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Globalization and wage inequality: Evidence from urban China ☆

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ABSTRACT

This paper examines the impact of globalization on wage inequality using Chinese Urban Household Survey data from 1988 to 2008. Exploring two trade liberalization shocks, Deng Xiaoping's Southern Tour in 1992 and China's accession to the World Trade Organization (WTO) in 2001, we analyze whether regions more exposed to globalization experienced larger changes in wage inequality than less-exposed regions. Contrary to the predictions of the Heckscher–Ohlin model, we find that the WTO accession was significantly associated with rising wage inequality. We further show that both trade liberalizations contributed to within-region inequality by raising the returns to education (the returns to high school after 1992 and the returns to college after 2001).

1. Introduction

The traditional Heckscher–Ohlin model and its companion Stolper–Samuelson theorem predict that integration into the world economy increases the relative returns to unskilled labor in labor-abundant developing countries. Therefore, the skill premium and wage inequality should decrease when a developing country integrates into the world economy. Unfortunately, this prediction has not fared well empirically. Although many developing countries have been increasingly integrated into world markets, wage inequality has often risen (see Goldberg and Pavcnik, 2004, 2007). Prior studies have explored variations in trade policy across manufacturing sectors to empirically identify the relationship between globalization and wage inequality (e.g., Cragg and Epelbaum, 1996; Hanson and Harrison, 1999; Wei and Wu, 2001; Orazio et al., 2004; and Goldberg and Pavcnik, 2005). In general, these studies have found a small but positive association between trade and wage inequality in developing countries. Such evidence clearly contradicts the Stolper–Samuelson prediction.[1]

The present empirical paper contributes to the literature by examining the impact of two trade liberalization shocks, Deng Xiaoping's Southern Tour in 1992 and China's accession to the World Trade Organization (WTO) in 2001, on wage inequality in urban China. These two rounds of trade liberalization dramatically increased the openness of the Chinese economy. More importantly for our purposes, these trade liberalizations affected some parts of the country much more than others because Chinese regions vary in their exposure to international trade and foreign investment. Thus, we can identify the impact of trade liberalization on inequality using two sources of sample variation: the variation between high-exposure and low-exposure regions and the variation before and after the trade liberalization shocks. Specifically, we apply a difference-in-difference (DD) strategy that compares

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[1] To reconcile theory with evidence, several new theories have been proposed. One stream focuses on the demand factors that may affect the relationship between globalization and wage inequality in developing countries. Representative studies include Feenstra and Hanson (1997), Hsieh and Woo (2005), and Zhu and Trefler (2005). In particular, Feenstra and Hanson (1997) show that outsourcing in the form of capital flows from the North to the South shift up the relative demand for skilled labor, thus increasing the relative wage of skilled labor in both areas. The other stream emphasizes institutional factors such as rigidities in the labor market, which may distort the relationship between globalization and wage inequality in developing countries (e.g., Topalova (2010)).

the changes in wage inequality between high-exposure and low-exposure regions before and after the trade liberalization shocks. This methodology is similar to that in previous studies for other developing countries, such as Goldberg and Pavcnik (2005) on Colombia, Hanson (2007) and Verhoogen (2008) on Mexico, and Topalova (2010) on India. We apply this methodology to examine the impact of globalization on wage inequality in a large developing country (China).

Our empirical work exploits a comprehensive dataset, Chinese Urban Household Survey (UHS) data, for the unusually long period of 1988–2008. The micro-level data enable us to go beyond the DD method just described. First, we use quantile regressions to compare real wage growth at various quantiles. This is an improvement over studies that only explain changes in an inequality index such as the Gini coefficient. Second, the data allow us to control for skill and other individual features when investigating the impact of globalization on wage inequality. Third, we add to the literature by using the Juhn et al. (1993) decomposition of changes in the Chinese wage distribution in order to explore possible channels through which globalization has affected wage inequality in urban China.

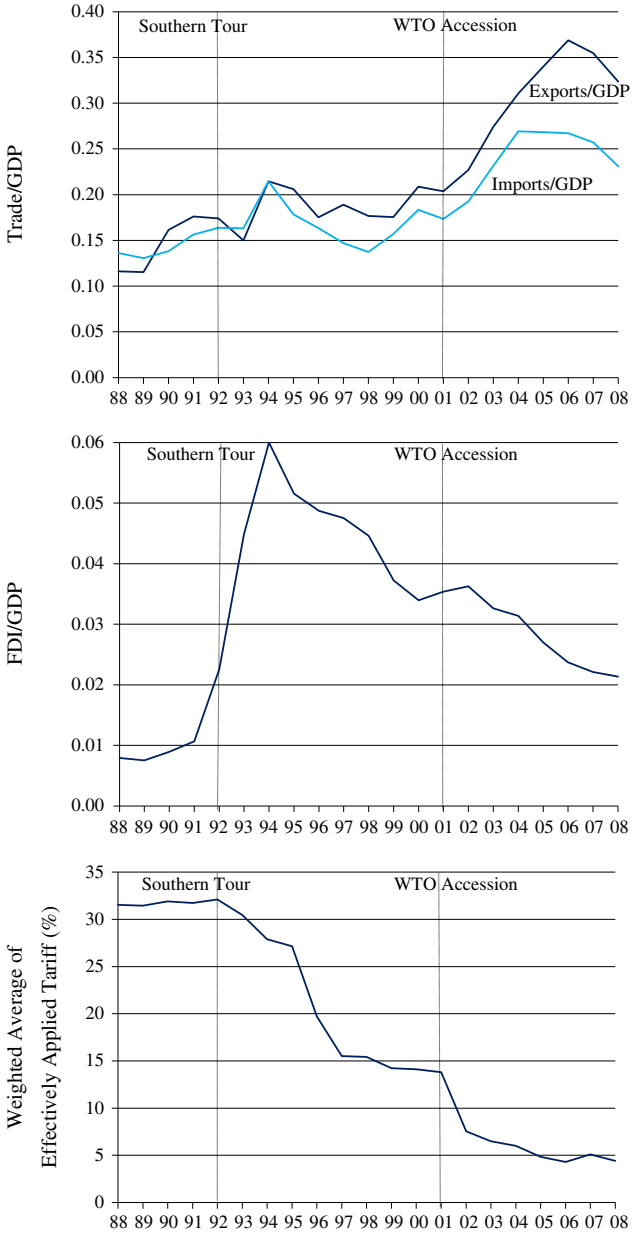
We find that wage inequality has been rising faster in exposed regions than in less-exposed regions of urban China. The WTO accession significantly contributed to widening wage inequality within exposed regions, particularly in the upper half of the wage distribution. Following Juhn et al. (1993), we decompose the changes in wage inequality in high-exposure and low-exposure regions. We show that rising returns to observed skills contributed substantially to rising wage inequality after the WTO accession. In contrast, rising wage inequality after the Southern Tour was driven by rising quantities and rising returns to unobserved skills. This is consistent with an institutional explanation featuring a transition from a communist wage-setting system to a market-oriented system as a result of the Southern Tour. We further show that trade liberalization contributed to within-region inequality by raising the returns to education (the returns to high school after 1992 and the returns to college after 2001). The increase in the skill premium was partially driven by the reallocation of labor to foreign sectors after trade liberalization but mostly by skill upgrading within state-owned enterprises (SOEs).

