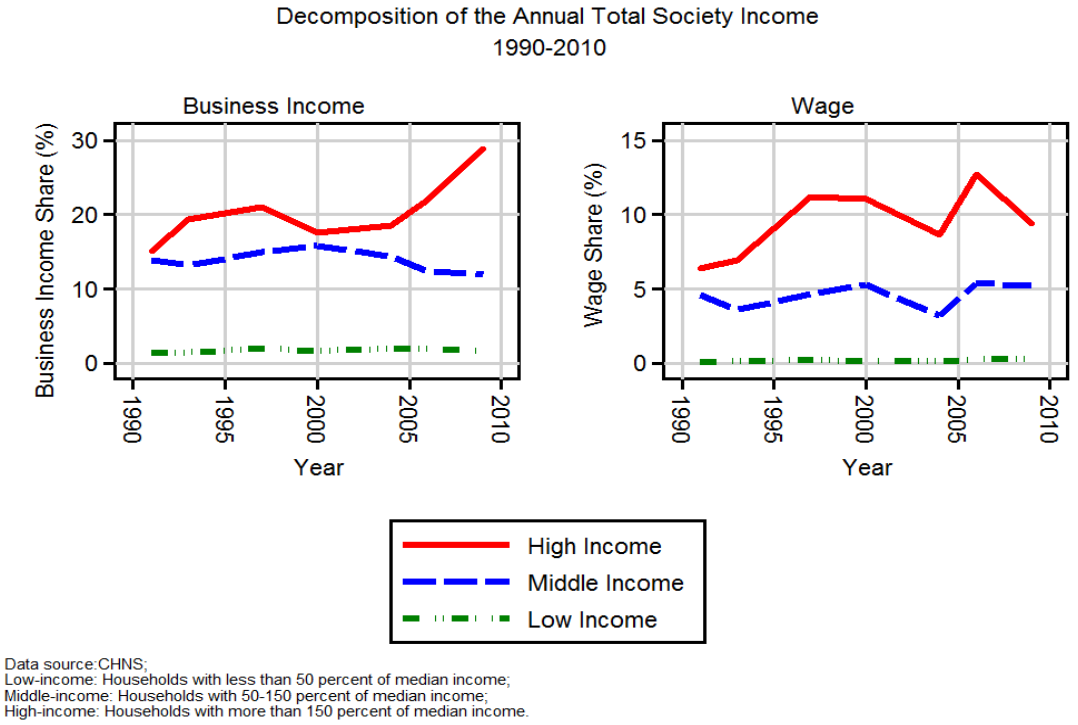


Figure 3: Decomposition of Annual Total Household Income

Figure 3 displays the evolution of business and labor income in contributing to total household income across all families. For instance, the business and labor income obtained by the high-income

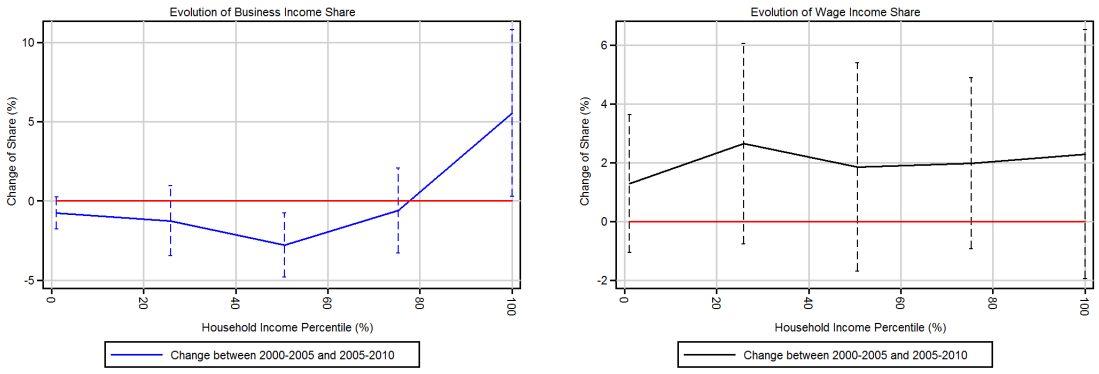
[15]The pattern of a shrinking middle class is robust to using different cutoffs to group households and using different datasets. The robustness is provided in Appendix D.

[16]Taking business income into consideration is also motivated by the findings of Tan et al. (2017), who investigate the role of income sources in shaping overall inequality. They find that income sources between the rich and the poor are systematically different, which explains a sizable margin of overall inequality. Business income accounts for the largest share (59.09%) in the total income of the top 1% households, whereas labor income accounts for only a small share (21.35%). In contrast, only 7.43% of income is from business income for the bottom 5% earners, and the main sources for this group are transfer income (63.15%) and labor income (22.68%).

group account for about 17% and 11% of the total in 2000. While there is a small difference in the business income share between the high- and middle-income households between 1990 and 2000, a striking divergence took place afterward. Business income has made up a sizable share of total income among the top earners (close to 30% in 2009). In contrast, the share of business income for the middle-income households declines notably, from 15% in 2000 to 11% in 2009. On the other hand, there is no systematic change in the proportion of labor income to overall household income.[17]

The 2000-2010 changes in household income composition by income percentile are provided in Figure 4. Panel (a) presents the change in business income share, and panel (b) shows the change in the labor income share. The horizontal axis denotes the percentile of household income with zero standing for the poorest households. According to the figure, the share of business income for the bottom 20th percentile households changes very little. A notable change is observed among the middle- and high-income households: the share of business income for the middle class has significantly declined, in contrast to the fast expansion for high-income households. Again, there are no significant changes in the labor income share across all households according to panel (b).

Summarizing, we present some empirical evidence documenting the decline in the skill premium and the polarization pattern for Chinese households during the post-WTO period. A more polarized income distribution is one with relatively fewer middle-income households and more low- and high-income households. Investigating the composition of household income, we find that business activity is a driving force for the polarization pattern, as the share of business income has risen greatly among the top earners and declined among the middle class. In the next section, we attempt to explain these findings with a simple trade model while also developing several hypotheses that are further tested in section 4.



(a) Business Income Change

(b) Wage Income Change

Figure 4: Evolution of Business Wage Income Share (1999-2003 and 2005-2008)

[17]The rising business income share among the high-income group is also found in the CHIP dataset, as shown in Figure A.6 of Appendix D.

3 Theoretical Analysis

We rationalize the empirical pattern with a model that features endogenous occupational choice for households, where a household can choose to become a low-skilled worker, a high-skilled worker, or an entrepreneur based on his innate ability and labor market conditions. The model highlights a new channel by which trade affects the skill premium and the household income distribution: the *selection-into-entrepreneurship* mechanism. To keep the analysis tractable, we study an economy consisting of two symmetric countries, and a unit mass of citizens populate each country. Individuals differ in their innate ability a, which follows a *c.d.f.* $G(a)$ with a density function as $g(a)$ at support $[a_{min}, +\infty)$. Based on their innate ability and labor market conditions, citizens endogenously choose the occupation that pays the highest net income. There are three occupations: unskilled workers (U), skilled workers (S), and entrepreneurs (E). The economy also has three sectors: one for the final good sector, one for the intermediate good sector, and one for the schooling sector. The final good sector is assumed to be non-tradable and in perfect competition. The production of the final good uses a variety of intermediate inputs that are aggregated in CES fashion. The intermediate good sector is tradable and monopolistic, which consists of differentiated firms that are set up by entrepreneurs. Each firm produces a differentiated variety of input that is used to produce the final product. A citizen can purchase college degree to become skilled worker or entrepreneur, and the degree is supplied by the absentee agents in the schooling sector. Education is not free and incurs a cost $c(a)$ depending on the student's ability a.[18]

Consumers, consisting of workers, firm managers, and the absentee agents in the schooling sector, consume a composite final product Q with a linear preference. When a household makes his educational and occupational decisions, he cares only about the net return. The individual with the ability of a maximizes utility by choosing his optimal occupation:

$$\begin{aligned} max_{i\in\{U,S,E\}} \quad & Q \\ s.t. \quad & PQ \leq w_i(a), \end{aligned} \tag{2}$$

where P is the final good's price index, and $w_i(a)$ denotes the net income received by an individual of ability a who chooses the occupation $i \in \{U, S, E\}$. The uneducated people work as unskilled workers and earn a wage that is normalized to unity (i.e., $w_L = 1$). Among the educated people, skilled workers earn w_H, and entrepreneurs collect firm profit $\pi(a)$ depending on their ability. The disposable income of the individual with ability a and working in occupation i is thus

[18]The absentee agents use the collected costs to consume the final product; that is, education costs can be considered as payment transfers from citizens to the schooling sector so that there is no income loss.

$$w_i(a) = \begin{cases} w_L = 1 & i = U \\ w_H - c(a) & i = S \\ \pi(a) - c(a) & i = E, \end{cases} \tag{3}$$

where $c(a)$ denotes education costs which satisfies properties as listed below.

Assumption 1. *Schooling cost $c(a)$ is a continuous function satisfying*

$$c(a) \geq 0, \;\; c'(a) < 0 \;\; and \;\; \lim_{a \to +\infty} c(a) = 0. \tag{4}$$

Assumption 1 suggests that students with higher ability pay less to earn a college degree. [19]

The production of the final good (Q) requires a continuum of differentiated inputs $y(\omega)$, which are aggregated under a CES technology:

$$Q = \left(\int_{\omega \in \Omega} y(\omega)^{\beta} d\omega \right)^{\frac{1}{\beta}}, \;\; \beta \equiv \frac{\sigma - 1}{\sigma} \;\; \text{and} \;\; \sigma > 1, \tag{5}$$

where Ω denotes the set of input varieties used in production and $y(\omega)$ denotes the quantity of variety ω. The elasticity of substitution in production is denoted as $\sigma > 1$. Firms in the intermediate sector are created, owned, and managed by entrepreneurs (E) in the same way as those in Dinopoulos and Unel (2015). The production of intermediate input requires both skilled and unskilled labor, and both labor inputs are combined with a Cobb-Douglas technology. The firm's productivity depends on the manager's effort z in operating the business. The production function of a firm with manager effort z is given as

$$y(z) = \kappa_y z^{\frac{1}{\sigma - 1}} H^{\alpha} L^{1-\alpha}, \;\; \kappa_y = \alpha^{-\alpha}(1-\alpha)^{-(1-\alpha)} \;\; \text{and} \;\; 0 < \alpha < 1, \tag{6}$$

where H is the number of hired skilled workers and L is the number of unskilled workers. The firm's productivity is given by $\phi = z^{1/(\sigma-1)}$ which increases with the endogenous managerial effort z. A manager has to pay a fixed cost to equip the firm with productivity at $\phi = z^{1/(\sigma-1)}$, and the realized productivity depends on the manager's innate ability and the cost of managerial effort. We specify the cost necessary for reaching a productivity level at $\phi = z^{1/(\sigma-1)}$ as $f(z, a) = \frac{\lambda z^2}{2a}$, where the parameter λ captures all other factors affecting a manager's utilization of managerial talent. Accordingly, more talented entrepreneurs pay lower costs to create and maintain the business

[19] We model education as a signaling device that allows workers to distinguish themselves from unskilled workers. Schooling alone does not improve employees' ability in our case. The assumption is quite standard in the human capital literature and is also used in a similar way in Davidson and Sly (2014). The schooling cost in Davidson and Sly (2014) is in the form of dis-utility.

and are more likely to enhance the productivity of their firms.[20] An entrepreneur makes the decision to export after the firm is created. Serving the foreign market involves an additional fixed cost of $f_x > 0$ and an iceberg variable trade cost $\tau > 1$.[21]

Occupational Choice

Occupational choice is pinned down by maximizing the household's net income. The citizen with ability a chooses his occupation after observing the net returns of each occupation, that is, $w_i(a), i \in \{U, S, E\}$.The benefit of obtaining a college degree is that it at least makes the citizen qualified for a skilled job earning higher wage than unskilled workers ($w_H = w > w_L = 1$). As schooling cost $c(a)$ decreases in ability (Assumption 1), there exists a threshold ability a_s such that individuals with threshold ability are just indifferent between receiving an education or not. Therefore, the threshold ability a_s must satisfy

$$w = c(a_s) + 1. \tag{7}$$

All individuals with ability below a_s strictly prefer working as unskilled worker, and the rest will be educated and will decide whether to set up a firm next.

An educated citizen can choose to become an entrepreneur if and only if the entrepreneurial return is greater than the college wage (i.e., $\pi(a) \geq w$). As entrepreneurial income increases with the manager's ability a, there exists another ability cutoff such that an individual with threshold ability is indifferent between becoming an entrepreneur or a white-collar worker. Because the marginal entrepreneur serves the domestic market only due to selection into exporting, the entrepreneur's ability cutoff a_e will satisfy[22]

$$a_e = \frac{2\lambda w}{(\kappa_\pi A^\sigma \tilde{w}^{1-\sigma})^2}. \tag{8}$$

Therefore, educated households with ability less than a_e choose to be white-collar workers earning skilled wage w, whereas the rest will become entrepreneurs producing differentiated inputs and receiving firm profit $\pi(a)$. Lastly, in combination with selection into exporting as in Melitz (2003), only entrepreneurs with high enough managerial ability can serve the foreign market, and this allows them to obtain higher entrepreneurial income. The export cutoff a_x can be obtained as:

$$a_x = \frac{f_x}{w(\tau^{2-2\sigma} + 2\tau^{1-\sigma})} a_e. \tag{9}$$

[20]Effort z captures factors that can affect a firm's production efficiency, such as managerial decisions. As also used in Dinopoulos and Unel (2015), the way of modeling the firm's productivity $\phi = z^{1/(\sigma-1)}$ is for algebraic simplicity. Results do not change qualitatively if the exponent of z varies. This parameter mirrors the spirit of the human capital theory of Becker (2009), which implies that entrepreneurs with higher managerial ability incur a lower marginal cost of improving firm efficiency through better management of the firm's operation. This specification is also used in Dinopoulos and Unel (2015), Unel (2015), Dinopoulos and Unel (2017), and Unel (2018).

[21]The full solution to the model is presented in the Appendix A1.

[22]The full expression to determine a_e is $[\kappa_\pi A^\sigma \tilde{w}^{1-\sigma}]^2 a_e/(2\lambda) = w$, where the left-hand side of equality denotes the profit of a domestic firm with manager's ability at a_e. Profit function is provided in (31) of appendix.

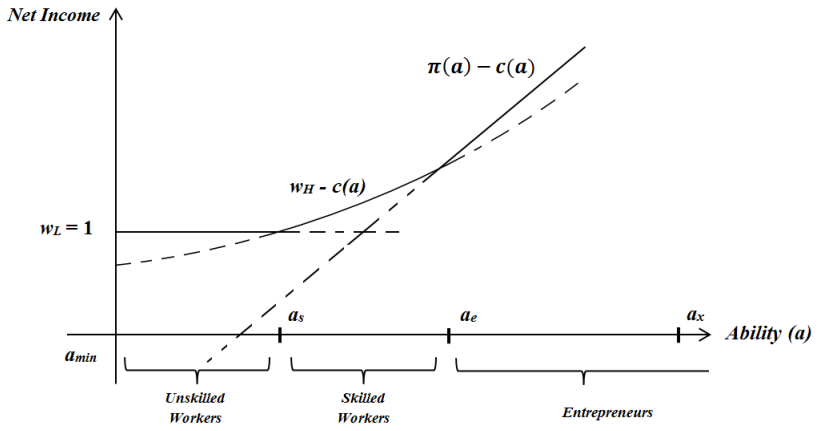


Figure 5: Equilibrium Occupation Sorting

In summary, the occupational returns of households consist of four categories, namely, blue-collar workers earning a unit wage $w_L = 1$, white-collar workers earning skilled wage $w_H = w$, and the domestic firm and exporting firm managers earning firm profits. The ability sorting across occupations is displayed in Figure 5, where the ability requirement increases from unskilled jobs to big entrepreneurs.

Proposition 1. *Trade liberalization (reducing f_x or τ) decreases the skill premium and increases the college dropout rate.*

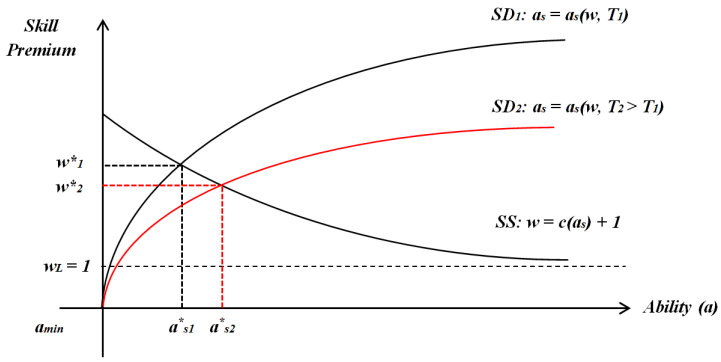


Figure 6: Impact of Trade Liberalization on the Skill Premium

The impact of globalization on the skill premium is driven by the skill-supply mechanism that highlights the occupational trade-off between entrepreneurship and high-skilled labor. Figure 6 illustrates how the skill premium responds to a trade shock, where the curve labeled SS captures skill supply and the one labeled SD denotes skill demand. Any trade policy that improves economic openness will shift the SD curve downward (from $SD1$ to $SD2$ with $T_2 > T_1$), leaving the SS curve

unchanged.[23] As the return to college decreases, fewer people want to pursue education, leading the college dropout rate to rise (i.e., a_s^* increases).

Corollary 1. *Trade liberalization (reducing f_x or τ) increases the entrepreneur ability cutoff a_e and the relative supply of skilled labor H^S/L^S.*

Trade liberalization increases the entrepreneur's cutoff a_e as a consequence of two opposite effects. First, because of the selection effect of trade, the less productive firms exit the domestic market and are replaced by more productive foreign counterparts, which increases the manager's cutoff. Second, as the skilled wage drops, the opportunity cost of being an entrepreneur also decreases, which leads to more entrepreneurs by reducing the cutoff a_e. The former effect dominates the latter overall, moving the entrepreneur's cutoff a_e rightward. Overall, trade liberalization intensifies firm competition for profit, discouraging the less able educated-workers from sorting into entrepreneurship and increasing the skill supply. As a result, the return to college declines, leading college enrollment to decrease.

Proposition 2. *Trade liberalization (reducing f_x or τ) affects the exporting cutoff a_x depending on the education cost. Specifically, a reduction in exporting fixed cost f_x or per-unit trade cost τ decreases (increases) the exporting cutoff when $|c'(a)|$ is sufficiently small (large); that is, the schooling cost exhibits little (vast) difference across innate abilities.*

One intriguing implication of Proposition 2 is that the selection effect of trade depends crucially on the education scheme of a country. When individuals are free to choose skill levels (i.e., the schooling cost exhibits a small difference across innate abilities), the decrease in skilled supply from the rising school dropout rate just cancels out the increase in the skill supply from discouraging educated workers from sorting into entrepreneurship. In this scenario, the model behaves similarly to Melitz (2003) with a fixed supply of labor.[24] In the other case, where the education cost exhibits an extraordinary difference across innate abilities, as all educated workers have been highly selected, the room left for skill adjustment from the left tail of the ability distribution is very limited. Instead, the excess skill supply from the right tail lowers skilled wages and the firm's production cost, which brings in additional competitiveness on top of the selection effect of trade. In this case, the magnified competition also affects exporters, that is, by increasing the exporting cutoff. [25] Proposition 2 implies that a healthy education system or enough educational investment to guarantee a flexible skill adjustment are important to determine a country's production performance, particularly in order to maintain a rich variety of products as also revealed by studies such as Addison (2003) and Frensch and Wittich (2009).

[23] In algebra, we let $T = (\eta^2 + 2\eta)^k / f_x^{k-1}$ where $\eta = \tau^{1-\sigma}$; that is, the reduction in f_x or τ suggests a greater value of T. For a detailed derivation refer to Appendix A1.

[24] In this case, the relative skill supply is barely changed across ability when $|c'(a)|$ is close to zero; that is, $d\ln\left(H^S/L^S\right) = -c'(a_s) \times da_s/w \approx 0$.

[25] The summary for selection effects in different models is provided in Appendix A8.

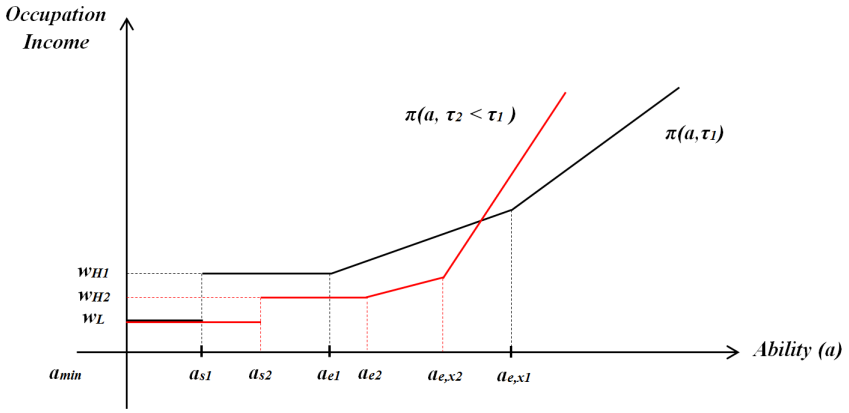


Figure 7: Impact of Reducing Per-unit Trade Cost τ on the Income Distribution

Proposition 3. *If the schooling cost exhibits a small difference across innate abilities (i.e., $|c'(a)|$ is sufficiently small), trade liberalization induced by reducing variable trade cost τ leads to labor market polarization by:*

1). expanding the population share of the low-income group $da_s/d\tau < 0$,

2). squeezing household income for the middle class: $dw/d\tau > 0$ for skilled workers and $d\pi_d(a)/d\tau > 0$ for small firm owners,

3). boosting the income and the population share for the top earners: $d\pi_x(a)/d\tau < 0$ and $da_x/d\tau > 0$.

Above analysis indicates that school cost plays a vital role in determining the wealth distribution due to trade liberalization. As presented in Proposition 3 and displayed in Figure 7, when individuals are relatively free to choose their skill level, the model predicts that trade liberalization (as captured by the curve in red) leads to a polarized household income distribution, which is consistent with our empirical evidence in China.

The theoretical results not only are consistent with our motivational evidence but also give rise to several testable implications that are associated with the *selection-into-entrepreneurship* mechanism: being more open to trade is associated with a lower skill premium, a stronger selection effect on household business activity, and a more polarized household income distribution.

4 Empirical Analysis

We proceed to test the main predictions of our model with an export exposure index, that is, the annual export change per worker. The export shock captures the growing export opportunities for Chinese producers. Further, we instrument this index with a Bartik-style export shock measure. The underlying assumption of Bartik measures is imperfect labor mobility, which is necessary for our identification strategy (David et al. (2013)).[26] The research on labor market adjustment to shocks

[26]If labor is highly mobile across regions, trade may affect workers without its consequences being identifiable at the regional level.

in China provides some supportive evidence for the assumption of Bartik measures, suggesting that labor mobility responses to shocks across Chinese regions are incomplete and restricted by the policy (Lin et al. (2004); Meng (2012)).

4.1 Export Shock Measures

The variable of interest is *ExportShock*, which is measured as export expansion per work (in thousand dollars per worker) by prefecture and year:

$$ExportShock_{r,t} = \frac{\Delta E_{r,t}}{L_{r,t-2}}, \tag{10}$$

where $\Delta E_{r,t}$ denotes prefecture r 's export growth in year t relative to 1999, and $L_{r,t}$ denotes the total labor force in prefecture r and year t. Even with comprehensive coverage of controls, directly including (10) in regressions would be problematic. The first type of shocks we may be concerned about is the local productivity (or factor supply changes) that could influence both local exports and our outcome variables simultaneously. To address this type of endogeneity, we employ a Bartik IV approach that does not use the export expansion at the local level but rather uses a weighted average of national export expansion.

The Bartik approach relies on variations consisting of both spatial and temporal components, where the spatial component stems from the initial / lagged difference in industrial specialization across Chinese regions, and the temporal component stems from the change in national exports.[27] This method is adopted by various studies using micro-level data to evaluate the local effects of trade liberalization. The Bartik IV for $ExportShock_{r,t}$ is constructed as follows:

$$ExportShock^{B}_{r,t} = \sum_{k} \frac{L_{rk,t-2}}{L_{r,t-2}} \frac{\Delta E_{k,t}}{L_{k,t-2}} \tag{11}$$

where $L_{rk,t}$ stands for the number of workers in industry k, region r, in year t, and $\Delta E_{k,t}$ denotes China's export changes in industry k and year t. The exogeneity of Bartik IV further relies on that other time- or region-specific determinants of the outcome variables are uncorrelated with: (1) the initial / lagged city-sector-specific employment pattern and (2) the industry shocks at the national level.

However, the first condition can be violated if the specialization pattern (i.e., the sectoral employment shares) is correlated with outcome variables through predetermined economic trends. To control for pre-existing industrial composition, we follow McCaig (2011) by including the initial / lagged labor shares of export-intensive industries at a more aggregate level in each regression. To do so, we first sort industries by their total pre-WTO exports for the years 1997, 1998, and 1999. We group the

[27] We construct the Bartik IV using both the lagged ($L_{rk,t-2}$) and the initial (the average $L_{rk,0}$ between 1997 and 1999) city-sector employment in computing the Bartik weights. The specialization pattern (i.e., the sectoral employment shares by region) remain highly persistent over time, which barely contributes to the temporal variation of Bartik IV even in the case where we use lagged employment as Bartik weights. Results remain similar regardless of using initial or lagged city-sector employment. Details are provided in section 4.6.

top ten ISIC (two-digit) industries and classify them as export-intensive industries, which account for 73.9% of China's total pre-WTO exports. We calculate the employment share of export-intensive industries by region and year. Another approach to address this issue is to include city (or city-year) fixed effects, which is supposed to take care of any city (or city-year) specific predetermined trends in the outcome variable that can be correlated with the initial (or lagged) industry specialization (Li (2018)). Moreover, we additionally construct the Bartik IV using employment by industry reported in the 1990 census as another robustness check. As the regional specialization pattern decades ago should be less correlated with that of recent years, the alternative Bartik IV will suffer less from some predetermined economic trends during the sample period we study (i.e., between 1999 and 2007). To harmonize the industry classification between trade data and the 1990 census data, we follow the method used in Erten and Leight (2017).

The second condition can also be violated if, for instance, a certain industry clusters in specific regions while these regions specialize in this industry, in which case the national shock can coincide with the local shock. To address this concern, we only employ the national export change that is attributed to the change in tariffs faced by Chinese exporters across sectors over time, with which we isolate the change in external demand for Chinese goods from other factors. We denote the foreign tariffs faced by Chinese exporters in sector k and year t as $ExportTariff_{k,t}$, which is constructed as the weighted average of tariffs across importing country j:

$$ExportTariff_{k,t} = \sum_j \frac{E^j_{k,t-2}}{E_{k,t-2}} \tau_{kj,t}, \tag{12}$$

where $\tau_{kj,t}$ stands for the foreign tariffs on Chinese exports imposed by country j in sector k and year t; $E^j_{k,t}$ denotes the total exports of sector k to country j in year t; and $E_{k,t} = \sum_j E^j_{k,t}$ is China's total exports of sector k in year t. We believe that the tariffs are exogenous in the sense that they are determined by political consideration and other countries' trade policies, which are unlikely to be correlated with the local shocks within China.[28]

Given the measure of $ExportTariff_{k,t}$, we assume that China's exports can be explained by the following specification:

$$\ln E_{kt} = \delta_k + \eta_t + \gamma \ln ExportTariff_{kt} + \epsilon_{kt}, \tag{13}$$

where δ_k and η_t denote sector and time fixed effects. Given the estimated parameters, we then obtain the predicted exports $\hat{E}_{kt}$ according to (14):

$$\hat{E}_{kt} = exp(\hat{\delta}_k + \hat{\eta}_t + \hat{\gamma} \ln ExportTariff_{kt}). \tag{14}$$

Directly applying the Bartik formula to the industrial exports, however, is subject to potential measurement error: the $ExportShock^B_{r,t}$ is intended to be an affine transformation of actual Chinese ex-

[28]The results remain similar if we construct $ExportTariff_{k,t}$ without export weights.

ports (up to an error) at the industry level, but not necessarily equal to such exports. Because this transformation can differ across industries, not correcting for it may incur measurement error when aggregating to the prefecture level. Following Feenstra et al. (2017), we correct for this potential error by regressing the actual exports on the predicted exports at the same industry aggregation with industry and year dummies (i.e., $E_{kt} = \alpha_k + \alpha_t + \beta \hat{E}_{kt}$). With the fitted value of exports after correcting for the measurement error, we construct the IV to $ExportShock_{r,t}$ by replacing $\Delta E_{k,t}$ with $\Delta \hat{E}_{k,t}$ in (11) as

$$ExportShock^{IV}_{r,t} = \sum_k \frac{L_{rk,t-2}}{L_{r,t-2}} \frac{\Delta \hat{E}_{k,t}}{L_{k,t-2}}. \tag{15}$$

Therefore, as the instrument results from the trade policies of other countries, it is unlikely to be affected by the change in the local market or the domestic demand in China.[29]

4.2 Empirical Strategy

To formally test the theory, we combine multiple data sources. The micro-level data sources are the China Household Income Project (CHIP) and the China Health Nutrition Survey (CHNS). In the analysis, we refine the data to an urban sample for the years 2000 to 2008. As both surveys are conducted every several years, the periods covered are 2000, 2004, and 2006 for the CHNS and 2002, 2007, and 2008 for the CHIP, respectively. To construct the export shock index and its instrument, we use the Annual Survey of Industrial Production for employment weights, and the China Custom Database for export information. The tariffs faced by Chinese exporters are from the Trade Analysis and Information System (TRAINS) database, and we harmonize the sector classification to International Standard Industrial Classification (ISIC) rev3 at the four-digit level. Other city controls are from the China Statistical Yearbook.[30]

Return to College

The first main prediction is that trade liberalization suppresses the skill premium, as shown in Proposition 1. We employ a specification as follows:

$$\ln w_{ict} = \beta_0 + \beta_1 College_{ict} + \beta_2 College_{ict} \times ExportShock_{ct} + \mathbf{I}_i \gamma' + \mathbf{R}_{ct} \delta' + \mu_t + \lambda_c + e_{ict}, \tag{16}$$

[29]The relationship between exports and tariffs is displayed in Figure A.3 of Appendix B. The negative slope indicates that a 1% rise in foreign tariffs imposed on Chinese exports decreases China's exports by 0.19% on average. This effect is highly significant and economically sizable. The strong correlation remains robust after we exclude outliers. In Table A.2 of Appendix B, we report the performance for Bartik IV. In both specifications, the F-statistics are all greater than 10, indicating a strong correlation between IV and the instrumented variable. We also show that the strong correlation is not from the employment weights, as the employment share of export-intensive industries is not correlated with the instrumented variable, as also reported in columns (3) and (4) in Table A.2. In addition, we report the first-stage regression results for all specifications in Table A.3, and all F-statistics are well above 10.

[30]Detailed information on data sources is provided in Appendix C1.

where $\ln w_{ict}$ is the logarithmic labor income of individual i in prefecture c in year t; $College_{ict}$ is the dummy variable that equals unity if individual i obtains a college degree (or above); $College_{ict} \times ExportShock_{ct}$ is the interaction between the college dummy and the export shock measure; $\mathbf{I}_i$ is the collection of individual characteristics variables that include marital status, gender, employed sector, working experience, and minor ethnicity; and $\mathbf{R}_{ct}$ denotes the controls for the local labor market including the regional average wage and the population of the labor force. Finally, μ_t and λ_c are the time and city fixed effects that control for other common time trend and regional time-invariant unobserved characteristics.[31] The average skill premium holding the export exposure unchanged at its initial level is β_1, and the effect of an export shock on skills is captured by β_2. Our theory predicts that export expansion is associated with the decline of return to college, and it implies $\beta_2 < 0$.