We structure the paper as follows. Section 2 describes the two trade liberalization shocks and discusses their different impacts on high-exposure and low-exposure regions in urban China. In Sections 3 and 4, we use the DD strategy to examine the impact of trade liberalization on wage inequality and the skill premium, respectively. Section 5 concludes.

2. Trade liberalization and regional exposure to globalization

In this paper, we explore two major shocks of trade liberalization to the Chinese economy since the "Reforming and Opening" program established by the Communist Party of China in 1978. The first trade liberalization shock is Deng Xiaoping's Southern Tour in the spring of 1992 (January 18–February 23). In the aftermath of the Tiananmen Square Protest in 1989, foreign loans to China were suspended and FDI commitments were canceled (Kelley and Shenkar, 1993). Within the Chinese government, some officials attempted to curtail the open market reforms that had been undertaken as part of the "Reforming and Opening" program. To reassert the "Reforming and Opening" agenda, Deng Xiaoping visited Guangzhou, Shenzhen, Zhuhai,[2] and Shanghai. During his Southern Tour, Deng Xiaoping delivered a series of speeches emphasizing the importance of "opening up" (Editorial Committee of the CPC Central Committee Literature, 1993). In response to Deng Xiaoping's authority and influence, central and local governments began to reduce the barriers to foreign trade and direct investment. Specific policies included establishing Pudong as a "New Open Economic Development Zone," offering tax incentives to foreign investors, reducing the administrative procedures for foreign investment projects, and providing favorable import and export policies to foreign firms (Montinola et al., 1995). As shown in Fig. 1, the Southern Tour significantly boosted foreign direct investment in China. At the same time, it moderately lowered the level of applied tariffs and increased the volume of trade.

The second trade liberalization shock we study is China's accession to the WTO on December 11, 2001. China committed to applying for the WTO membership in 1995. As a result, China has implemented tariff reductions and other trade liberalization measures to gain credibility among its negotiating partners. As indicated in Fig. 1, the



Notes: Trade and Tariff data are extracted from the UN Comtrade dataset and the TRAINS dataset provided by the World Integrated Trade Solutions (WITS). FDI data are from the Chinese Statistical Yearbooks. GDP data are extracted from the Penn World Table 7.0.

Fig. 1. Openness of the Chinese economy, 1988–2008.*Notes:* Trade and tariff data are extracted from the UN Comtrade dataset and the TRAINS dataset provided by the World Integrated Trade Solutions (WITS). FDI data are from the Chinese Statistical Yearbooks. GDP data are extracted from the Penn World Table 7.0.

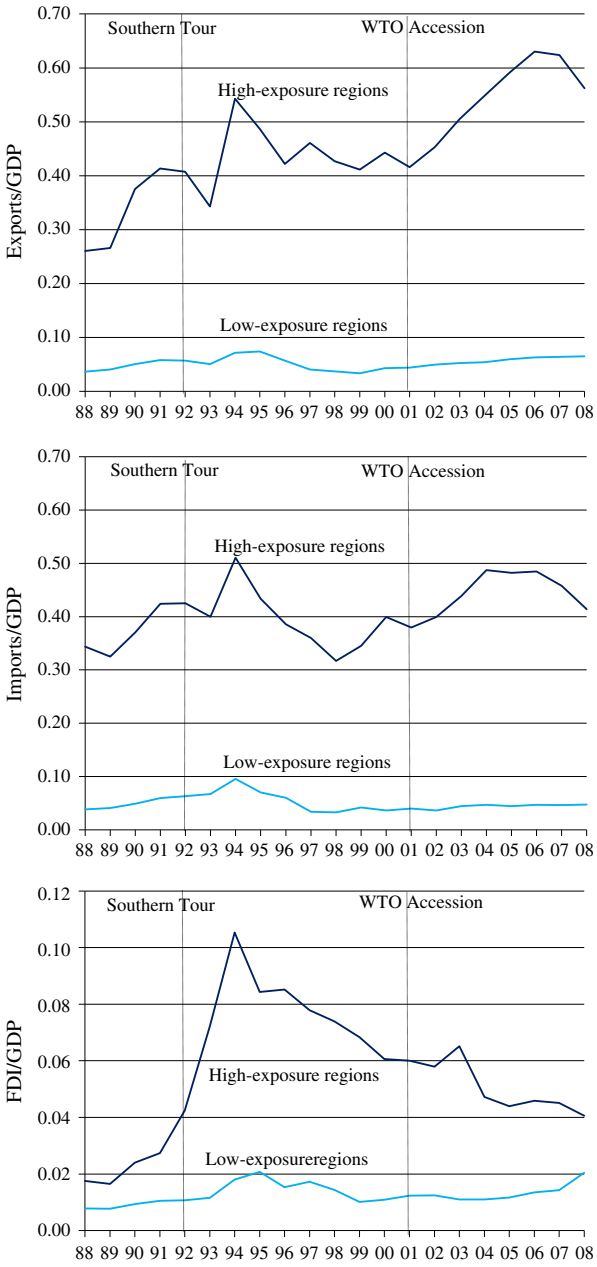
[2] All three cities are in Guangdong province.

average applied tariff began to dip significantly in 1995. After joining the WTO, China had to meet its commitments to the organization by further reducing trade and investment restrictions (Chen and Ravallion, 2003; Branstetter and Lardy, 2006). As shown in Fig. 1, the average tariff rate decreased significantly in 2001; since then, the volume of trade has increased to a higher level. In our baseline estimation, we use 1992 as the cut-off year for the Southern Tour and 2001 for the WTO accession.[3]

These two rounds of trade liberalization have dramatically increased the openness of the Chinese economy. More importantly, trade liberalization appears to have affected some parts of the country much more than others given their different degrees of exposure to trade and foreign investment. In our baseline regressions, we classify the Chinese regions into two categories: high-exposure and low-exposure regions based on their geographical distance to the coast.[4] Specifically, we classify Guangdong, Zhejiang, Liaoning, and Beijing as high-exposure regions and Sichuan and Shaanxi as low-exposure regions.[5] We use distance to classify high-exposure and low-exposure regions in China because regional openness in China is significantly related to a region's geographical distance to the coast.[6] Moreover, distance is likely to be exogenous to our interested labor market outcomes such as wage inequality and the skill premium (Wei and Wu, 2001). Fig. 2 shows the differential impact of trade liberalization on high-exposure and low-exposure regions. High-exposure regions always generate more trade and attract more FDI than low-exposure regions. Indeed, Deng Xiaoping's Southern Tour in 1992 and China's WTO accession in 2001 have shifted the percentage levels of exports, imports, and FDI over GDP in high-exposure regions to a greater level relative to that of low-exposure regions.