Selection Effect on Business Activity

The second prediction is that trade liberalization intensifies firm competition for profit, discouraging the less able educated-workers from sorting into entrepreneurship. Therefore, we expect the extensive margin of reported household business activities – which we map to *entrepreneurship* – to decline in regions with a rapid expansion of exports, all else equal.[32]

We employ a probability model to study the extensive margins of household business activity in a specification displayed in (17):

$$Prob(B_{hct}) = \rho_0 + \sum_{s \in \{High,\, Low/Mid\}} \rho_s Group_s \times ExportShock_{ct} + u_g + \gamma_{ct} + v_{hct}, \tag{17}$$

where B_{hct} is an indicator that equals one if household h in region c and time t is involved in business activity and zero otherwise; $Prob(B_{hct})$ denotes the conditional probability that a household owns a business; and $Group_s$ is a dummy variable that equals unity if household h is in income group $s \in \{H, M, L\}$. This group dummy is designed to study the heterogeneous impact of trade on business activity.[33] The group fixed effects (u_g) control for the fact that households in the high-, middle-, and low-income group may systematically differ in their motivation of owning a business. We also have region-time specific fixed effects, as denoted by γ_{ct} . As discussed in Corollary 1, export expansion increases the ability cutoff of entrepreneurship, and we test this hypothesis by applying both logit and probit models to the specification (17). We expect $\rho_s < 0$ for all groups.

Next, we move on to study how globalization affects the profitability of the surviving entrepreneurs. As trade liberalization reallocates resources toward the more productive entrepreneurs, we expect

[31] We refer to a region as a city in CHIP and as a province in CHNS due to restrictions on information disclosure in CHNS. We also include the region-year fixed effects as additional specifications. As discussed earlier, the region (region-year) fixed effects also take care of any city (city-year) specific predetermined trends in outcome variables that can be correlated with the initial (or lagged) industry specialization.

[32] In the baseline regression, we consider a business activity as a real business if the generated income is large enough; that is, the business income accounts for at least 50% of total household income. In robustness checks, we relax this restriction: any business activity that generates a positive income will be considered as a real business.

[33] We combine the middle- and low-income groups because of the lack of enough observations of households who own a business in the low-income group. Similarly, we merge middle- and low-income groups into one in regression (18).

the return to entrepreneurship to increase conditional on surviving the competition. We test this hypothesis with a specification displayed in (18):

$$\ln(\Pi_{hct}|B_{hct}=1) = \delta_0 + \sum_{s\in\{High,\,Low/Mid\}} \delta_s Group_s \times ExportShock_{ct} + u_g + \gamma_{ct} + v_{hct} \qquad (18)$$

where $\ln(\Pi_{hct}|B_{hct}=1)$ denotes the logarithmic business income of household h in city c and year t. Other controls are the same as in the specification in (17). We expect a positive effect of trade on the profitability of household business activity, implying $\delta_s > 0$. Proposition 3 also suggests that the effects of trade on business activity are heterogeneous depending on the type of business activities; that is, trade will shrink the profit margin for small and medium firms while increasing that for large firms. As the likelihood of exporting for the high-income group is higher than that of the other groups because of ability sorting, we also expect $\delta_H > \delta_{L/M} > 0$.

Labor Market Polarization

Last, we focus on the pattern of household income polarization, as implied by Proposition 3. First, trade liberalization increases the population share of the low- and high-income group and decreases that of the middle-income group. The specification for population change is:

$$\ln PopShare_{gct} = \alpha_0 + \sum_{s\in\{H,M,L\}} \alpha_s Group_s \times ExportShock_{ct} + \mathbf{R}_{ct}\delta' + u_g + \mu_t + \lambda_c + e_{ict}, \qquad (19)$$

where $PopShare_{gct}$, $g \in \{H, M, L\}$ denotes the population share of group g in city c and year t and $Group_s$ is the dummy variable for group $s \in \{H, M, L\}$. In addition to the group (u_g), time (μ_t), and city (λ_c) fixed effects, we also control for local labor market characteristics including the regional average wage and the population of the labor force, as denoted by $\mathbf{R}_{ct}$. Population polarization implies that $\alpha_H > 0$, $\alpha_L > 0$ and $\alpha_M < 0$.

Likewise, household income polarization implies that total income is re-allocated toward the low- and high-income group, for which we adopt a similar specification:

$$\ln IncomeShare_{gct} = \kappa_0 + \sum_{s\in\{H,M,L\}} \kappa_s Group_s \times ExportShock_{ct} + \mathbf{R}_{ct}\delta' + u_g + \mu_t + \lambda_c + e_{ict}, \qquad (20)$$

where $IncomeShare_{gct}$, $g \in \{H, M, L\}$ is the aggregate income share of group g in city c and year t, and other controls remain the same as in (19). Income polarization implies that $\kappa_H > 0$, $\kappa_L > 0$, and $\kappa_M < 0$.

4.3 Main Results

In this section, we report and discuss the empirical results. In all the baseline tables, we follow McCaig (2011) to control for pre-existing regional patterns. We first report the results on the impact of trade on the skill premium in Table 2, where panel (A) reports the coefficients obtained using the CHIP and panel (B) using the CHNS. In each panel, the first three columns are for OLS and the last three are 2SLS estimates with IV. Particularly, we equip columns (3) and (6) with a more detailed control using city-year fixed effects to account for other omitted variables and also to control for pre-existing regional patterns as a second approach. According to the table, workers with a college degree (or above) earn a higher wage than workers without a college degree. The positive coefficient of $ExportShock_{ct}$ indicates that regions with rapid export expansion benefit from higher wage growth overall. Our variable of interest, $College_{ict} \times ExportShock_{ct}$, is significantly negative through various specifications, indicating that trade liberalization suppresses the skill premium. Based on the coefficient of column (6), a 1,000 USD per worker rise in $ExportShock_{ct}$ decreases the skill premium by 0.70%. The number suggests that the skill premium has declined by 11.65% between 1999 and 2007.[34] In the CHNS sample, the suggestive effect of an export shock on the skill premium is also negative. Column (6) in panel (B) implies that the skill premium has declined by 14.98% during the same horizon.

Table 3 shows how export expansion influences business activity. We report the evidence obtained from using both the CHIP and the CHNS in panels (A) and (B), respectively. As shown in columns (1) through to (4) in each panel, $ExportShock_{ct}$ has significant negative effects on the extensive margins of household business. The results are robust for the business activities from different income groups, regardless of using the logit or the probit model. We further calculate the marginal effect by evaluating the probability at the mean value of the explanatory variables. Accordingly, in the logit model, a rise of 1,000 USD per worker in $ExportShock_{ct}$ decreases the probability of self-business by about 2.38% for high-income households and by 2.47% for middle- and low-income households in the CHIP sample.[35] The point estimates also suggest that the selection effect on the extensive margin is stronger for the business activities of middle- and low-income households, as captured by the more negative coefficient for the interaction between $ExportShock_{ct}$ and $Middle/Low_{ict}$. Turning to the intensive margin as reported in columns (5) and (6), $ExportShock_{ct}$ significantly raises business income for households conditional on surviving the competition. According to column (6) in panel (A), a 1,000 USD per worker rise in $ExportShock_{ct}$ increases business income by about 2.80%, which implies that the average return to entrepreneurship has increased by about 46.59% from 1999 to 2007 for a household who owns a business. We also observe the heterogeneity pattern across business types; that is, business activities from the high-income group benefit more from globalization. Similar results are obtained when we use the CHNS sample.

[34] In 2007, $ExportShock_{ct}$ has increased by about \$16,640 per worker on average relative to 1999.

[35] In the probit model, the two numbers are 2.14% and 2.26% for the high- and middle/low-income households, respectively.

Table 2: Trade Shock and Skill Premium Change

	(A) China Household Income Project (CHIP)					
	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
$College_{ict}$	0.501***	0.458***	0.406***	0.506***	0.379***	0.326***
	(0.117)	(0.104)	(0.096)	(0.122)	(0.104)	(0.097)
$College_{ict} \times Export\ Shock_{ct}$	-0.004***	-0.003***	-0.003**	-0.004***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
$Export\ Shock_{ct}$	0.015***	0.012***		0.024***	0.016***	
	(0.003)	(0.004)		(0.005)	(0.005)	
Observations	18,544	18,544	18,544	18,544	18,544	18,544
R-squared	0.208	0.328	0.151	0.180	0.326	0.150
City FE	-	YES	YES	-	YES	YES
Year FE	-	-	YES	-	-	YES
City-Year FE	-	-	YES	-	-	YES
	(B) China Health and Nutrition Survey (CHNS)					
	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
$College_{ict}$	0.450**	0.565**	0.496**	0.443**	0.540***	0.486***
	(0.179)	(0.171)	(0.189)	(0.177)	(0.164)	(0.188)
$College_{ict} \times Export\ Shock_{ct}$	-0.005	-0.008	-0.008*	-0.002	-0.008**	-0.009***
	(0.005)	(0.004)	(0.003)	(0.006)	(0.003)	(0.003)
$Export\ Shock_{ct}$	0.039***	0.004		0.057***	0.013*	
	(0.004)	(0.004)		(0.010)	(0.007)	
Observations	5,254	5,254	5,254	5,254	5,254	5,254
R-squared	0.229	0.306	0.156	0.208	0.303	0.156
City FE	-	YES	YES	-	YES	YES
Year FE	-	-	YES	-	-	YES
City-Year FE	-	-	YES	-	-	YES

Notes: The dependent variable is individual log wage. Besides the key variables reported in the table, both panels control for marriage status, gender, minor ethnicity, employed sector, and working experience, as well as the squared term of working experience. In both panels A and B, we control for the lagged employment share of export-intensive industries at the regional level (city for CHIP and province for CHNS) and an interaction between the lagged employment share and the college dummy $College_{ict}$. Robust standard errors are clustered at the region level (city for CHIP and province for CHNS) and reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Finally, we report the effects of $ExportShock_{ct}$ on the household income polarization. The results are reported in Table 4. In each panel, columns (1) to (4) report the trade-induced population share changes, and columns (5) to column (8) display the changes in the income distribution. In the CHIP sample, we observe that export expansion drives the population and income shares toward the rich and poor; that is, the point estimates are significantly positive for the interactions with high- and low-income groups but negative for the middle-income group. Based on the CHIP estimates, a 1,000 USD per worker rise in $ExportShock_{ct}$ increases the population share of the high- and low-income group by 0.8% and 1.5% while decreasing the population share of the middle-income group by 0.7%. The point estimates also indicate a polarized income distribution: a shock of the same magnitude increases the income share by 1.3% and 1.2% for the high- and low-income group and decreases it by 0.9% for the middle-income group. Putting all these figures together, between 1999 and 2007,

average household income has risen by 7.3% for the high-income group and decreased by 3.8% and 4.0% for the middle- and low-income groups, respectively.

Table 3: Trade Shock and Business Activities

	(A) China Household Income Project (CHIP)					
	Extensive Margin				Intensive Margin	
	Export Shock		IV:$\widehat{Export\ Shock}$		OLS	2SLS
	(1) Logit	(2) Probit	(3) Logit	(4) Probit	(5)	(6)
$Export\ Shock_{rt} \times High_{irt}$	-0.687***	-0.267***	-0.678***	-0.261***	0.052***	0.029***
	(0.008)	(0.004)	(0.010)	(0.005)	(0.002)	(0.009)
$Export\ Shock_{rt} \times Middle/Low_{irt}$	-0.699***	-0.273***	-0.705***	-0.276***	0.048***	0.028***
	(0.007)	(0.003)	(0.008)	(0.003)	(0.000)	(0.009)
R-squared	-	-	-	-	0.858	0.857
Observations	10,959	10,959	10,959	10,959	506	506
Class FE	YES	YES	YES	YES	YES	YES
Region-Year FE	YES	YES	YES	YES	YES	YES
	(B) China Health and Nutrition Survey (CHNS)					
	Extensive Margin				Intensive Margin	
	Export Shock		IV:$\widehat{Export\ Shock}$		OLS	2SLS
	(1) Logit	(2) Probit	(3) Logit	(4) Probit	(5)	(6)
$Export\ Shock_{rt} \times High_{irt}$	-1.930***	-1.121***	-1.854***	-1.076***	0.018*	0.278
	(0.115)	(0.057)	(0.154)	(0.076)	(0.009)	(0.185)
$Export\ Shock_{rt} \times Middle/Low_{irt}$	-1.971***	-1.147***	-1.938***	-1.128***	0.011***	0.243
	(0.117)	(0.059)	(0.131)	(0.062)	(0.002)	(0.193)
R-squared	-	-	-	-	0.760	0.758
Observations	2,549	2,549	2,549	2,549	804	804
Class FE	YES	YES	YES	YES	YES	YES
Region-Year FE	YES	YES	YES	YES	YES	YES

Notes: The dependent variable for studying the extensive margin is the dummy variable that equals unity if a household is involved in business activity. The dependent variable for studying the intensive margin is the business income in nature log. In all regressions, we control for the lagged employment share of export-intensive industries at the regional level (city for CHIP and province for CHNS) and interactions between the lagged employment share and class dummies ($High_{irt}$ and $Middle/Low_{irt}$). Robust standard errors are clustered at the region-year level (city for CHIP and province for CHNS) and reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4.4 Selection Effect: Evidence from Firm Data

Because of data limitations, one caveat to using household data to study the selection effect of trade on business activity is that we cannot tell whether a business is in a tradable or non-tradable sector (e.g., service sector). Trade may also affect the return to entrepreneurship in service sectors that are independent of the mechanisms proposed by this paper. To corroborate the findings, we use the

Table 4: Trade Shock and Household Polarization

(A) China Household Income Project (CHIP)	Population by Class				Income by Class			
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) OLS	(7) 2SLS	(8) 2SLS
$Export\ Shock_{ct} \times High\ Income\ Group$	0.013**	0.014***	0.008**	0.008***	0.015***	0.016***	0.012***	0.013***
	(0.005)	(0.004)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
$Export\ Shock_{ct} \times Middle\ Income\ Group$	-0.003	-0.003	-0.008**	-0.007**	-0.006*	-0.005	-0.010***	-0.009**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$Export\ Shock_{ct} \times Low\ Income\ Group$	0.015***	0.016***	0.015***	0.015***	0.012**	0.013***	0.011**	0.012***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
Observations	213	213	213	213	213	213	213	213
R-squared	0.882	0.882	0.880	0.881	0.942	0.943	0.942	0.942
Class FE	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
City Controls	-	YES	-	YES	-	YES	-	YES
(B) China Household Nutrition Survey (CHNS)	Population by Class				Income by Class			
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) OLS	(7) 2SLS	(8) 2SLS
$Export\ Shock_{ct} \times High\ Income\ Group$	0.026***	0.015	0.034**	0.021	0.025**	0.021	0.038**	0.028
	(0.008)	(0.008)	(0.016)	(0.017)	(0.008)	(0.019)	(0.015)	(0.023)
$Export\ Shock_{ct} \times Middle\ Income\ Group$	0.017	0.006	-0.015	-0.029	-0.015	-0.018	-0.039***	-0.049**
	(0.011)	(0.020)	(0.010)	(0.022)	(0.015)	(0.023)	(0.011)	(0.023)
$Export\ Shock_{ct} \times Low\ Income\ Group$	0.005	-0.007	0.036	0.023	0.007	0.003	0.021	0.011
	(0.021)	(0.019)	(0.027)	(0.019)	(0.026)	(0.022)	(0.031)	(0.015)
Observations	81	81	81	81	81	81	81	81
R-squared	0.870	0.871	0.883	0.884	0.957	0.957	0.955	0.955
Class FE	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	-	YES	-	YES	-	YES	-	YES

Notes: The dependent variable is the logarithmic population share for studying *Population by Class* and the logarithmic income share for studying *Income by Class*. City controls include regional average wage and the population of labor force. In all regressions, we control for the lagged employment share of export-intensive industries at the regional level (city for CHIP and province for CHNS) and interactions between the lagged employment share and class dummies for the high-, middle-, and low-income groups. Robust standard errors are clustered at the province level and reported in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: Trade Shock and Business Activities: Evidence from Firm Data (ASIP)