We explore the time variation arising from the two trade liberalizations and the regional variation arising from the differences in exposure to trade and foreign investments to identify the association between globalization and wage inequality. Our strategy shares most of the advantages of a standard DD strategy. It allows us to control for both region and year fixed effects, thereby allowing us to control for all time-invariant differences across regions and secular changes over time.

Our strategy also shares most of the disadvantages of a standard DD strategy. First, this strategy assumes that no other non-trade shocks occurred around the same time as trade liberalization that affected both high-exposure and low-exposure regions differently. We summarize the two major non-trade reforms during 1988–2008 as follows. One is the restructuring of SOEs, which happened around 1996 and in most cases involved their privatization to make this sector more efficient (Garnaut et al., 2004). The other is the Grand Western Development program implemented around 1999 and designed to help the development of western China (Naughton, 2004). These non-trade reforms could potentially have had a different impact on the earnings structure across regions. However, these non-trade shocks happened at distinctly different times as the trade liberalization shocks we examine. Therefore, our estimation captures the impact of trade liberalization rather than other non-trade reforms on the earning structure of urban China. Second, the standard DD strategy assumes the trends of wage inequality and the skill premium will be the same in both regions in the absence of trade liberalization. As pointed out by Angrist and Pischke (2008), "The common trends assumption can be investigated using data on multiple periods." We have about 20 years of individual data across different regions. Thus, we try our best to present the trends of earning structure across the regions to shed light on whether the deviation from the common trend is associated with trade liberalization.



Notes: GDP, trade, and FDI data are compiled from various series of Chinese Statistical Yearbooks and provincial Statistical Yearbooks.

Fig. 2. Differential impact of trade liberalization on high-exposure and low-exposure regions.*Notes:* GDP, trade, and FDI data are compiled from various series of Chinese Statistical Yearbooks and provincial Statistical Yearbooks.

[3] The definitions of the pre- and post-treatment periods are very important to our DD strategy. Therefore, we also use 1995 as an alternative cut-off year for the WTO accession to capture the early engagement of the Chinese government in applying for WTO membership. Noticing that trade liberalization occurred in stages over time, we also use the average tariff rate over the years as a continuous treatment variable in our empirical estimation to check the robustness of our baseline results.

[4] The definitions of the treatment and non-treatment groups are very important to our DD strategy. Therefore, we also use the log level of per capita trade as a continuous measure of potential exposure to international trade to check the robustness of our baseline results.

[5] We include five provinces (Guangdong, Zhejiang, Liaoning, Sichuan, and Shaanxi) and one municipality (Beijing) in the analysis due to the availability of the UHS data from the Chinese National Bureau of Statistics.

[6] Our online Appendix Table 1 shows the regional exposure to globalization based on various measures such as distance to the port, average value of FDI/exports/imports, average value of per capita FDI/exports/imports, and ratio of FDI/exports/imports over GDP. The table also indicates the significant correlation between distance to the port and other openness measures.

3. Trade liberalization and wage inequality

We use rich data from 21 consecutive annual Urban Household Surveys from 1988 to 2008 to create measures of wage inequality. The surveys are conducted by the Urban Survey Organization of the Chinese National Bureau of Statistics. The sample of households in UHS is drawn based on a stratified random sampling procedure to ensure the representativeness of all urban households in over 220 cities and towns of various sizes and regions in China.[7] We have access to all the household survey data for five provinces (Liaoning, Guangdong, Shaanxi, Sichuan, and Zhejiang) and one municipality (Beijing) for all the years between 1988 and 2008 from the Chinese National Bureau of Statistics.[8] There are about 222,000 individuals in our sample.

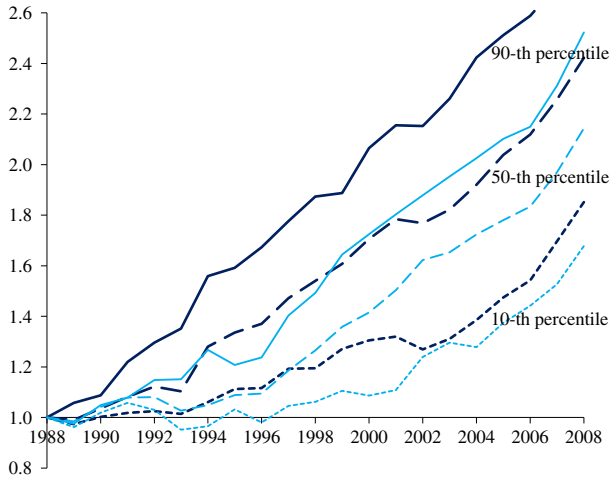
We restrict the sample to full-time employed individuals with labor earnings by excluding those who are part-time workers, such as students, the disabled, and re-employed retired workers. We further restrict the sample to workers between the ages of 18 and 60. Labor earnings in the UHS data include salaries, bonuses, and subsidies. We deflate all the labor earnings by the corresponding regional CPI (using 1988 as the base year) to measure the real labor income.[9]

3.1. Overview of wage inequality in urban China

Following Katz and Murphy (1992) and Juhn et al. (1993), we use the difference between the 90th and 10th percentile of the log wage distribution to measure the overall wage inequality. We also use the 90th–50th percentile wage gap to measure wage inequality in the upper half of the wage distribution and the 50th–10th percentile wage gap to measure wage inequality in the lower half of the wage distribution.

Fig. 3 illustrates the changes in the wage differentials in the high-exposure and low-exposure regions. We plot the indexed real wage of the 10th, 50th, and 90th percentiles in the high-exposure and low-exposure regions for 1988–2008 (1988 = 1). Real wages have risen faster for all three percentile groups in high-exposure regions than in low-exposure ones, resulting in rising inequality between regions. Within each region, the rate of real wage increases is much faster in the higher percentile than in the lower percentile, which indicates rising inequality within regions.

Fig. 4 shows that this rapid divergence in wages is pervasive across all wage percentiles. We plot the log real wage changes between 1988 and 2008 by percentile group for the high-exposure and low-exposure regions. As indicated, wage differentials between the regions have increased at all percentiles (with a larger divergence in the upper half of the distribution). Inequality has also risen greatly within each region.[10] However, it has grown faster in high-exposure regions than in low-exposure regions during 1988–2008.



Notes: Dark lines indicate high-exposure regions and light lines indicate low-exposure regions.

Fig. 3. Indexed real wage at the 90th, 50th and 10th quantiles in high-exposure and low-exposure regions.*Notes:* Dark lines indicate high-exposure regions and light lines indicate low-exposure regions.