	(A) Extensive Margin: New Entry Rate					
	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
$Export\ Shock_{ct}$	-0.007***	-0.007***	-0.007***	-0.008**	-0.008**	-0.009***
	(0.001)	(0.001)	(0.001)	(0.003)	-0.003	(0.003)
Observations	35,693	35,687	35,351	35,693	35,687	35,351
R-squared	0.523	0.524	0.556	0.523	0.524	0.556
City Control	-	YES	YES	-	YES	YES
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Ind FE	YES	YES	YES	YES	YES	YES
Ind-Year FE	-	-	YES	-	-	YES
	(B) Extensive Margin: Exporter Rate					
	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
$Export\ Shock_{ct}$	0.005***	0.005***	0.004***	0.003***	0.004***	0.002***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	106,746	106,746	106,715	106,746	106,746	106,715
R-squared	0.406	0.408	0.428	0.405	0.408	0.428
City Control	-	YES	YES	-	YES	YES
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Ind FE	YES	YES	YES	YES	YES	YES
Ind-Year FE	-	-	YES	-	-	YES
	(C) Intensive Margin: Firm Export Sales					
	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
$Export\ Shock_{ct}$	0.002**	0.002**	0.002**	0.012***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)
Observations	108,624	108,624	108,624	132,590	108,624	108,624
R-squared	0.895	0.895	0.895	0.800	0.895	0.895
Ownership FE	-	-	YES	-	-	YES
City Control	-	YES	YES	-	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Ind FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Notes: The dependent variables are (logarithmic) new-entry rate (city-industry-year) for panel A, exporter rate (city-industry-year) for panel B, and export sales (firm-year) for Panel C. City controls include regional average wage, population of labor force, and the lagged employment share of exporting-intensive industries. Firm controls include firm employment, total sales, capital intensity, and value added per worker. Robust standard errors are clustered at the industry level for panels A and B, at the city and industry level for panel C, and are reported in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

firm-level data from the Annual Survey of Industrial Production (ASIP) to provide more evidence on the selection effect. To test the extensive margin, we apply the regression

$$\ln(EntryRate_{ckt}) = \rho ExportShock_{ct} + \mathbf{R}_{ct}\delta' + \lambda_c + \mu_t + \chi_k + v_{hct}, \tag{21}$$

where $EntryRate_{ckt}$ denotes the firm entry rate measured as the number of new start-ups as a share of the total number of firms in sector k, prefecture c, and year t; and city controls $\mathbf{R}_{ct}$ are the same as in specification (19). We expect $\rho < 0$ to suggest the existence of a selection effect induced by trade liberalization. The selection effect also implies that there are more exporters, as implied by Proposition 3. We test the extensive margin for exporters using the same regression as in (21) but with $\ln(ExportRate_{ckt})$ as the outcome variable, where $ExportRate_{ckt}$ measures the number of exporters as a share of the total number of firms in sector k, prefecture c, and year t. We expect the point estimate for $ExportShock_{ct}$ to be positive. We test the intensive margin using the specification

$$\ln(ExportSale_{ft}) = \kappa ExportShock_{ct} + \mathbf{R}_{ct}\delta' + \mathbf{F}_{ft}\gamma + \eta_f + \mu_t + v_{hct}, \tag{22}$$

where $ExportSale_{ft}$ is the total exports by firm f in year t. Besides the city controls, we also include firm controls including employment, capital, firm size as measured by total annual sales, capital intensity, and value added per worker. Note that we include firm fixed effects η_f in the regression, which admits both prefecture and sector fixed effects. In practice, we also add ownership fixed effects to control for the evolution of firm ownership over time. We expect $\kappa > 0$, as implied by Proposition 3. In practice, we also exclude processing exports by matching firm export transactions (China Custom Data) to firm characteristics (ASIP).

Panel (A) of Table 5 demonstrates how $ExportShock_{ct}$ affects new entries. The negative sign on point estimates suggests that a deterrent effect is suppressing the new entries to the domestic market, which is consistent with the findings obtained from using the household data. In the global market, trade liberalization leads more firms to export and increases exporting sales for the surviving firms, which is captured by panels (B) and (C), respectively.[36] To sum up, evidence obtained by using firm-level data also suggests the existence of a selection effect, which echoes the previous study that uses household data.

4.5 Selection Effect: The Impact on the Skill Premium

Complementing the earlier contributions that emphasize the demand-side effect of trade on the skill premium, this paper highlights the selection-into-entrepreneurship channel: the selection effect of trade discourages educated workers from sorting into entrepreneurship and increases the skill supply. To provide suggestive evidence for the mechanism, we aim to isolate the variation in

[36]These empirical findings are consistent with the prediction of Proposition 3. So far, we have completed testing all implications of Proposition 3.

$ExportShock_{ct}$ that is correlated with the selection effect of trade and test whether this component has statistical power to explain the decline in the skill premium.[37]

Table 6 displays the results in specification (16), where we replace $ExportShock_{ct}$ with its two components. Our variable of interest is the one correlated with the selection effect of trade, and we denote it as $ExportShock_{ct}^{Select}$. In construction, we use both household and firm data. As reported in the table, in the case of household data, the coefficients of $ExportShock_{ct}^{Select}$ are significantly negative across various specifications, indicating that the decline in the skill premium is associated with the channel captured by $ExportShock_{ct}^{Select}$. In the case of firm data, the point estimates of $ExportShock_{ct}^{Select}$ remain significantly negative, and other channels are also found to have explanatory power in explaining the skill premium reduction. Comparing both channels, $ExportShock_{ct}^{Select}$ remains as the primary factor in explaining the decline in the skill premium, in terms of both significance and magnitude. All of these pieces of evidence suggest that the selection effect of trade is strongly associated with the decrease in the skill premium.

Table 6: Suggestive Evidence: Supply of Skills Due to Selection Effect

	CHIP				ASIP	
	(1) Logit	(2) Logit	(3) Probit	(4) Probit	(5) FE	(6) FE
$College_{ict} \times Export\ Shock_{ct}^{Select}$	-0.004***	-0.004***	-0.004***	-0.004***	-0.004**	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$College_{ict} \times Export\ Shock_{ct}^{Other}$	0.001	0.001	0.001	0.001	-0.003	-0.003*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Observations	13,342	13,342	13,342	13,342	18,544	18,544
R-squared	0.365	0.157	0.365	0.157	0.347	0.151
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
City-Year FE	-	YES	-	YES	-	YES

Notes: The export shock uses (10). The dependent variable is individual log wage. Besides variables of interest reported in the table, both panels include all individual controls as used in panel A of Table 2. Robust standard errors are clustered at the city level and reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4.6 Robustness

For robustness, we first report the regression results where the employment weights of the Bartik export shock use their initial values prior to China's joining the WTO:

$$ExportShock_{r,t}^{IV} = \sum_k \frac{L_{rk,0}}{L_{r,0}} \frac{\Delta \hat{E}_{k,t}}{L_{k,0}}.$$

The change in exports in industry k at the national level (i.e., $\hat{E}_{kt}$) remains the same as the one we use for the baseline regressions. We use the average value of city-sector employment across 1997 and

[37]The description of the method is provided in Appendix E.

1999 to measure $L_{rk,0}$ for industry k and region r.[38] Likewise, $L_{r,o}$ and $L_{k,0}$ denote the total labor force for prefecture r and for industry k in the initial period.

Table A.5 in Appendix F reports the robustness checks for the skill premium. Compared to Table 2, the direct impact of an export shock on wages becomes smaller and less significant, and the estimates for the interaction remain stable. In column (7), we exclude the service job from our sample, and the estimate remains barely changed. Table A.6 reports the robustness check for business activities, and the estimates remain similar to those in Table 3. The results on polarization are displayed in Table A.7, from which one can still observe a polarization pattern for both population and income shares. In Tables A.8 to A.10 in Appendix F, we report the robustness checks using the Bartik IV whose employment weights are fixed in 1990. All of our main results remain unchanged qualitatively.

In addition, we also try alternative classifications for business activity and income group. In panel (A) of Table A.11, any business activity that generates a positive income will be considered as a real business. In panel (B), we apply 25/175 criteria to classify income groups.[39] In both panels, we observe consistently negative and positive effects of an export shock on the extensive and intensive margins of business activity. Though the magnitudes are sensitive to the alternative classifications, our results remain qualitatively robust.

Last, Table A.12 reports the robustness check for the channel study, where we apply $ExportShock^{IV}_{r,t}$ (equation (15)) to the regression instead of using $ExportShock_{r,t}$ (equation (10)). Each robustness regression also controls for the labor share of export-intensive industries. According to the table, the component of the export shock that is correlated with the selection effect remains an important factor in explaining the drop in the skill premium, which is robust to different specifications and data samples.

4.7 Discussion of Limitations

While our identification manages to capture a variety of facts concerning trade, the skill premium, and the income distribution in a class of settings, because of inherent data limitations, there are some scenarios in which one should interpret our results with caution. The first concern is about the existence of pretrend in our outcome variables, which is also a common issue in using Bartik IV. While we address some issues resulting from pre-existing regional patterns by following McCaig (2011) and by controlling for detailed fixed effects, employment shares in the Bartik index can still be correlated with the dependent variables via some mechanisms that are independent of a city's industrial composition. For instance, if the implementation of some pre-existing policies (such as ones to promote higher education) correlates with export exposure, we can under-estimate the negative impact

[38] The results hardly change if we use employment in a single year only; that is we also use $ExportShock^{IV}_{r,t} = \sum_k \frac{L_{rk,0}}{L_{r,0}} \frac{\Delta \hat{E}_{k,t}}{L_{k,t}}$, and the results remain similar.

[39] The high-income group refers to households with income more than 175% of the median level; the middle-income group refers to households with income between 25% to 175% of the median; and the low-income group refers to households with income less than 25% of the median income.

of trade on the skill premium. Another concern is about the migration of entrepreneurs/firms across regions in response to a trade shock. Though we do not observe a clear firm relocation pattern (i.e., only about 4% of firms in the ASIP change city locations during 1998-2007 according to Mau and Xu (2019)), the selection effect of trade can be under-estimated if entrepreneurs' migration propensity to the cities experiencing greater trade shocks is higher.[40] Therefore, inherent data limitations prevent us from pinpointing the casual identification of our proposed mechanism.

The empirical results obtained so far, however, leave us with the strong belief that an investigation into how trade affects entrepreneurship of different types using more detailed data is, therefore, a fruitful avenue for further research. It also would help to further our understanding of how trade affects the skill premium and the income distribution through the lens of sorting workers into occupations and skill levels.

5 Conclusion

The goal of this paper is to study the impact of trade on the skill premium and the income distribution. The occupational trade-off between entrepreneurship and skilled labor is highlighted in this paper as a new channel for understanding the empirical pattern in China: the suppressed skill premium and the polarized household income distribution since China joined the WTO. Investigating the data, we find that business activity is a driving force in the pattern, which has become increasingly important among rich households while negligible for the middle class. We argue that this finding is in line with the mechanism of *selection-into-entrepreneurship*.

We illustrate this mechanism with a simple trade model, in which trade liberalization intensifies firm competition for profit, discouraging the less able educated-workers from sorting into entrepreneurship and increasing the skill supply. As a result, the return to college declines, leading college enrollment to decrease. During the fast transition, highly talented households optimally respond to export opportunity by engaging in entrepreneurial investment and moving up the income distribution, and the less able educated-households self-select downward along the income distribution, the gradual effect of which is household income polarization. An empirical test of the model with Chinese household survey data reveals that regions facing more export exposure are associated with a larger drop in the skill premium, a greater selection effect on business activity, and a stronger polarization pattern. The main predictions of the model are examined and validated.

This paper makes a positive contribution to our understanding of the channels that give rise to the unequal gains from trade. The *selection-into-entrepreneurship* mechanism provides a new lens through which one can study the broader impact of trade shocks on workers' occupation sorting and the distribution of income. In addition, this research also delivers straightforward policy implications: enough educational investment to guarantee flexible skill adjustment is important for a country,

[40] A similar issue results from the migration of workers, which has been investigated by Li (2018). In the same context as China, she finds that selective migration on the worker side doesn't have much of an effect on the estimation of how trade affects the educational choice.

not only to preserve a prosperous middle-class population, but also to maintain the competitive capability to supply product varieties.

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Online Appendix – Not for Publication

A. Theoretical Appendix

A1. Solving the Model

Though the model is static by nature, it is convenient to think of it as unfolding in three sub-periods. In the first sub-period, after observing their innate ability and the return to each occupation, citizens decide whether to attend college. Individuals who receive education from the schooling sector will pay a cost $c(a)$. In the second sub-period, non-college citizens will work as unskilled workers and receive an unskilled wage, while educated individuals have the option of becoming skilled workers or entrepreneurs. An entrepreneur invests a fixed cost to open a firm and earn a profit, while skilled workers earn a skilled wage. Finally in the third sub-period, after firms hire labor and the production of all goods, consumption takes place.

The Consumer's Problem Cost minimization of (5) implies that the inverse demand for typical variety $y(\omega)$ is

$$p(w) = Aq^{\beta-1}(\omega), \;\; A \equiv P^{\beta}\mathcal{E}^{1-\beta}, \tag{23}$$

where $p(\omega)$ is the unit cost of variety ω, A is an aggregate demand shifter, and $\mathcal{E}$ denotes the total expenditure on final goods. The marginal cost of the final product is derived as

$$P = \big(\int_{\omega\in\Omega} p(\omega)^{1-\sigma} d\omega \big)^{\frac{1}{1-\sigma}}. \tag{24}$$

The Firm's Problem Given the love of variety in the final good sector and a fixed production cost of exporting, no firm will serve the foreign market without serving the domestic market. If a firm exports, the manager allocates the firm's output $y(z)$ between the domestic and foreign market to equate the marginal revenues obtained from the two markets:

$$y(z) = y_d(z) + \mathbb{I}_x y_x(z), \tag{25}$$

where $\mathbb{I}_x$ is an indicator that equals one if firm z exports and zero otherwise. Using the inverse demand function (23), we derive the domestic and foreign revenues as

$$r_d(z) = Ay_d(z)^{\beta}, \quad r_x(z) = A\big(\frac{y_x(z)}{\tau}\big)^{\beta}, \tag{26}$$

The firm's total revenue $r(z) = r_d(z) + \mathbb{I}_x r_x(z)$ is then the sum of the two:[41]

[41] Revenue is derived from solving the maximization of $r(z) = r_d(z) + r_x(z)$ subject to $y(z) = y_d(z) + y_x(z)$. The solution to the optimization yields $y_x(z) = \tau^{1-\sigma} y_d(z)$ and $r_x(z) = \tau^{1-\sigma} r_d(z)$. Substituting $y_x(z) = \tau^{1-\sigma} y_d(z)$ in (25) , we derive $y_d(z) = (1 + \mathbb{I}_x \tau^{1-\sigma})^{-1} y(z)$. Jointly applying this expression and $r_x(z) = \tau^{1-\sigma} r_d(z)$ to $r(z) = r_d(z) + \mathbb{I}_x r_x(z)$, one could derive equation (27).

$$r(z) = (1 + \mathbb{I}_x \tau^{1-\sigma})^{1-\beta} A y(z)^{\beta}, \tag{27}$$

By the nature of the Cobb-Douglas production function, the marginal cost of output with the firm's manager investing z effort is given by $mc(z) = \tilde{w}/z^{\frac{1}{\sigma-1}}$, where $\tilde{w}$ is the composite factor price defined as $\tilde{w} \equiv w_H^{\alpha} w_L^{1-\alpha}$. The marginal cost decreases with the entrepreneur's effort z and increases with the factor price w. Closely following Dinopoulos and Unel (2015), we assume entrepreneurial income equals firm profit, which abstracts from other effects such as profit taxation that affects the wealth distribution among firm owners and employees. It is made for tractability purposes and is consistent with the empirical literature regarding the top income and profits of small, family-owned firms, as discussed in Kaplan and Rauh (2010).

The entrepreneur with managerial ability a maximizes his income (i.e., firm profits) by optimally choosing the entrepreneur's effort level z, total production y, and exporting status $\mathbb{I}_x$. Combining (6) and (27), we write the firm's profit maximization problem as

$$\pi(a) = \max_{\mathbb{I}_x \in \{0,1\}, y, z} \left\{ \Upsilon(z)^{1-\beta} A y^{\beta} - \frac{\tilde{w}}{z^{\frac{1}{\sigma-1}}} y - \frac{\lambda z^2}{2a} - \mathbb{I}_x f_x \right\}, \tag{28}$$

where we use $\Upsilon(z)$ to denote a firm's market access, defined as follows:

$$\Upsilon(z) = \begin{cases} 1, & \text{if } \mathbb{I}_x(z) = 1 \\ 1 + \tau^{1-\sigma}, & \text{if } \mathbb{I}_x(z) = 0. \end{cases} \tag{29}$$

The optimal solution to (28) yields

$$z(a) = \frac{\kappa_\pi (1 + \mathbb{I}_x \tau^{1-\sigma}) A^{\sigma} \tilde{w}^{1-\sigma}}{\lambda} a, \tag{30}$$

where κ_π is a constant defined by $\kappa_\pi = \beta^{\sigma-1}/\sigma$. The above equation states that optimal managerial effort increases with managerial talent a and firm-market size A, and decreases with the marginal cost of utilization of managerial effort λ and factor prices $\tilde{w}$. Substituting $z(a)$ in equation (30) with (28), we obtain the firm's profit as

$$\pi(a) = \frac{[\kappa_\pi (1 + \mathbb{I}_x \tau^{1-\sigma}) A^{\sigma} \tilde{w}^{1-\sigma}]^2}{2\lambda} a - \mathbb{I}_x f_x. \tag{31}$$

Firm profitability increases with manager's ability a. As shown in (31), exporting activity generates larger profits by incurring an exporting fixed cost. It implies that there is an exporting cutoff in the manager's ability (i.e., a_x), such that an entrepreneur with managerial talent below a_x does not find it profitable to export. This is also consistent with the large body of literature documenting that only productive firms export.

Because of the selection to exporting, only entrepreneurs with high enough managerial ability will serve the foreign market, which allows them to obtain a higher entrepreneurial income as char-

acterized by the following inequality:

$$\frac{[\kappa_\pi(1+\tau^{1-\sigma})A^\sigma \tilde{w}^{1-\sigma}]^2}{2\lambda}a - f_x \geq \frac{[\kappa_\pi A^\sigma \tilde{w}^{1-\sigma}]^2}{2\lambda}a. \tag{32}$$

The export cutoff a_x is obtained by equalizing the above inequality:

$$a_x = \frac{f_x}{w(\tau^{2-2\sigma}+2\tau^{1-\sigma})}a_e. \tag{33}$$

To be consistent with the empirical finding that only larger and more productive firms export, we limit the parameters to $f_x/w(\tau^{2-2\sigma}+2\tau^{1-\sigma}) > 1$ such that only a subset of firms export (i.e., $a_x > a_e$). The parameter restrictions are provided in Assumption 2.

Assumption 2. *The fixed cost of exporting f_x is large enough so that*

$$f_x > 3(c_{min}+1), \ \ \textit{where } c_{min} = c(a_{min}). \tag{34}$$

We summarize the above analysis so far by considering properties of the following key variables: managerial effort $z(a)$, firm productivity $\phi(a)$, firm revenue $r(a)$, as well as entrepreneur income $\pi(a)$, which are listed in (35) to (38). Notably, managerial effort $z(a)$, firm sales revenue $r(a)$, and entrepreneur income (firm profit) $\pi(a)$ linearly increase with managerial ability a :

$$z(a) = (1+\mathbb{I}_x\tau^{1-\sigma})\Big(\frac{2w}{\lambda a_e}\Big)^{\frac{1}{2}}a \tag{35}$$

$$\phi(a) = (1+\mathbb{I}_x\tau^{1-\sigma})^{\frac{1}{\sigma-1}}\Big(\frac{2w}{\lambda a_e}\Big)^{\frac{1}{2(\sigma-1)}}a^{\frac{1}{\sigma-1}} \tag{36}$$

$$r(a) = \frac{2\sigma(1+\mathbb{I}_x\tau^{1-\sigma})^2 w}{a_e}a \tag{37}$$

$$\pi(a) = \frac{(1+\mathbb{I}_x\tau^{1-\sigma})^2 w}{a_e}a - \mathbb{I}_x f_x \tag{38}$$

Figure A.1 plots the key variables as a function of innate ability a. Panel (a) represents the manager's effort $z(a)$, which becomes zero for an ability level below the cutoff a_e. Managerial effort increases with the manager's ability and jumps up at the export cutoff a_x, after which it rises with a steeper slope for more talented entrepreneurs. Panel (b) illustrates the relationship between firm productivity and the entrepreneur's ability. Firm productivity increases in managerial talent with a concave (convex) shape for σ greater (less) than two. Similarly, firm productivity jumps up at the export cutoff a_x. Panel (c) displays the profiles of firm revenue $r(a)$ and occupational return. Revenue $r(a)$ increases with manager's ability from a_e and exhibits an upward jump at export cutoff a_x because of the access to the foreign market. The slope becomes steeper for a higher level of managerial talent.

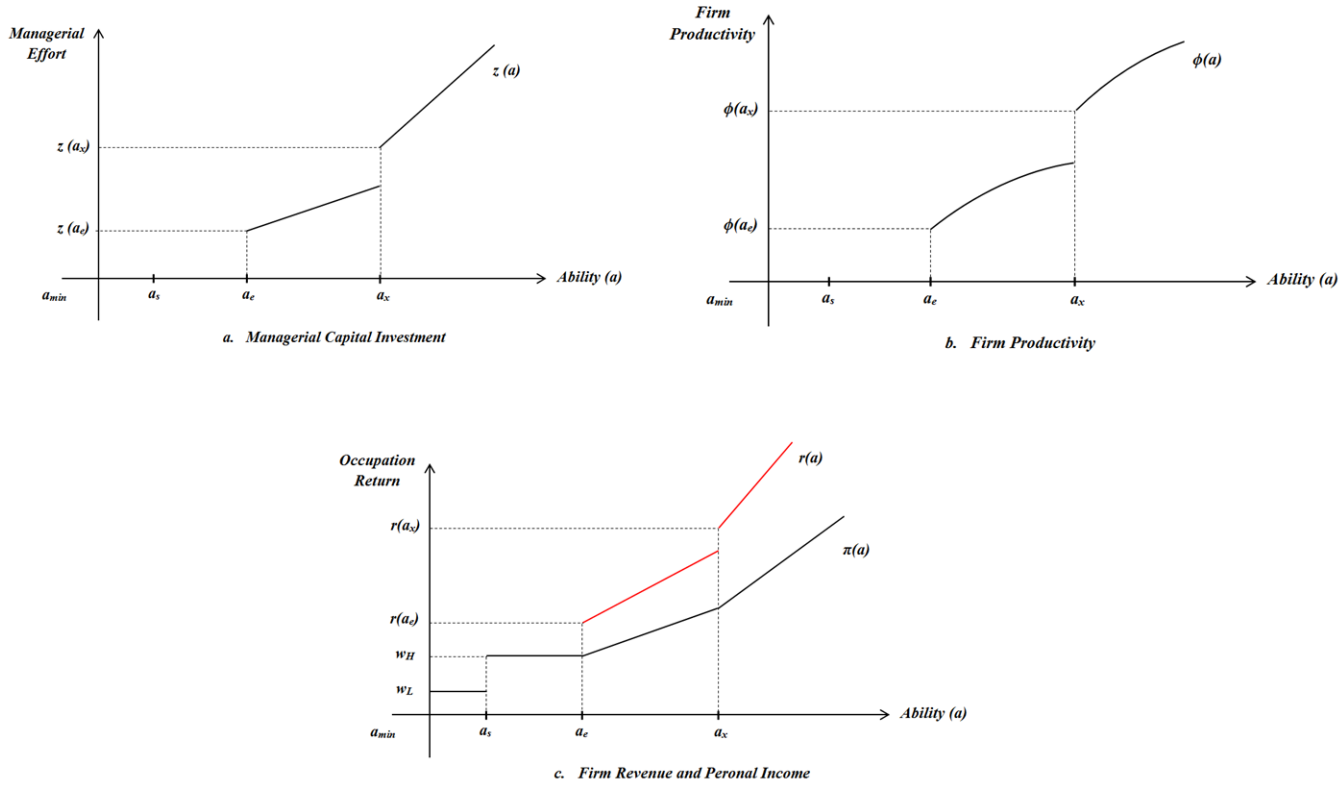


Figure A.1: Key Variables as a Function of Innate Ability

To solve for the general equilibrium, we proceed by describing labor market clearing for both skilled and unskilled workers. Let η measure an economy's openness which is defined by $\eta \equiv \tau^{1-\sigma}$, $\eta \in (0,1)$. A higher value for η represents a more open economy. Denoting $l(a)$ and $h(a)$ as the measure of unskilled and skilled workers hired by an entrepreneur of type a, we have

$$l(a) = \frac{2(1-\alpha)(\sigma-1)[1+\eta \mathbb{I}_x(a)]^2 w}{a_e} a \tag{39}$$

$$h(a) = \frac{2\alpha(\sigma-1)[1+\eta \mathbb{I}_x(a)]^2}{a_e} a. \tag{40}$$

As captured by firm-specific demand, the more productive firm will employ a greater number of both types of workers. The relative demand for skilled labor decreases with the skill premium. The overall demand for both types of labor is obtained by aggregating the firm-specific demand across domestic firms $[a_e, a_x)$ and exporters $[a_x, +\infty)$. We now introduce some parameterization in the ability distribution.

Assumption 3. *The cumulative distribution function of innate ability $G(a)$ is Pareto and given by*

$$G(a) = 1 - a^{-k}, \tag{41}$$

where $a_{min} = 1$ and k is the shape parameter.

Under Assumption 3, we can explicitly derive aggregate demand, as displayed in (42) and (43):

$$L^D = \frac{2k(1-\alpha)(\sigma-1)w}{k-1} \times \frac{(\eta^2+2\eta)a_x^{-k+1} + a_e^{-k+1}}{a_e} \tag{42}$$

$$H^D = \frac{2k\alpha(\sigma-1)}{k-1} \times \frac{(\eta^2+2\eta)a_x^{-k+1} + a_e^{-k+1}}{a_e}. \tag{43}$$

The supply of labor is pinned down by the sorting of individuals into occupations and skill levels. As the segments of the unskilled and skilled worker are $[1, a_s)$ and $[a_s, a_e)$, given the ability distribution, we can derive the aggregate supply of each type of labor as

$$L^S = 1 - a_s^{-k} \tag{44}$$

$$H^S = a_s^{-k} - a_e^{-k}. \tag{45}$$

Labor clearing conditions imply that the supply meets demand.

Finally, equilibrium is characterized by several conditions. First, consumers choose occupations based on their innate ability and labor market conditions to maximize their levels of utility subject to the budget constraint. Second, entrepreneurs (i.e., firms) maximize profits given labor wages and output prices. Third, the labor market clears for both types of labor. To summarize, the equilibrium is defined as follows.

Definition. *The symmetric equilibrium is characterized by the total nominal output $\mathcal{E}$, the labor supply $\{H^s, L^s\}$, and the wage of skilled workers w, which satisfy:*

1. Utility maximization: Consumers optimally choose their occupations $\{U, S, E\}$ and consumption to maximize their utility subject to the budget constraint, given their innate ability and prices.

2. Profit maximization: Entrepreneurs maximize profits given factor prices $\{w_L = 1, w_H = w\}$ and the price index P .

3. Labor market clearing: The labor market clears for both skilled and unskilled labor.

4. Balance of payments: The aggregate expenditure (consumption and education) equals the aggregate revenue:[42]

$$\mathcal{E} = \int_{\omega\in\Omega} p(\omega)q(\omega)d\omega = L^s + wH^s + \int_{a\in\Omega} \pi(a)da + \int_{a\in\Omega} f(z(a), a)da + \int_{a\in\Omega_x} f_x da. \tag{46}$$

We solve the equilibrium by uncovering three ability cutoffs, a_s, a_e, and a_x, and the skill premium w via solving a system of equations as shown below:

[42] Balance of payments holds due to Walra's law.

$$w = c(a_s) + 1 \tag{47}$$

$$a_x = \frac{f_x}{w(\eta^2 + 2\eta)} a_e \tag{48}$$

$$a_s^{-k} - a_e^{-k} = \frac{2k\alpha(\sigma - 1)}{k - 1} \times \frac{(\eta^2 + 2\eta)a_x^{-k+1} + a_e^{-k+1}}{a_e} \tag{49}$$

$$1 - a_s^{-k} = \frac{2k(1 - \alpha)(\sigma - 1)w}{k - 1} \times \frac{(\eta^2 + 2\eta)a_x^{-k+1} + a_e^{-k+1}}{a_e} \tag{50}$$

where (47) characterizes the cutoff ability of schooling; (48) depicts the selection to exporting; (49) and (50) comes from the labor market clearing conditions. For algebra convenience, let $T = (\eta^2 + 2\eta)^k / f_x^{k-1}$, the above system of equations is rewritten as:

$$a_x = \left[\frac{\alpha\kappa T w^{k-1} + \alpha\kappa + 1}{T w^k} f_x\right]^{1/k} a_s \tag{51}$$

$$a_e = \left[\alpha\kappa T w^{k-1} + \alpha\kappa + 1\right]^{1/k} a_s \tag{52}$$

$$a_s = \left[\frac{\alpha\kappa T w^{k-1} + \alpha\kappa + 1}{(1 - \alpha)\kappa T w^k + \alpha\kappa T w^{k-1} + (1 - \alpha)\kappa w + \alpha\kappa + 1}\right]^{-1/k} \tag{53}$$

$$w = c(a_s) + 1 \tag{54}$$

where κ is a constant defined by $\kappa = \frac{2k(\sigma-1)}{k-1}$.

Appendix Proposition 1. *There exists a unique symmetric equilibrium in the two-country economy.*

The joint determination of a_s and skilled wage w is illustrated in Figure A.2. The curve labeled SS captures skill supply, and the curve labeled SD denotes skill demand.[43] The reduction in the skill premium increases the aggregate demand for skills and leads more individuals to obtain a college degree, lowering the cutoff ability for schooling (i.e., a_s). This relationship is captured by the positive slope of the SD curve. In the meantime, the decline in the skilled wage also increases the opportunity cost of schooling and decreases individuals' willingness to purchase education, which increases the ability cutoff a_s. The negative slope of the SS curve reflects such a relationship, and equilibrium is determined by the intersection of SD and SS.

[43]The proof is provided in appendix A2. The skill supply curve is characterized by equation (7), and the skill demand curve is characterized by equation (53).

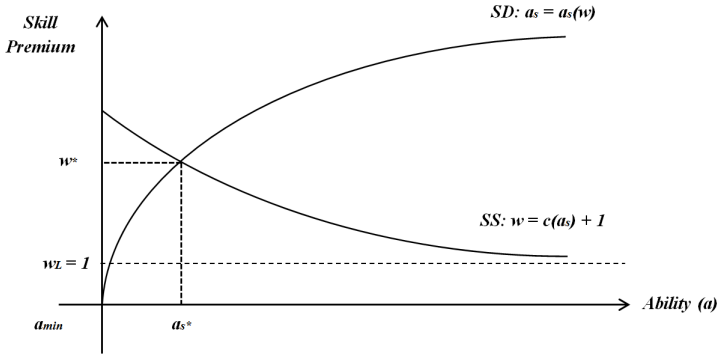


Figure A.2: The Joint Determination of a_s^* and w^*

The ability sorting across occupations is provided in Appendix Corollary 1, and ability requirement increases from unskilled jobs to big entrepreneurs.

Appendix Corollary 1. *In the equilibrium, the skilled wage w is no less than the unskilled wage, and the cutoff ability satisfies $a_s < a_e < a_x$; that is, individuals are positively sorting to occupations based upon innate ability.*

The proof of Appendix Corollary 1 is immediate. As the schooling cost is positive $c(a) \geq 0$, the skilled wage w is no less than the unskilled wage according to equation (7). The ability sorting across occupations is guaranteed by the model assumptions. Equation (52) guarantees that $a_e > a_s$. Assumption 2 and equation (9) confirm that $a_x > a_e$.

Finally, we show in Appendix Proposition 2 that the impact of trade liberalization on real consumption is mixed. It raises the aggregate level of nominal output, leading to a higher level of real consumption. On the other hand, the loss of variety from the strong selection effect boosts the price index and decreases real consumption. The net outcome depends crucially on the degree of love of variety. When consumers care less about varieties, trade liberalization increases real consumption, as we show in Appendix A7.

Appendix Proposition 2. *Trade liberalization*[44]

1). increases both nominal and aggregate real output;

2). has an ambiguous impact on aggregate real consumption. Specifically, when preference exhibits a weak degree of love of variety, trade liberalization increases real consumption overall.