3.2. Baseline and flexible estimates for wage inequality

We use quantile regression to examine whether trade liberalization has contributed to widening the wage gap in high-exposure regions relative to that in low-exposure regions. Our baseline specification for the quantile regression is as follows: [11]

$$\ln(w_{irt}) = \beta_0 + \beta_1 \cdot HighExposure_r \times SouthernTour_t + \beta_2 \cdot HighExposure_r \times WTO_t + \varphi X_{it} + \delta Y_{rt} + \lambda_r + \lambda_t + \varepsilon_{irt} \quad (1)$$

where $\ln(w_{irt})$ is the log level of real labor earnings. $HighExposure_r$ is a regional dummy indicating whether region r experiences high exposure to globalization. As described in Section 2, we define the coastal regions, including Guangdong, Zhejiang, Liaoning, and Beijing, as high-exposure regions and the inland regions, including Sichuan and Shaanxi, as low-exposure regions in our baseline estimation. To increase the precision of our estimation, we pool all years together to run a regression with two trade liberalization dummies. $SouthernTour_t$ is a period dummy variable indicating the years after the Southern Tour (i.e., after 1992). WTO_t is a period dummy indicating the years after the WTO accession (i.e., after 2001). To test the robustness of our baseline results, we also experiment with an alternative exposure measure (the average log level of per capita trade for each region), an alternative definition of the treatment variable (1995 as the cut-off year for WTO accession), and a continuous treatment variable (the yearly average tariff rate) in our estimation.

In the regression, we control for a vector of observed individual characteristics including years of schooling, experience, experience square, and a dummy variable for male.[12] To control for other provincial characteristics that could possibly result in the differential growth of real wages before and after trade liberalization, we control for the interaction of initial provincial GDP with the two trade liberalization dummies. We further use province fixed effects λ_r to control for time-invariant provincial characteristics and year fixed effects λ_t to control for secular shocks in each year. Lastly, we cluster the standard

[7] Although the UHS data are likely to be the most comprehensive to examine income inequality in urban China (Fang et al., 2002), they have one limitation: the survey does not cover the floating population (migrants not listed in the urban household registry, known in Chinese as *hu kou*). The exclusion of migrants in the UHS data may underestimate the wage inequality in urban China because the earnings of these migrants are often concentrated at the lower tail of the wage distribution (Li, 2001).

[8] Note that the six provinces/municipalities covered in our analysis are representative of China's different regions. Beijing is a rapidly growing municipality in north-central China, and Guangdong and Zhejiang are dynamic economic provinces in the southern coastal region. Liaoning is a northeast province with many heavy industries. Shaanxi and Sichuan are less developed provinces in the northwest and southwest of China, respectively.

[9] Online Appendix Table 2 presents the summarized statistics of the sample.

[10] Another interesting finding is that the wage gaps in the upper and lower halves of the wage distributions contribute almost equally to the overall increasing wage inequality in both regions. However, in the US and India, the increasing wage inequality is mostly concentrated in the top-end of the wage distribution during the 1990s (Kijima, 2006, Lemieux, 2008).

[11] In a wage equation setting, we can write the standard quantile regression model as $\ln w_i = x_i\beta_\theta + \varepsilon_{\theta i}$ with $Quant_\theta(\ln w_i|x_i) = x_i\beta_\theta$. Compared to the OLS regression at the mean, the advantage of quantile regression is that it can offer a full characterization of the conditional distribution of wages. See a summary in Koenker and Hallock (2001) and its application to the wage setting in Buchinsky (1994).

[12] We calculate the experience as age minus years of schooling minus six.

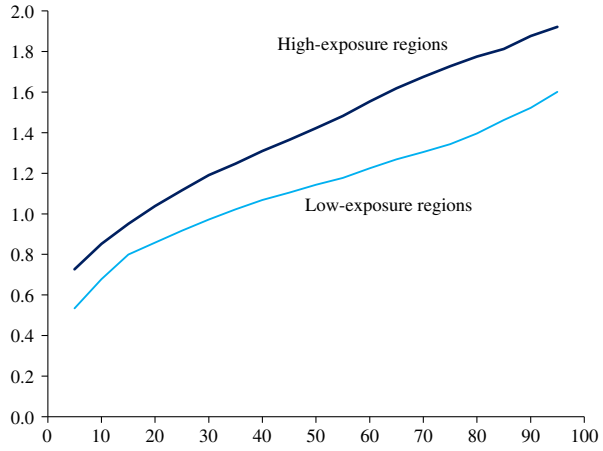


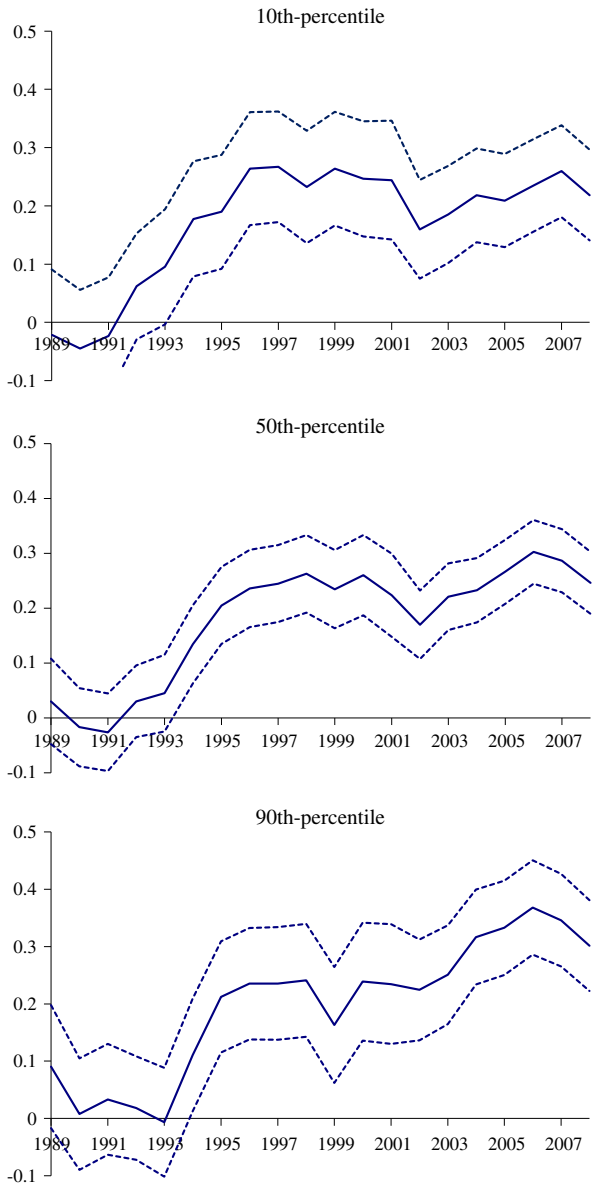
Fig. 4. Change in log real wage by percentile, 1988–2008.

errors at the province-year level to adjust for the correlation within each group.