A2. Proof of Appendix Proposition 1

As $c(a)$ is a continuous and strictly decreasing function, we immediately have $w \leq 1 + c(1)$ and that there exists a inverse function such that $a_s = c^{-1}(w-1)$. Define $H(w) = c^{-1}(w-1) - a_s(w)$. It can be shown that

[44] Appendix Proposition 2 studies the case where $|c'(a)|$ is small.

$$\frac{da_s}{dw} = \frac{1}{k} a_s^{k+1} \frac{(1-\alpha)\kappa[\alpha\kappa T^2 w^{2k-2} + (2\alpha\kappa + k)Tw^{k-1} + (\alpha\kappa + 1)]}{[...]^2} > 0$$

One can easily derive the results in the limiting case:

$$\lim_{w \to 1^+} H(w) = +\infty$$
$$\lim_{w \to c_1 + 1} H(w) = 1 - a_s(c_1 + 1) < 1 - a_s(1) < 0$$

where the first result comes from $\lim_{a \to +\infty} c(a) = 0$ and $c'(a) < 0$; the second comes from the property $a_s'(w) > 0$ (which has been shown above). Therefore, there is a fixed point $w^* \in (1, c(1) + 1]$ such that $H(w^*) = 0$, and it confirms the existence of equilibrium. On the other hand, $H'(w) = 1/c'(w-1) - a_s'(w) < 0$, which confirms that the equilibrium is unique.

A3. Proof of Proposition 1

By defining $T = \frac{(\eta^2 + 2\eta)^k}{f_x^{k-1}}$, trade liberalization (larger η or smaller f_x) increases the parameter T. According to (53), we can derive:

$$\frac{da_s(w)}{dT} = \frac{1}{k} a_s^{k+1} \frac{(1-\alpha)\kappa w^k}{[...]^2} > 0$$

Applying implicit function theorem to $H(w^*, T) = 0$, one can derive:

$$\frac{dw^*}{dT} = -\frac{H_T}{H_w} = \frac{da_s(w^*)/dT}{H_w} < 0$$

On the other hand

$$\frac{da_s^*}{dT} = \frac{1}{c'(w^* - 1)} \frac{dw^*}{dT} > 0$$

where the equality comes from $a_s^* = c^{-1}(w^* - 1)$.

In sum, trade liberalization decreases the skill premium and increases the skilled labor cutoff a_s (i.e., it increases the college dropout rate among the people with low ability).

A4. Proof of Corollary 1

As the production function is in the form of Cobb-Douglas, we have:

$$\frac{H^S}{L^S} = \frac{H^D}{L^D} = \frac{\alpha}{1-\alpha} \frac{1}{w^*}$$

According to Proposition 1 ($dw^*/dT < 0$), it is immediately that $\frac{dH^S/L^S}{dT} > 0$.

On the other hand, substituting $H^S = G(a_e^*) - G(a_s^*)$ and $L^S = G(a_s^*)$ in $H^S/L^S = H^D/L^D = \frac{\alpha}{1-\alpha} \frac{1}{w^*}$, we can derive:

$$G(a_e^*) = G(a_s^*) + \frac{\alpha}{1-\alpha}\frac{G(a_s^*)}{w^*}$$

where a_x can be solved as $a_x = \left[\frac{Tw^k/f_x}{(1-\alpha)\kappa Tw^k+\alpha\kappa Tw^{k-1}+(1-\alpha)\kappa w+\alpha\kappa+1}\right]^{-1/k}$. Since $G'(a) > 0$ and trade liberalization (i.e., bigger value of T) increases a_s^* and decreases w^* (Appendix Proposition 1), it is immediately that $da_e^*/dT > 0$.

A5. Proof of Proposition 2

To study the effect of trade liberalization, a_x can be written in the form of $a_x(f_x, T(f_x), w(T(f_x)))$:

$$a_x = \left[\frac{Tw^k/f_x}{(1-\alpha)\kappa Tw^k + \alpha\kappa Tw^{k-1} + (1-\alpha)\kappa w + \alpha\kappa + 1}\right]^{-1/k}$$

Applying the chain rule, one can derive

$$\frac{da_x}{df_x} = \underset{(+)}{\frac{da_x}{df_x}} + \underset{(-)}{\frac{da_x}{dT}}\underset{(-)}{\frac{dT}{df_x}} + \underset{(-)}{\frac{da_x}{dw}}\underset{(-)}{\frac{dw}{dT}}\underset{(-)}{\frac{dT}{df_x}}$$

The net effect of reducing fixed cost seems to be ambiguous. However, one can rewrite

$$\frac{dw}{dT} = \frac{dc(a_s)}{dT} = \frac{da_s}{dT}c'(a_s) = -\frac{da_s}{dT}|c'(a_s)|$$

The sign of da_x/df_x depends crucially on the shape of education cost $c(a)$. Specifically, when $|c'(a)|$ is sufficiently small (e.g., zero in the limiting case), it is immediate that reducing fixed cost f_x decreases the ability cutoff of exporter ($da_x/df_x > 0$); when $|c'(a)|$ is sufficiently large in the other extreme (e.g., infinity in the limiting case), reduction of fixed cost f_x increases the ability cutoff of exporter ($da_x/df_x < 0$).

Similarly, the effect of trade cost τ on a_x is derived as follows:

$$\frac{da_x}{d\tau} = (\underset{(-)}{\frac{da_x}{dT}} - \underset{(-)}{\frac{da_x}{dw}}\underset{(+)}{\frac{da_s}{dT}}|c'(a_s)|)\underset{(-)}{\frac{dT}{d\tau}}$$

When $|c'(a)|$ is sufficiently small (e.g., zero in the limiting case), a reduction of trade cost τ decreases the ability cutoff of exporter ($da_x/d\tau > 0$); when $|c'(a)|$ is sufficiently large in the other extreme (e.g., infinity in the limiting case),a reduction of trade cost τ increases the ability cutoff of exporter ($da_x/d\tau < 0$).

A6. Proof of Proposition 3

The proof of Proposition 1 confirms that $da_s/d\tau < 0$ and $dw/d\tau > 0$. Proposition 2 reveals that $da_x/d\tau > 0$ when $|c'(a_s)|$ is small. In this part, we will prove $d\pi_d(a)/d\tau > 0$ and $d\pi_x(a)/d\tau < 0$.

First, I show that trade liberalization in the form of a reduction in τ decreases the income of the small and median firms (i.e., the firms selling in the domestic market only) by showing $d\pi_d(a)/d\eta <$

0. In contrast, the same change in trade cost increases the income of the large firms (i.e., the exporters) by showing $d\pi_x(a)/d\eta > 0$.[45] According to (31), we have the following expressions for firm profits:

$$\pi_d(a) = \frac{w}{a_e}a, \quad \pi_x(a) = \frac{(1+\eta)^2}{a_e}a - f_x$$

As $dw/d\eta = dw/dT \times dT/d\eta < 0$ and $da_e/d\eta = da_e/dT \times dT/d\eta > 0$ according to Proposition 1 and the proof of Corollary 1, the slope of the profit function of domestic firms decreases with the openness measure, i.e., $\frac{d(w/a_e)}{d\eta} < 0$. Therefore, trade liberalization by reducing the per-unit trade cost decreases the profit for the small and medium firm, i.e., $d\pi_d(a)/d\eta < 0$.

Next, I show that trade liberalization in the form of a reduction in τ increases the profit of exporters. Let $h(\eta) = (1+\eta)/a_e^{1/2}$ denote the slope of exporting firm's profit, which can be expressed as

$$\frac{dh(\eta)}{d\eta} = a_e^{-\frac{1}{2}}\left[1 - \frac{1}{2}a_e^{-1}(\eta+1)\frac{da_e}{d\eta}\right] \tag{55}$$

where we can express a_e as

$$a_e = \left[(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1} + (1-\alpha)\kappa w + \alpha\kappa + 1\right]^{\frac{1}{k}}$$

The derivative of a_e with respect to η can be written as:[46]

$$\frac{da_e}{d\eta} = \frac{da_e}{dT}\times\frac{dT}{d\eta} + \frac{da_e}{dw}\times\frac{dw}{d\eta} = 2a_e^{1-k}\times\frac{(\eta+1)}{\eta^2+2\eta}[(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1}] + \frac{da_e}{dw}\times\frac{dw}{d\eta}$$

Substituting the above equation to (55), one can derive

$$\begin{aligned}\frac{dh(\eta)}{d\eta} &= a_e^{-\frac{1}{2}}\left\{1 - a_e^{-k}\frac{(\eta+1)^2}{\eta^2+2\eta}[(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1}]\right\} - \frac{1}{2}a_e^{-\frac{3}{2}}(\eta+1)\frac{da_e}{dw}\times\frac{dw}{d\eta} \\ &= a_e^{-(\frac{1}{2}+k)}\left\{(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1} + (1-\alpha)\kappa w + \alpha\kappa + 1 - \frac{(\eta+1)^2}{\eta^2+2\eta}[(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1}]\right\} \qquad (56) \\ &\quad - \frac{1}{2}a_e^{-\frac{3}{2}}(\eta+1)\frac{da_e}{dw}\times\frac{dw}{d\eta} \\ &= a_e^{-(\frac{1}{2}+k)}\left\{(1-\alpha)\kappa w + \alpha\kappa + 1 - \frac{(1-\alpha)\kappa T w^k}{\eta^2+2\eta} - \frac{\alpha\kappa T w^{k-1}}{\eta^2+2\eta}\right\} - \frac{1}{2}a_e^{-\frac{3}{2}}(1+\eta)\frac{da_e}{dw}\times\frac{dw}{d\eta} \qquad (57)\end{aligned}$$

As $a_x = \frac{f_x}{w(\eta^2+2\eta)}a_e$, we have $(\eta^2+2\eta)w/f_x < 1$ due to the selection into exporters. This inequality can be further written as $\frac{Tw^k}{\eta^2+2\eta} < w$ or $\frac{Tw^{k-1}}{\eta^2+2\eta} < 1$.[47] Applying the inequality to (56) and given that

[45] By definition $\eta = \tau^{1-\sigma}$, smaller τ implies larger η.

[46] $dT/d\eta = T \times 2k(\eta+1)/(\eta^2+\eta)$ and $da_e/dT = a_e^{1-k}\left[(1-\alpha)\kappa w^k + \alpha\kappa w^{k-1}\right]/k$

[47] The inequality is derived by jointly applying the definition of T and the fact that $(\eta^2+2\eta)^{k-1}w^{k-1}/f_x^{k-1} < 1$.

$\frac{da_e}{dw} \times \frac{dw}{d\eta} < 0$, it is immediate to obtain:

$$\frac{dh(\eta)}{d\eta} > a_e^{-(\frac{1}{2}+k)} > 0$$

Therefore, we have proved that $d\pi_x/d\eta > 0$.

A7. Proof of Appendix Proposition 2

The aggregate nominal output $\mathcal{E}$ consists of two parts (i.e., $\mathcal{E} = C + M$, where C is the aggregate consumption and M denotes the expenditure on various fixed costs.), and the real output is defined by $\mathcal{E}/P$. The total consumption expenditure is given by

$$\begin{aligned} C =& 1 - a_s^{-k} + w(a_s^{-k} - a_e^{-k}) + \int_{a_e}^{a_x} \pi_d(a) dG(a) + \int_{a_x}^{+\infty} \pi_x(a) dG(a) \\ =& \kappa(Tw^k + w)a_e^{-k} + \frac{k}{k-1}\frac{w}{a_e}\left[(\eta^2+2\eta)a_x^{-k+1} + a_e^{-k+1}\right] - f_x a_x^{-k} \\ =& \left[(\kappa + \frac{1}{k-1})Tw^k + (\kappa + \frac{k}{k-1})w\right] a_e^{-k} \end{aligned} \tag{58}$$

where the derivation uses $wH/L = \alpha/(1-\alpha)$, $a_x = \frac{f_x}{(\eta^2+2\eta)w} a_e$ and $T = (\eta^2+2\eta)^k / f_x^{k-1}$. Similarly, one can derive the aggregate expenditure on various fixed costs as:

$$\begin{aligned} M =& \int_{a_e}^{+\infty} \frac{\lambda z(a)^2}{2a} dG(a) + \int_{a_x}^{+\infty} f_x dG(a) \\ =& \frac{k}{k-1}(Tw^k + w)a_e^{-k} + f_x a_x^{-k} \\ =& \left(\frac{2k-1}{k-1}Tw^k + \frac{k}{k-1}w\right) a_e^{-k} \end{aligned}$$

where the derivation uses $a_x = \frac{f_x}{(\eta^2+2\eta)w} a_e$ and $T = (\eta^2+2\eta)^k / f_x^{k-1}$. Given the expressions for C, M and $\kappa = \frac{2k(\sigma-1)}{k-1}$, the aggregate nominal output is calculated as

$$\begin{aligned} \mathcal{E} =& (\frac{2k}{k-1} + \kappa)(Tw^k + w)a_e^{-k} \\ =& \frac{2k\sigma}{k-1} \frac{Tw^k + w}{(1-\alpha)\kappa Tw^k + \alpha\kappa Tw^{k-1} + (1-\alpha)\kappa w + \alpha\kappa + 1} \end{aligned} \tag{59}$$

Using (8) and the definition of $A = P^\beta \mathcal{E}^{1-\beta}$, one can derive the real output as

$$\frac{\mathcal{E}}{P} = \left[\frac{\kappa_\pi^2}{2\lambda}\right]^{\frac{1}{2(\sigma-1)}} w^{-\frac{1+2\alpha(\sigma-1)}{2(\sigma-1)}} \mathcal{E}^{\frac{\sigma}{\sigma-1}} a_e^{\frac{1}{2(\sigma-1)}} \tag{60}$$

The nominal output in (59) can be written as the function of $\mathcal{E} = \mathcal{E}(w(T), T)$. Therefore, when $|c'(a_s)|$ is sufficiently small, we can derive the following:

$$sign\left(\frac{d\mathcal{E}(w(T),T)}{dT}\right) = sign\left(-\frac{d\mathcal{E}}{dw}\frac{da_s}{dT}|c'(a_s)| + \frac{d\mathcal{E}}{dT}\right) \approx sign\left(\frac{d\mathcal{E}}{dT}\right) > 0$$

where the last inequality comes from the fact that

$$\frac{d\mathcal{E}}{dT} = \frac{2k\sigma}{k-1}\frac{w^k}{[(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1} + (1-\alpha)\kappa w + \alpha\kappa + 1]^2} > 0$$

The rise in the real output can also be proved by showing that

$$\frac{d(\mathcal{E}/P)}{dT} = \underset{(+)}{\frac{d(\mathcal{E}/P)}{dw}}\frac{dw}{dT} + \underset{(+)}{\frac{d(\mathcal{E}/P)}{da_e}}\frac{da_e}{dT} + \underset{(+)}{\frac{d(\mathcal{E}/P)}{d\mathcal{E}}}\frac{d\mathcal{E}}{dT} > 0$$

Therefore, trade liberalization (i.e., a smaller f_x or τ) increases both nominal and real output.

Next we study the impact of trade liberalization on the real consumption. According to (58) and (60), we can solve it as:

$$\begin{aligned}
\frac{C}{P} &= \left[(\kappa + \frac{1}{k-1})Tw^k + (\kappa + \frac{k}{k-1})w\right] a_e^{-k} \times \left[\frac{\kappa_\pi^2}{2\lambda}\right]^{\frac{1}{2(\sigma-1)}} w^{-\frac{1+2\alpha(\sigma-1)}{2(\sigma-1)}} \mathcal{E}^{\frac{1}{\sigma-1}} a_e^{\frac{1}{2(\sigma-1)}} \\
&= \left[\frac{\kappa_\pi^2}{2\lambda}\right]^{\frac{1}{2(\sigma-1)}} \times \left[(\frac{1}{k-1} + \kappa)Tw^k + (\frac{k}{k-1} + \kappa)w\right] \\
&\quad \times \left[(1-\alpha)\kappa T w^k + \alpha\kappa T w^{k-1} + (1-\alpha)\kappa w + \alpha\kappa + 1\right]^{-[\frac{1}{2k(\sigma-1)} + \frac{1}{\sigma-1} + 1]} \\
&\quad \times w^{-\frac{1+2\alpha(\sigma-1)}{2(\sigma-1)}} \left(Tw^k + w\right)^{\frac{1}{\sigma-1}}
\end{aligned}$$

Trade liberalization affects real consumption through the direct channel by changing T and by an indirect effect by affecting w. The net impact is crucially determined by the degree of love-of-variety. One can easily show that in some values of σ, trade liberalization decreases real consumption (i.e., $\frac{dC/P}{dT} < 0$). This is mostly due to the effect of over-selection, in which case the price index rises due to the loss of varieties. However, when consumers care less on varieties, we can show that trade liberalization increases real consumption. To prove this, we can consider the extreme case where $\sigma = +\infty$. Applying L'hopital rule, we can show that:

$$\lim_{\sigma \to +\infty} \frac{C}{P} = \frac{w^{1-\alpha}}{(1-\alpha)w + \alpha} \tag{61}$$

The real consumption in the limiting case (61) decreases with w. Recalling that $dw/dT < 0$,it is immediate that the reduction in the unit trade cost τ or in the exporting fixed cost f_x increases real consumption.

A8. Comparison: Selection Effect of Trade Liberalization

The selection effect of trade is measured as the ratio of productivity cutoff between the exporter and the domestic firm (i.e., $a_x/a_e > 1$) . The first row of Table A.1 presents the ratio implied by each model. The second and third rows present the changes in the selection effect due to the reduction in variable trade cost τ and the exporting fixed cost f_x. As shown in the table, trade liberalization (i.e., $\hat{\tau} < 1$ and $\hat{f}_x < 1$) decreases the ratio (i.e., $\widehat{a_x/a_e} < 1$) in both Melitz (2003) and Dinopoulos and Unel (2015). While in our baseline model, the selection effect is also affected by the change in the skilled wage that further depends on education cost. Specifically, when education cost is in good shape (i.e., there is no magnificent drop with the marginal increase of ability), the change of skilled wage is modest and it cannot overturn the decrease of selection effect (i.e., $\widehat{a_x/a_e} < 1$) . In this case, the baseline model behaves similarly to that in Melitz (2003) and Dinopoulos and Unel (2015). However, if education cost is steep around equilibrium state, the drop in the return to college can be large enough (i.e., $\hat{w}$ is sufficiently small) so that the selection effect is overturned (i.e., $\widehat{a_x/a_e} > 1$).

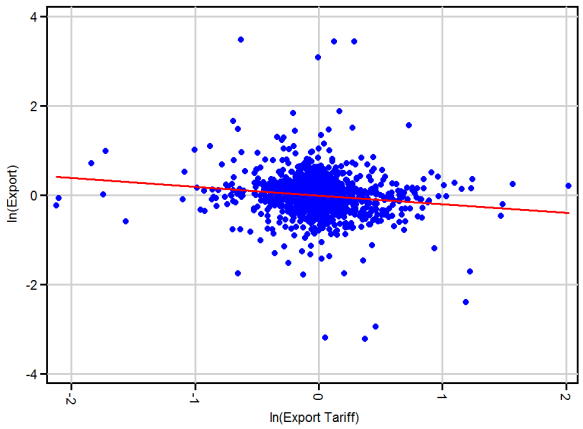
Table A.1: Selection Effect Comparison

$\sigma > 1$	Melitz (2003)	Dinopoulos (2016)	Baseline
a_x/a_e	$\tau\left(\frac{f_x}{f_d}\right)^{\frac{1}{\sigma-1}}$	$\frac{2f_x}{(\Psi_0+2f_d)\tau^{1-\sigma}(2+\tau^{1-\sigma})}$	$\frac{f_x}{w\tau^{1-\sigma}(2+\tau^{1-\sigma})}$
$\widehat{a_x/a_e}$ due to $\hat{\tau}$	$\hat{\tau}$	$\frac{2+\tau^{1-\sigma}}{\hat{\tau}^{1-\sigma}(2+\hat{\tau}^{1-\sigma}\tau^{1-\sigma})}$	$\frac{2+\tau^{1-\sigma}}{\hat{\tau}^{1-\sigma}(2+\hat{\tau}^{1-\sigma}\tau^{1-\sigma})}/\hat{w}$
$\widehat{a_x/a_e}$ due to $\hat{f}_x$	$\hat{f}_x^{\frac{1}{\sigma-1}}$	$\hat{f}_x$	$\hat{f}_x/\hat{w}$

Notes: f_d and f_x denote the domestic and exporting fixed costs; σ is the CES elasticity of substitution; τ is the ice-berg trade cost; Ψ_0 captures the labor market friction and is assumed to be an exogenous constant parameter; w denotes the skill premium in the baseline model. $\hat{x} \equiv x'/x$ where x is the value before some shock and x' denotes the value after some shock.

B. Instrument for Export Shock Index

Figure A.3 displays the relationship between the national export and tariff. The negative slope indicates that a 1% rise in foreign tariffs imposed on Chinese exports decreases China's export by 0.19% on average. This effect is highly significant and economically sizable. The strong correlation remains robust after we exclude outliers.



Note: Both axes report the residuals of the variable after controlling the time and sector fixed effects.

Figure A.3: Relationship Between ln $Export$ and ln $ExportTariff$

Table A.2 reports the performance of export shock IV. As reported in column (1) and (2), the F-statistics are all greater than 10, indicating a strong correlation between IV and the instrumented variable. In column (3) and (4), we study if the strong correlation comes from employment weights. We use the employment share of export-intensive industries as an additional control, and its point estimate remains insignificant.

Table A.2: Performance of Export Shock IV

Dep. Var: $ExportShock$	(1)	(2)	(3)	(4)
$ExportShock^{IV}$	0.777***	0.664***		
	(0.085)	(0.188)		
$EmploymentShare$			-0.506	8.322
			(10.053)	(10.231)
F Stat	84.37	12.47	0.00	0.66
R-squared	0.435	0.438	0.453	0.564
City FE	YES	YES	YES	YES
Year FE	-	Yes	-	Yes

Notes: Dependent variable $ExportShock$ is export change per worker as constructed in (10); $ExportShock^{IV}$ is the instrument as constructed in (15). $EmploymentShare$ measures the employment share of the export-intensive industries at the city and year level. Robust standard errors are clustered at city and year level, and are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

We report the first-stage regression results for all specifications in Table A.3. The dependent variable is the instrumented variable in each specification, and the independent variables are the corresponding IV. All F-statistics are well above 10.

Table A.3: Summary: First Stage Regressions

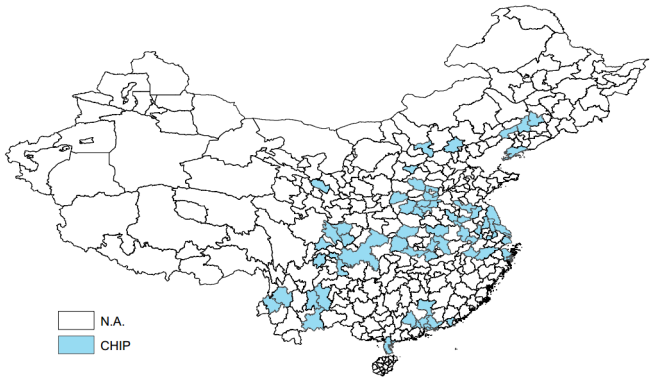
Specification:	(1) Skill Premium	(2) Business Activity	(3) Polarization
$College_{ict} \times Export\ Shock_{ct}^{IV}$	1.134***		
	(0.283)		
$Business\ Type_{ict} \times Export\ Shock_{ct}^{IV}$		1.272***	
		(0.195)	
$Export\ Shock_{ct}^{IV}$			0.025
			(0.089)
$Income\ Group_{ict} \times Export\ Shock_{ct}^{IV}$			1.132***
			(0.176)
F-stat	16.0	42.6	22.4
Class FE	-	YES	YES
Province FE	-	-	YES
City-Year FE	YES	YES	-
Year FE	YES	YES	YES

Notes: The instrumented variables are $College_{ict} \times Export\ Shock_{ct}$ for skill premium regression, $Business\ Type_{ict} \times Export\ Shock_{ct}$ ($Business\ Type_{ict} \in \{H, M/L\}$) for business activity regression, and $Income\ Group_{ict} \times Export\ Shock_{ct}$ ($Income\ Group_{ict} \in \{H, M, L\}$) for polarization regression. The baseline regressions for skill premium and business activity include city-year fixed effects, and the that for polarization includes city and year fixed effects. For each specification, same controls are included and omitted in above table. Standard errors are clustered at the same level as Table 2, Table 3 and Table 4, and are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

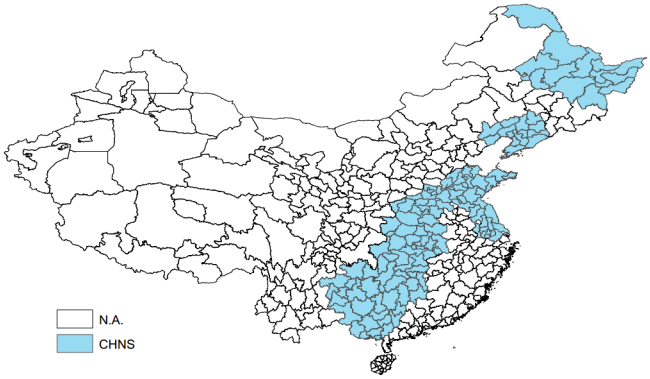
C. Data Source Description

C1. Micro Survey Data

The micro-level information sources from the China Health Nutrition Survey (CHNS) and the China Household Income Project (CHIP). China Health Nutrition Survey was funded by the National Institutes of Health, designed to evaluate the effects of government policy on public health and nutrition intake. Despite that CHNS is a health-related micro survey, it also provides rich information on the respondent's wealth and income. Several studies have used this dataset to research on the inequality issues, such as Zhang and Wan (2006); Liu (2008); Goh et al. (2009). The Chinese Household Income Project was launched by the Chinese Academy of Social Science and the Ford Foundation. It is a widely used dataset for studying labor market, migration and inequality. A detailed report of CHIP can refer to Griffin et al. (1993) and Gustafsson et al. (2008).



(a) CHIP



(b) CHNS

Figure A.4: Geographic Coverage for CHIP and CHNS

In the analysis, we refine the data to urban sample for the years between 2000 and 2008. As both surveys are conducted every several years, the time periods covered in the analysis are 2000, 2004 and 2006 for CHNS, and 2002, 2007 and 2008 for CHIP, respectively. Panel (A) of Table A.4 summarize the number of province and cities included in the data,[48] and Figure A.4 display the geographic coverage for both data surveys. According to the map, both coastal and inland provinces are included in our study. In Panel (B) of Table A.4, we report the employment shares by sector in the data. Though a large proportion of workers are employed in the service sector, we exclude the workers in the service sector from the sample as the robustness check, and we find the estimates remain similar.

[48] In CHNS, the refined sample covers nine provinces, namely Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. In CHIP, the refined sample includes 14 provinces and 69 cities. The sample includes Beijing, Shanxi, Liaoning, Shanghai, Jiangsu, Zhejiang, Hanhui, Henan, Hubei, Guangdong, Chongqing, Sichuan, Yunnan, and Gansu.

Table A.4: Geographic Coverage and Employed Sector Summary

A. Geographic Coverage	CHIP	CHNS
Number of Cities	69	-
Number of Provinces	14	9
B. Sector Employment Shares	Mean	Std
Agriculture	1.5%	2.1%
Construction	6.9%	3.2%
Government	12.3%	8.0%
Industry	23.3%	10.2%
Mining & Resources	2.1%	3.9%
Service	44.0%	10.9%
Transportation	8.3%	4.1%
Other	1.6%	2.4%

Notes: CHIP includes years 2002, 2007 and 2008; CHNS includes years 2000, 2004 and 2006. We report sector employment shares for CHIP as those information is not available for CHNS. We summarize the employment shares across cities and years, which are computed from survey.

C2. Annual Survey of Industrial Production

The annual city-sector specific employment and average wage are computed from the Annual Survey of Industrial Production (ASIP), which is conducted by the National Bureau of Statistics of China. The dataset surveys all types of firms (e.g., the state-owned and the non-state-owned) whose revenue is more than five million RMB each year in the manufacturing sector in China. The sample size varies from 165,119 in 1998 to 336,768 in 2007. The detailed information regarding ASIP can refer to Brandt et al. (2014). The industry classification of ASIP uses China Standard Industrial Classification (GB/T4754- 1984, GB/T4754-1994 and GB/T4754-2002) at the 4-digit level.

C3. Export Tariff and Export Data

The foreign tariff data sources from the Trade Analysis and Information System (TRAINS) database, which is maintained by the United Nations Conference on Trade and Development (UNCTAD). The raw tariff data is withdrawn with the simple average by destination-industry (HS 6-digit level). The export information is derived from China Custom Dataset, which provides the annual trade data on values and quantities at the HS 8-digit level for the period 1998 to 2008. This dataset covers the universe of Chinese exporters. As the industry classification is different between the one used in the Annual Survey of Industry Production (i.e., CSIC 4-digit) and the one used in the tariff and China Custom Dataset (i.e., HS 6-digit), we correspond them to International Standard Industrial Classification (ISIC) revision three at the 4-digit level to construct various export shock measures in practice.

D. Robustness: Hollowing Out the Middle Class

FigureA.5 reports the change of skill premium that is estimated from the CHNS. Using the CHIP sample, Figure A.6 decomposes the overall household income into the business and labor income. Figure A.7 display the population and income share changes by income group, whose classification uses alternative criteria: 60/25 in Panel a and 75/125 in Panel b. Through both classifications, the polarization pattern remains similar to our baseline. The polarization pattern obtained from the CHIP sample is provided in Figure A.8.

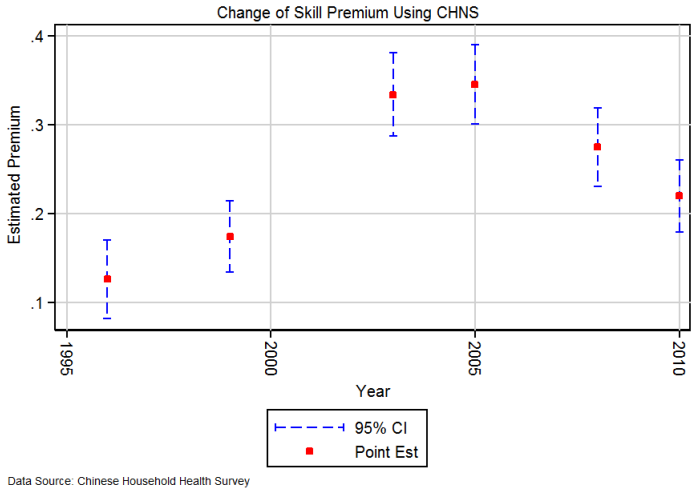


Figure A.5: Estimated Skill Premium with CHNS

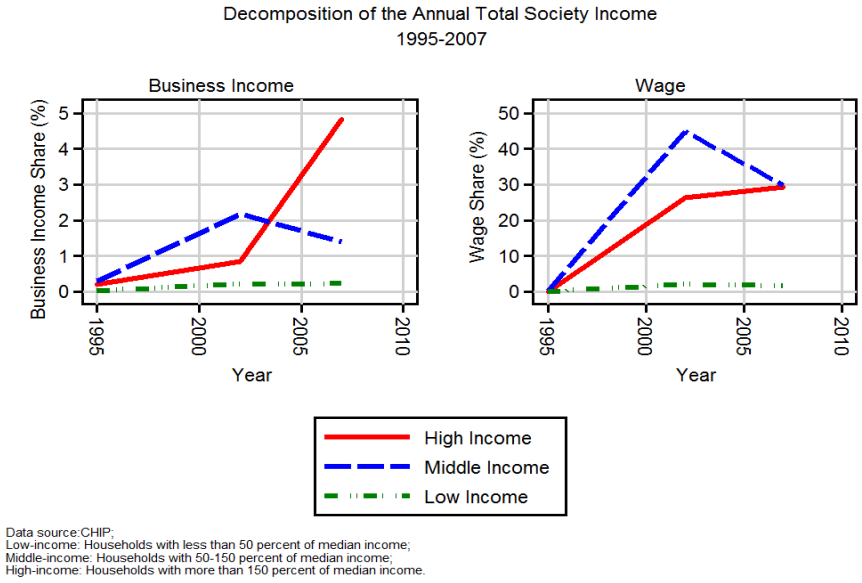
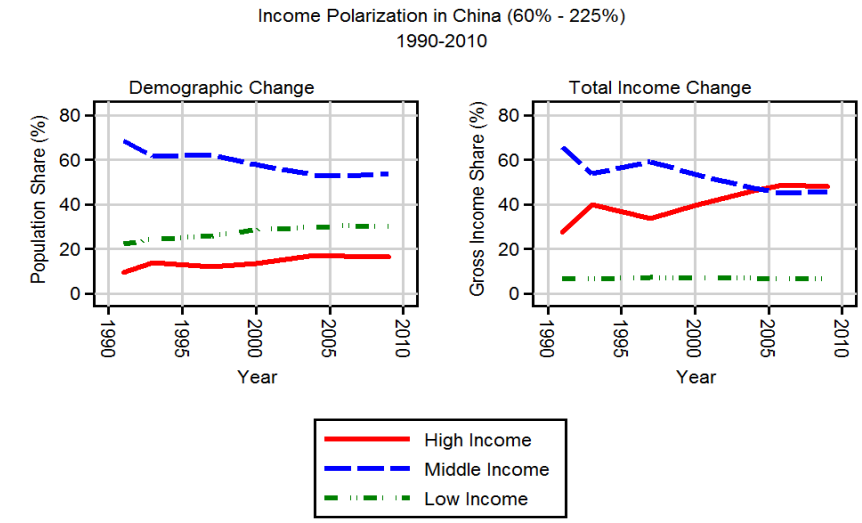
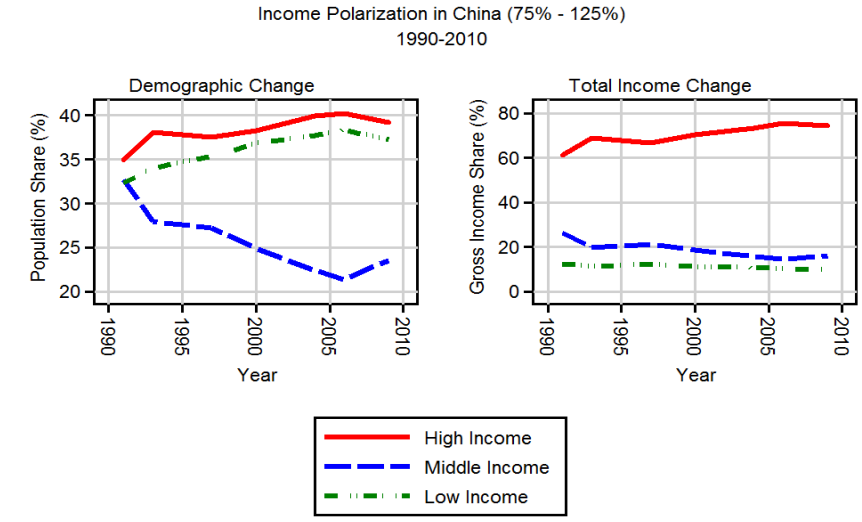