The focus of our DD strategy is the coefficients of the two interaction terms in the regression: β_1 and β_2. In quantile regression, these coefficients capture the impact of trade liberalization on the entire conditional wage distribution in high-exposure regions relative to low-exposure regions. On the one hand, estimations of β_1 and β_2 at different quantiles show whether globalization contributes to the higher real wage growth in high-exposure regions relative to low-exposure regions, that is, the growing wage inequality between regions. On the other hand, we compare the estimates β_1 and β_2 across the different conditional quantiles to examine whether globalization contributes to the rising wage inequality in high-exposure regions.

Before we present the estimation results of Regression (1), we first present evidence on the timing effects of trade liberalization on different wage quantiles. We augment Regression (1) by replacing the trade liberalization dummies $SouthernTour_t$ and WTO_t with a vector of year dummies λ_t, indicating the years from 1989 to 2008 (1988 is the reference year). In doing so, we impose little structure on the data and simply examine how the difference in real wages between high-exposure and low-exposure regions varies over time at different quantiles. If real wages in high-exposure regions increase significantly after the Southern Tour or the WTO accession, we expect to see β_1 shift up significantly after 1992 or 2001 (compared with β_1 before 1992 or 2001) in each quantile. Furthermore, by comparing β_1 across different quantiles, i.e., across the 90th and 10th quantiles, we can show if the within-region wage inequality has widened in exposed regions after trade liberalization. We plot the estimated coefficients of the interaction $HighExposure_r \times \lambda_t$ and their 95% confidence intervals in Fig. 5.[13] For all three wage quantiles, Fig. 5 shows that prior to 1992, there is almost no difference in the wage growth trend between high-exposure and low-exposure regions. However, after the 1992 Southern Tour and the 2001 WTO accession, there is a significantly positive and monotonically increasing effect on all wage quantiles. Moreover, the estimated coefficient is significantly bigger for higher quantiles after 2001.

Table 1 presents the quantile results of Regression (1) for the 10th, 50th, and 90th quantiles. We present our baseline estimations in Columns (1)–(3) of Table 1. The impacts of the Southern Tour on real wages are significantly positive in all three quantiles. The real wages at the 10th, 50th, and 90th percentiles increase by 22%, 20%, and 16% more in high-exposure regions after the Southern Tour than those in low-exposure regions, respectively. This indicates that the Southern Tour has widened the between-region inequality. However,



Notes: Each figure presents the estimated coefficients of the interaction terms between high-exposure dummy and year dummies and their 95% confidence intervals at different quantiles.

Fig. 5. Flexible estimates of the relationship between globalization and wage inequality.*Notes:* Each figure presents the estimated coefficients of the interaction terms between high-exposure dummy and year dummies and their 95% confidence intervals at different quantiles.

the lower increasing rate of real wages at the higher percentiles implies that the rising within-region wage inequality in high-exposure regions is not associated with the Southern Tour. In contrast, the impacts of WTO membership on real wage are insignificant at the 10th quantile but significantly positive at the 50th and 90th quantiles by 6% and 13%, respectively. The estimated coefficients are significantly larger at the 90th quantile than at the 50th quantile,[14] indicating that the rising between-region inequality is associated with the WTO accession. It also indicates that the within-region wage inequality, especially the widened gap in the upper half of the wage distribution in high-exposure regions, is associated with the WTO accession.

[13] We present the regression results in online Appendix Table 3.

[14] The tests of equalization of coefficients show a significant difference between the 10th and 50th quantiles and between the 50th and 90th quantiles.

Table 1
Globalization and wage inequality—quantile regression results.

	Baseline			Alternative exposure measure: Using provincial per capita trade			Alternative treatment period: Using yearly average tariff rate			Continuous treatment variable: Using yearly average tariff rate		
	10th-percentile	50th-percentile	90th-percentile	10th-percentile	50th-percentile	90th-percentile	10th-percentile	50th-percentile	90th-percentile	10th-percentile	50th-percentile	90th-percentile
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Globalization variables	*HighExposure × SouthernTour*			*Trade × SouthernTour*			*HighExposure × SouthernTour*					
	0.220**	0.202**	0.164**	0.089**	0.094**	0.080**	0.157**	0.134*	0.091			
	(0.055)	(0.055)	(0.036)	(0.012)	(0.022)	(0.014)	(0.035)	(0.060)	(0.073)			
	HighExposure × WTO			*Trade × WTO*			*HighExposure × preWTO*			*HighExposure × Tariff*		
	0.005	0.058**	0.126**	−0.003	0.007**	0.026*	0.075*	0.122*	0.181**	−0.007**	−0.009**	−0.011*
	(0.024)	(0.020)	(0.038)	(0.008)	(0.002)	(0.011)	(0.031)	(0.060)	(0.033)	(0.0014)	(0.0032)	(0.0043)
Schooling	0.070**	0.083**	0.076**	0.069**	0.083**	0.076**	0.070**	0.083**	0.076**	0.070**	0.083**	0.076**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.005)	(0.003)
Experience	0.033**	0.029**	0.024**	0.032**	0.029**	0.023**	0.032**	0.029**	0.024**	0.032**	0.030**	0.024**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Experience2	−0.001**	−0.0008**	−0.0006**	−0.001**	−0.0008**	−0.0006**	−0.001**	−0.0008**	−0.0006**	−0.001**	−0.0008**	−0.0006**
	(0.00002)	(0.00003)	(0.00003)	(0.00002)	(0.00003)	(0.00003)	(0.00004)	(0.00004)	(0.00003)	(0.00003)	(0.00002)	(0.00003)
Male	0.206**	0.199**	0.172**	0.204**	0.199**	0.172**	0.204**	0.198**	0.172**	0.205**	0.198**	0.171**
	(0.003)	(0.003)	(0.003)	(0.016)	(0.011)	(0.010)	(0.014)	(0.016)	(0.008)	(0.015)	(0.019)	(0.016)
Observations	222,859	222,859	222,859	222,859	222,859	222,859	222,859	222,859	222,859	222,859	222,859	222,859
R2/pseudo R2	0.23	0.36	0.40	0.24	0.36	0.40	0.21	0.36	0.40	0.23	0.36	0.40
Test for equality[a]	b50 = b10	b90 = b50	b90 = b10	b50 = b10	b90 = b50	b90 = b10	b50 = b10	b90 = b50	b90 = b10	b50 = b10	b90 = b50	b90 = b10
Southern Tour	−0.0181*	−0.0379**	−0.056**	0.005	−0.014**	−0.009**	−0.023*	−0.0429**	−0.066**			
	(0.009)	(0.007)	(0.006)	(0.003)	(0.002)	(0.002)	(0.012)	(0.009)	(0.008)			
WTO	0.052**	0.068**	0.120**	0.010**	0.019**	0.029**	0.048**	0.059**	0.106**	−0.0023**	−0.0022**	−0.0022**
	(0.006)	(0.006)	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)	(0.008)	(0.006)	(0.0002)	(0.0002)	(0.0002)

Notes: The dependent variable is log annual earnings. All regressions include year fixed effects and province fixed effects. All regressions also control for the two-way interaction variables between ln(initial GDP) and dummies for Southern Tour and WTO. Quantile regression coefficients are reported with robust standard errors, clustered at the province-year level, in the parentheses.

** Denotes significance at 1% level.

* Denotes significance at 5% level.

[a] *t*-test for the equality of the estimated coefficients between different quantiles with robust standard errors in the parentheses.

In Columns (4)–(6) of Table 1, we use the log level of average per capita trade as an alternative definition of regional exposure. We obtain similar findings that the Southern Tour does not relate to the widening wage gap in high-exposure regions. However, the WTO accession significantly widens the wage inequality in the upper half of the wage distribution. In Columns (7)–(9), we use 1995 as the cut-off year for WTO instead of 2001. We find that the WTO accession is now associated with overall wage inequality and wage inequality in the lower and upper half of the wage distribution. Lastly, we use the average tariff rate at each year as a continuous treatment variable to replace the dummy variables for trade liberalization. We report the results in Columns (10)–(12). As a lower tariff rate is associated with higher globalization, we find that the globalization coefficients are negative at each percentile and become smaller for the higher percentiles. Thus, we confirm our finding that trade liberalization contributes to wage inequality in the high-exposure regions of urban China.[15]

We have run quantile regressions at the individual level to show the impact of trade liberalization on within-region inequality by comparing the estimates at different wage quantiles. An alternative strategy is to calculate the measures of wage inequality at the city level and use city-year as the unit of analysis (e.g., Topalova (2010)). We present the city-level results in online Appendix Table 5. The results confirm the role of the WTO accession in driving the rising wage inequality in exposed regions, particularly the rising 90th–50th log wage differential.

3.3. Decomposing changes in wage inequality

In this section, we decompose the changes in wage inequality in the high-exposure and low-exposure regions to understand the sources of the changes in wage distribution. In particular, we apply the decomposition method introduced in an influential paper by Juhn et al. (1993). We can use their technique to decompose the changes in wage distribution into three components: changes in observable quantities of labor market skills, changes in observable prices of labor market skills, and changes in the unobservables (i.e., changes in unmeasured prices and quantities).[16]

Panel A of Fig. 6 shows the actual changes in the 90th–10th log wage differential in high-exposure and low-exposure regions (1988 is the reference year). Overall wage inequality clearly keeps increasing in both high-exposure and low-exposure regions and rises faster in exposed regions. During 1988–2008, the 90th–10th log wage differential increases by 103% in high-exposure regions and 84% in low-exposure regions. Panel B indicates that changes in the distribution of observable characteristics (i.e., education and experience) only have minimal impact on the changes of overall wage inequality in both high-exposure and low-exposure regions. Panel C presents the contribution of changes in observable prices (i.e., changes in the returns to education and experience) to changes in overall inequality. As indicated in the figure, the change in observable prices has a sizable effect on wage inequality. It increases the 90th–10th log wage

[15] We also use the distance to the coast as a measure of exposure and present the robustness results in online Appendix Table 4. The results are again similar to our baseline results.

[16] When decomposing changes in wage distribution, we use 1988 as the benchmark year. The Mincerian wage regressions used to construct the hypothetical wage distributions include years of schooling, experience, experience square, and an indicator variable for female. See Juhn et al. (1993) for more details of the decomposition technique.

Notes: Dark lines indicate high-exposure regions. Light lines indicate low-exposure regions.

Fig. 6. Decomposing the 90th–10th log wage differential.*Notes*: Dark lines indicate high-exposure regions. Light lines indicate low-exposure regions.

differential in high-exposure regions by 38% and in low-exposure regions by 28% from 1988 to 2008. Panel D presents the contribution of changes in unobserved residuals. As the figure shows, unobservables contribute significantly to the changes of overall wage inequality in both high-exposure and low-exposure regions. The change in unobservables increases the 90th–10th log wage differential in high-exposure regions by 65% and by 60% in low-exposure regions. These findings are quite similar to those in Juhn et al. (1993), where they decompose wage inequality in the US and find that observed skill prices and unobservables contribute significantly to the US wage inequality.

Let us now turn to the comparison of the decomposition results across high-exposure and low-exposure regions around the two rounds of trade liberalization. Comparing the contribution of the three components around the 1992 Southern Tour, we find that the rise of unobservable skills drives almost all the changes of wage inequality. This finding is different from that in Kijima (2006), who decomposes wage inequality in urban India in the 1990s and finds that the rise in returns to observed skills is the major contributor to the increase in wage inequality. To understand our finding, one needs to consider the institutional context around the Southern Tour. Before the Southern Tour, wage setting in the Chinese labor market was still centralized, and thus a worker's ability (especially unobservable skills) was largely ignored. To a large extent, Deng Xiaoping's Southern Tour has stimulated the economic environment and brought about wage decentralization (Han, 2006). Workers' unobserved cognitive and non-cognitive abilities are now rewarded in the new environment and rewarded most in exposed regions.

Comparing the decomposition results around the WTO accession, we find that the role of the rising prices for observed skills (such as education and experience) becomes more prominent even though the quantity of and returns to unobservables are still the most significant contributors to changes in wage inequality. Compared to low-exposure regions, the prices for observed skills in high-exposure regions rise considerably after the 2001 WTO accession and become one main driver for the faster growth of wage inequality in high-exposure regions. In the following section, we examine in detail the rising role of skill prices in driving within-region wage inequality and its association with trade liberalization.

4. Trade liberalization and the skill premium

Since Feenstra and Hanson (1997), there has been intense interest in the issue of whether trade raises within-region inequality by increasing returns to education. The above decomposition results of wage inequality have shown some preliminary suggestive evidence. In this section, we use regression analysis to specifically examine whether trade liberalization has raised the skill premium.