Figure A.6: Decomposition of Total Income



(a) Alternative Measure: 60-225% of Median



(b) Alternative Measure: 75-125% of Median

Figure A.7: Income Polarization: Alternative Income Group Definitions

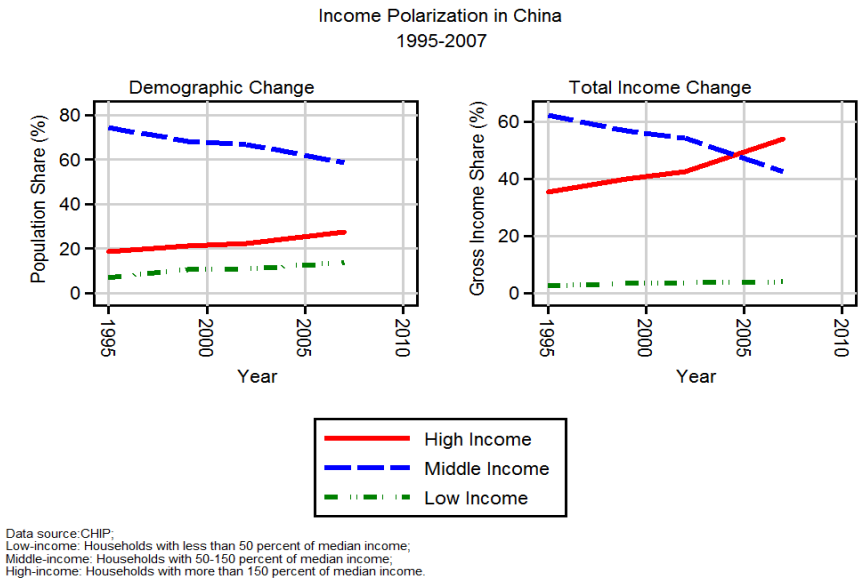


Figure A.8: Income Polarization

E. Channel Discussion

In this section, we isolate the variation in $ExportShock_{ct}$ that is correlated to the selection effect of trade. We first predict the probability of owning a business, i.e., $\widehat{Prob}(BI_{hct} > 0)$, using the regression in (17). Then we average the predicted values across households to obtain a prefecture-year specific probability, i.e., $\overline{\widehat{Prob}(BI_{hct} > 0)}$. The selection effect is measured as $S_{ct} \equiv 1 - \overline{\widehat{Prob}(BI_{hct} > 0)}$. We also construct S_{ct} using the predicted rates of new entry after running the regression in (21) with firm data. A greater value of S_{ct} indicates a stronger selection effect, as there are fewer business activities or entries of new firms. Next, we extract the variation in $ExportShock_{ct}$ that is correlated to selection effect by running the regression $ExportShock_{ct}^{Select} = \hat{b}_1 S_{ct} + \hat{b}_0$, where $\hat{b}$s are the point estimates. We repeat the wage regression in (16) but replacing $ExportShock_{ct}$ with $ExportShock_{ct}^{Select}$ and $ExportShock_{ct}^{Other}$:

$$\begin{aligned}\ln w_{ict} = {} & \beta_0 + \beta_1 College_{ict} + \beta_2 College_{ict} \times ExportShock_{ct}^{Select} + \beta_3 College_{ict} \times ExportShock_{ct}^{Other} \\ & + \mathbf{I}_i \gamma' + \mathbf{R}_{ct} \delta' + \mu_t + \lambda_c + e_{ict}\end{aligned}$$

where $ExportShock_{ct}^{Other}$ denotes all other variations in $ExportShock_{ct}$ that affect the skill premium but are not associated with selection effect. If the selection effect help to explain the supply of skilled labor thus the skill premium, we expect β_2 to be statistically significant.

F. Robustness Tables

Table A.5: Robustness: Trade Shock and Skill Premium Change

	CHNS			CHIP			
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS (Non-Service)
$College_{ict}$	0.447**	0.563***	0.494***	0.507***	0.349***	0.296***	0.313***
	(0.179)	(0.168)	(0.190)	(0.124)	(0.110)	(0.101)	(0.104)
$College_{ict} \times Export\ Shock_{ct}$	-0.003	-0.010***	-0.010***	-0.004**	-0.009***	-0.009***	-0.007**
	(0.006)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
$Export\ Shock_{ct}$	0.055***	0.004		0.024***	0.015***		
	(0.009)	(0.006)		(0.006)	(0.005)		
Observations	5,254	5,254	5,254	18,545	18,545	18,545	9,568
R-squared	0.213	0.306	0.157	0.180	0.325	0.148	0.099
City FE	-	YES	YES	-	YES	YES	YES
Year FE	-	-	YES	-	-	YES	YES
City-Year FE	-	-	YES	-	-	YES	YES

Notes: table details refer to Table 2.

Table A.6: Robustness: Trade Shock and Business Activities

	CHIP			CHNS		
	Extensive Margin		Intensive	Extensive Margin		Intensive
	(1) Logit (IV)	(2) Probit (IV)	(3) 2SLS	(4) Logit (IV)	(5) Probit (IV)	(6) 2SLS
$Export\ Shock_{rt} \times High_{irt}$	-0.682***	-0.262***	0.029***	-1.844***	-1.068***	0.342***
	(0.010)	(0.005)	(0.004)	(0.170)	(0.085)	(0.124)
$Export\ Shock_{rt} \times Middle/Low_{irt}$	-0.707***	-0.277***	0.028***	-1.918***	-1.115***	0.313**
	(0.009)	(0.004)	(0.003)	(0.142)	(0.067)	(0.131)
R-squared	-	-	0.856	-	-	0.759
Observations	10,859	10,859	505	2,549	2,549	804
Class FE	YES	YES	YES	YES	YES	YES
Region-Year FE	YES	YES	YES	YES	YES	YES

Notes: table details refer to Table 3.

Table A.7: Trade Shock and Household Polarization

(A) Chinese Household Income Project (CHIP)	Population by Class			Income by Class		
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(1) 2SLS	(2) 2SLS	(3) 2SLS
$Export\ Shock_{ct} \times High\ Income\ Group$	0.012***	0.009***	0.009***	0.014***	0.013***	0.014***
	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)
$Export\ Shock_{ct} \times Middle\ Income\ Group$	-0.005**	-0.007**	-0.007**	-0.008***	-0.009***	-0.008**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$Export\ Shock_{ct} \times Low\ Income\ Group$	0.020***	0.017***	0.018***	0.015***	0.014***	0.015***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Observations	210	210	210	210	210	210
R-squared	0.879	0.879	0.879	0.942	0.942	0.942
Class FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES
Year FE	-	YES	YES	-	YES	YES
City Controls	-	-	YES	-	-	YES
(B) China Household Nutrition Survey (CHNS)	Population by Class			Income by Class		
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(1) 2SLS	(2) 2SLS	(3) 2SLS
$Export\ Shock_{ct} \times High\ Income\ Group$	0.029**	0.035**	0.029	0.036***	0.039***	0.024
	(0.014)	(0.016)	(0.020)	(0.012)	(0.014)	(0.028)
$Export\ Shock_{ct} \times Middle\ Income\ Group$	-0.022**	-0.016	-0.022	-0.044***	-0.041***	-0.056**
	(0.009)	(0.010)	(0.021)	(0.011)	(0.010)	(0.022)
$Export\ Shock_{ct} \times Low\ Income\ Group$	0.031	0.037	0.031*	0.017	0.019	0.004
	(0.027)	(0.027)	(0.018)	(0.028)	(0.030)	(0.013)
Observations	81	81	81	81	81	81
R-squared	0.871	0.882	0.883	0.952	0.955	0.955
Class FE	YES	YES	YES	YES	YES	YES
Province FE	-	YES	YES	-	YES	YES
Year FE	-	-	YES	-	-	YES

Notes: table details refer to Table 4.

Table A.8: Robustness: Trade Shock and Skill Premium Change (1990 Employment Weights)

	CHNS			CHIP		
	(1)2SLS	(2)2SLS	(3)2SLS	(4)2SLS	(5)2SLS	(6)2SLS
$College_{ict}$	0.451**	0.581***	0.489***	0.505***	0.431***	0.379***
	(0.177)	(0.170)	(0.190)	(0.120)	(0.105)	(0.098)
$College_{ict} \times Export\ Shock_{ct}$	-0.001	-0.011***	-0.009***	-0.004**	-0.005***	-0.005***
	(0.006)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)
$Export\ Shock_{ct}$	0.058***	-0.006		0.023***	0.017***	
	(0.010)	(0.010)		(0.005)	(0.005)	
Observations	5,256	5,256	5,256	18,312	18,312	18,312
R-squared	0.201	0.301	0.155	0.187	0.323	0.148
City FE	-	YES	YES	-	YES	YES
Year FE	-	-	YES	-	-	YES
City-Year FE	-	-	YES	-	-	YES

Notes: table details refer to Table 2.

Table A.9: Robustness: Trade Shock and Business Activities (1990 Employment Weights)

	CHIP			CHNS		
	Extensive Margin		Intensive	Extensive Margin		Intensive
	(1) Logit (IV)	(2) Probit (IV)	(3) 2SLS	(4) Logit (IV)	(5) Probit (IV)	(6) 2SLS
$Export\ Shock_{rt} \times High_{irt}$	-0.683***	-0.264***	0.033***	-1.812***	-1.048***	0.375***
	(0.008)	(0.004)	(0.003)	(0.199)	(0.103)	(0.099)
$Export\ Shock_{rt} \times Middle/Low_{irt}$	-0.706***	-0.277***	0.030***	-1.900***	-1.103***	0.344***
	(0.009)	(0.004)	(0.002)	(0.153)	(0.073)	(0.108)
R-squared	-	-	0.856	-	-	0.759
Observations	10,859	10,859	490	2,549	2,549	804
Class FE	YES	YES	YES	YES	YES	YES
Region-Year FE	YES	YES	YES	YES	YES	YES

Notes: table details refer to Table 3.

Table A.10: Trade Shock and Household Polarization (1990 Employment Weights)

(A) Chinese Household Income Project (CHIP)	Population by Class			Income by Class		
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(1) 2SLS	(2) 2SLS	(3) 2SLS
$Export\ Shock_{ct} \times High\ Income\ Group$	0.011***	0.005	0.005*	0.014***	0.009**	0.010***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
$Export\ Shock_{ct} \times Middle\ Income\ Group$	-0.006***	-0.012**	-0.012**	-0.010***	-0.014***	-0.013***
	(0.002)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)
$Export\ Shock_{ct} \times Low\ Income\ Group$	0.016***	0.010***	0.011***	0.010**	0.006	0.007
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	204	204	204	204	204	204
R-squared	0.888	0.890	0.890	0.946	0.947	0.947
Class FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES
Year FE	-	YES	YES	-	YES	YES
City Controls	-	-	YES	-	-	YES
(B) China Household Nutrition Survey (CHNS)	Population by Class			Income by Class		
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(1) 2SLS	(2) 2SLS	(3) 2SLS
$Export\ Shock_{ct} \times High\ Income\ Group$	0.034**	0.039**	0.053	0.039***	0.042**	0.050
	(0.017)	(0.018)	(0.037)	(0.014)	(0.017)	(0.039)
$Export\ Shock_{ct} \times Middle\ Income\ Group$	-0.025**	-0.020*	-0.006	-0.047***	-0.044***	-0.036
	(0.011)	(0.011)	(0.025)	(0.014)	(0.012)	(0.027)
$Export\ Shock_{ct} \times Low\ Income\ Group$	0.037	0.042	0.056*	0.024	0.027	0.036
	(0.029)	(0.030)	(0.029)	(0.033)	(0.035)	(0.033)
Observations	81	81	81	81	81	81
R-squared	0.867	0.879	0.877	0.951	0.954	0.954
Class FE	YES	YES	YES	YES	YES	YES
Province FE	-	YES	YES	-	YES	YES
Year FE	-	-	YES	-	-	YES

Notes: table details refer to Table 4.

Table A.11: Robustness: Trade Shock and Business Activities

	Extensive Margin		Intensive Margin
	(1) Logit (IV)	(2) Probit (IV)	(3) 2SLS
(A) Robustness 1: Alternative Business Activity Criteria			
$Export\ Shock_{rt} \times High_{irt}$	-0.559***	-0.243***	0.414***
	(0.007)	(0.004)	(0.082)
$Export\ Shock_{rt} \times Middle/Low_{irt}$	-0.578***	-0.254***	0.408***
	(0.006)	(0.002)	(0.082)
R-squared	-	-	0.495
Observations	11,056	11,056	944
Class FE	YES	YES	YES
City-Year FE	YES	YES	YES
(B) Robustness 2: Alternative Household Class Criteria			
$Export\ Shock_{rt} \times High_{irt}$	-0.968***	-0.400***	0.029***
	(0.049)	(0.019)	(0.005)
$Export\ Shock_{rt} \times Middle/Low_{irt}$	-0.989***	-0.413***	0.033***
	(0.056)	(0.023)	(0.003)
R-squared	-	-	0.804
Observations	10,959	10,959	506
Class FE	YES	YES	YES
City-Year	YES	YES	YES

Notes: Regressions use Chinese Household Income Project (CHIP). Other table details refer to Table 3.

Table A.12: Robustness: Supply of Skills due to Selection Effect

	CHIP				ASIP	
	(1) Logit	(2) Logit	(3) Probit	(4) Probit	(5) FE	(6) FE
$College_{ict} \times Export\ Shock_{ct}^{Select}$	-0.005***	-0.006***	-0.005***	-0.006***	-0.006***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$College_{ict} \times Export\ Shock_{ct}^{Other}$	-0.005	-0.006	-0.006	-0.008	-0.008***	-0.008***
	(0.008)	(0.009)	(0.010)	(0.010)	(0.001)	(0.001)
Observations	13,342	13,342	13,342	13,342	18,544	18,544
R-squared	0.365	0.157	0.365	0.157	0.348	0.152
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
City-Year FE	-	YES	-	YES	-	YES

Notes: We add lagged employment shares for controlling industrial composition. Export shock uses instrument variable. Other table details refer to Table 6.