4.1. Overview of the skill premium in urban China

Following the literature (see Goldberg and Pavcnik, 2007), we use the return to education to measure the skill premium in urban

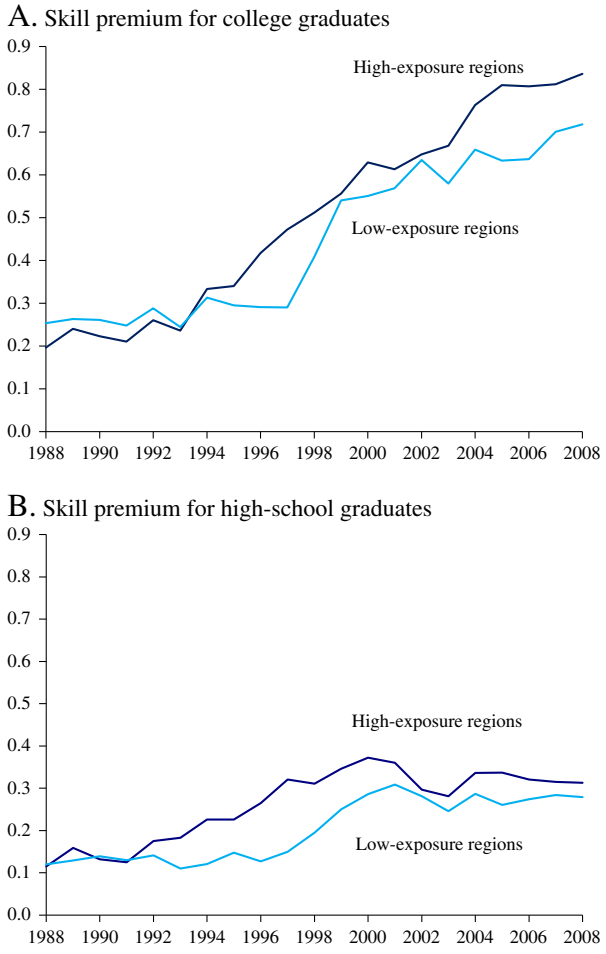


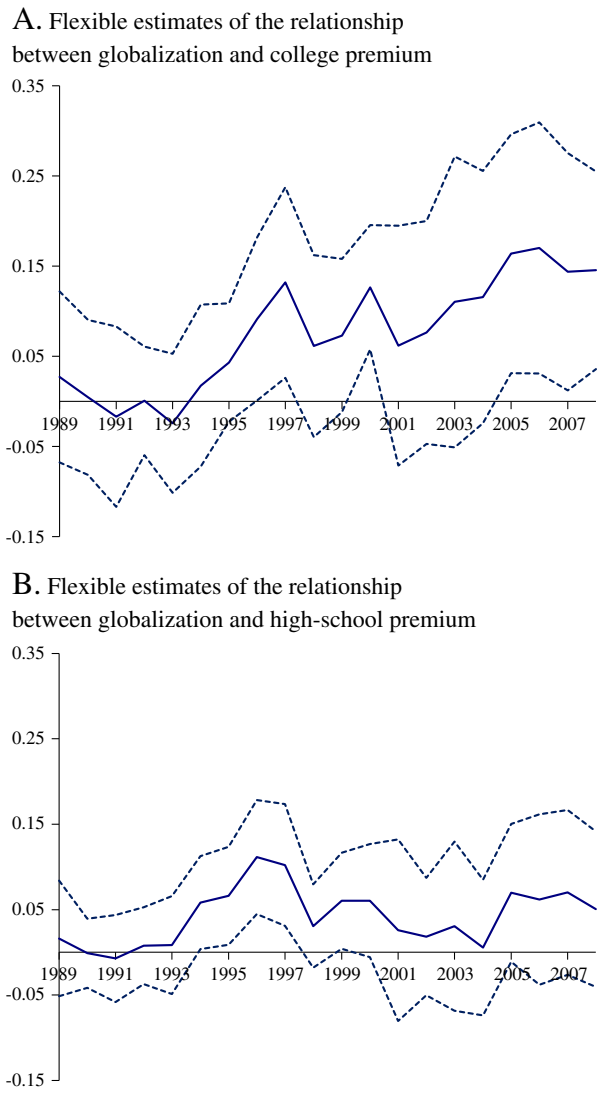
Fig. 7. A: Skill premium for college graduates.B: Skill premium for high-school graduates.

China.[17] Fig. 7 plots the skill premium for college graduates and high school graduates in high-exposure and low-exposure regions for the period of 1988–2008.[18]

Fig. 7 shows that the skill premium for college graduates is quite similar between high-exposure and low-exposure regions before 1992. Since the 1992 Southern Tour, the college premium has risen faster in high-exposure regions than in low-exposure ones. The college premium in high-exposure regions has risen relatively faster again after the 2001 WTO accession. Fig. 7B presents the pattern for the high school premium. The high school premium is quite similar in both regions before 1992. The high school premium in high-exposure regions has risen after 1992 compared with a stable high school premium in low-exposure regions. Around 2001, the high school premium in low-exposure regions has caught up and moved quite close to the level of high-exposure regions.

[17] We present the skill premium as both the return to high school education and the return to college education. However, we focus our analysis on the return to college education because it is the focus of the skill premium literature (see Katz and Autor, 1999 for a survey).

[18] Returns to college and high school education are the coefficients of the college and high school dummies in the standard Mincerian regressions of log annual wages. In the Mincerian regressions, the college dummy equals one if the worker completes college and zero otherwise; the high school dummy equals one if the worker completes high school and zero otherwise. The reference group is the high school dropouts. Other independent variables include experience, experience square, and a dummy for male workers.



Notes: Figure 8A presents the estimated coefficients of the interaction term between college dummy, high-exposure dummy and year dummies and their 95% confidence intervals. Figure 8B presents the estimated coefficients of the interaction term between high-school dummy, high-exposure dummy and year dummies and their 95% confidence intervals.

Fig. 8. A: Flexible estimates of the relationship between globalization and college premium. B: Flexible estimates of the relationship between globalization and high-school premium.*Notes:* Figure8A presents the estimated coefficients of the interaction term between college dummy, high-exposure dummy and year dummies and their 95%confidence intervals. Figure8B: presents the estimated coefficients of the interaction term between high-school dummy, high-exposure dummy and year dummies and their 95% confidence intervals.

4.2. Baseline and flexible estimates for the skill premium

We use the differences-in-differences-in-differences (DDD) regression to examine whether trade liberalization contributes to the higher skill premium in exposed regions. The regression is as follows:

$$\begin{aligned}\ln(w_{irt}) = {} & \beta_0 + \beta_1 \cdot Education_i \times HighExposure_r \times SouthernTour_t \\ & + \beta_2 \cdot Education_i \times HighExposure_r \times WTO_t \\ & + \beta_3 \cdot Education_i \times SouthernTour_t + \beta_4 \cdot Education_i \times WTO_t \\ & + \beta_5 \cdot HighExposure_r \times SouthernTour_t + \beta_6 \cdot HighExposure_r \times WTO_t \\ & + \beta_7 \cdot Education_i \times HighExposure_r + \varphi X_{it} + \delta Y_{rt} + \lambda_r + \lambda_t + \varepsilon_{irt}\end{aligned} \quad (2)$$

where all variables are similar to those in Regression (1) except that $Education_i$ is a vector of two education dummies: one indicates college graduates and the other indicates high school graduates. Our

Table 2
Globalization and skill premium—OLS regression results.

	Baseline	Alternative exposure measure:	Alternative treatment period:	Continuous treatment variable:
		Using provincial per capita trade	Using 1995 as WTO cut-off year	Using yearly average tariff rate
	(1)	(2)	(3)	(4)
Globalization variables	*College* × *HighExposure* × *SouthernTour*	*College* × *Trade* × *SouthernTour*	*College* × *HighExposure* × *SouthernTour*	
	0.067	0.026**	0.015	
	(0.043)	(0.008)	(0.031)	
	HS × *HighExposure* × *SouthernTour*	*HS* × *Trade* × *SouthernTour*	*HS* × *HighExposure* × *SouthernTour*	
	0.054**	0.012*	0.044**	
	(0.009)	(0.006)	(0.007)	
	College × *HighExposure* × *WTO*	*College* × *Trade* × *WTO*	*College* × *HighExposure* × *preWTO*	*College* × *HighExposure* × *Tariff*
	0.075*	0.028**	0.135*	−0.005*
	(0.035)	(0.008)	(0.050)	(0.002)
	HS × *HighExposure* × *WTO*	*HS* × *Trade* × *WTO*	*HS* × *HighExposure* × *preWTO*	*HS* × *HighExposure* × *Tariff*
	−0.013	0.001	0.002	−0.001
	(0.018)	(0.010)	(0.025)	(0.001)
Observations	222,859	222,859	222,859	222,859
R-squared	0.56	0.56	0.56	0.56

Notes: The dependent variable is log annual earnings. All regressions include year fixed effects, province fixed effects, individual characteristics, and all the two-way interaction variables among college/high school dummies, high exposure dummy and Southern Tour/WTO dummies. All regressions also control for the two-way and three-way interaction variables among ln(initial GDP), college/high school dummies and Southern Tour/WTO dummies. OLS coefficients are reported with robust standard errors, clustered at province-year level, in the parentheses.
** Denotes significance at 1% level.
* Denotes significance at 5% level.

coefficients of interest are β_1 and β_2, the coefficients of the third-level interaction $Education_i \times HighExposure_r \times SouthernTour_t$ and $Education_i \times HighExposure_r \times WTO_t$. They capture the changes in the college or high school premium in high-exposure regions (relative to low-exposure regions) in the years after trade liberalization (relative to the years before trade liberalization). If the coefficients are significantly positive, more exposed regions experience a greater increase in the college or high school premium after trade liberalization.

Before we present the estimation results of baseline Regression (2), we use a flexible regression to present evidence on the timing effects of trade liberalization on the skill premium. To achieve this, we augment Regression (2) by replacing the period dummy $SouthernTour_t$ and WTO_t with a vector of year dummies λ_t indicating the period of 1989–2008 (1988 is the reference year). We plot the vector of the estimated coefficients of the interaction $Education_i \times HighExposure_r \times \lambda_t$ and their 95% confidence intervals in Fig. 8.[19] Fig. 8 shows that prior to 1992, there are no differentials in the college premium trend between high-exposure and low-exposure regions. After the Southern Tour, there is a significantly positive and monotonically increasing effect on the college skill premium. This pattern reappears after the 2001 WTO accession. However, the high school premium in high-exposure regions only experiences a short-period increase after 1992 relative to that of low-exposure regions and then goes back to the same level as low-exposure regions.

Let us now turn to the baseline results of Regression (2) presented in Column (1) of Table 2. We find that the estimate of β_1 is significantly positive for the high school premium but not for the college premium. This indicates that the Southern Tour significantly increases the high school premium in high-exposure regions but has no differential impact on the college premium across regions. The high school premium increases by 5% in high-exposure regions relative to that in low-exposure regions after the Southern Tour. The estimate of β_2 is significant for the college premium but not for the high school premium, indicating that the WTO accession has contributed to the rising college premium in exposed regions. WTO accession increases the college premium in the high-exposure regions by about 8% relative to the low-exposure regions.

In Columns (2)–(4), we check the robustness of our baseline estimation using the alternative definition of trade exposure, the alternative definition of treatment period, and the tariff rate as a continuous treatment measure. The results confirm our findings in the baseline regressions. We further provide the results of a city-level analysis of the skill premium in online Appendix Table 5. We estimate a standard DD specification with city-year as the unit of analysis. Trade liberalization has raised within-region inequality by raising the returns to education. Specifically, the Southern Tour has raised the high school premium and the WTO accession has raised the college premium in the more exposed regions. To some extent, this differential impact indicates that the demand has moved up for workers with higher education as China becomes more integrated with the rest of the world.

4.3. Decomposing the relative demand for skilled workers

The above results indicate that trade liberalization is significantly associated with the rising skill premium in urban China. Given that the relative supply of college graduates also increases during the examined period (Han, 2006), the rising skill premium must be induced by the significant demand shift toward skilled labor with college degrees (Katz and Murphy, 1992; Berman et al.,1994; Katz and Autor, 1999). Indeed, there is substantial skill upgrading in both high-exposure and low-exposure regions: the proportion of college graduates in the labor force has increased by 31% and 27% between 1988 and 2008, respectively. The trend is aligned with similar trends in other developing countries such as India (Kijima, 2006) and Colombia (Orazio et al., 2004). In this section, we decompose the rising relative demand for college graduates to provide evidence on the channels through which trade liberalization affects the relative demand for college graduates and thus the skill premium.

We decompose the change in the relative demand for college graduates (i.e., the change in the share of college graduates) into "between changes" due to the reallocation of workers toward sectors that demand more skilled workers and "within changes" due to skill upgrading within sectors. We present the decomposition results in online Appendix Table 7.[20] Given that the foreign sector is more skilled-labor-intensive than other sectors (Han, 2006), the expansion of the foreign sector will increase the aggregate relative demand for

[19] We present the regression results in online Appendix Table 6.

[20] Specifically, we decompose the aggregate changes in relative demand for college graduates between 1989 and 1996 (four years before and four years after the Southern Tour) and between 1998 and 2005 (four years before and four years after the WTO accession) into four different ownership sectors (i.e., SOEs, collective-owned enterprises, foreign investors, and private-owned enterprises). We use the 1992 information to interpolate sector information in 1989 because the information for each ownership sector is only available beginning in 1992.

skilled workers. The decomposition results show that reallocation to the foreign sector contributes to 17% and 28% of the overall changes in relative demand for skilled labor in high-exposure regions after the Southern Tour and the WTO accession, respectively. Comparably, in low-exposure regions, we observe a smaller contribution of reallocation to the foreign sector to the overall rising skill demand. This comparison indicates that the huge increase in foreign investment in exposed regions after trade liberalization contributes to the rising skill demand and the skill premium by inducing labor reallocation among different ownership sectors. However, we find that the skill upgrading within SOEs contributes the most to the overall change in relative demand for skills: about 54% of the overall changes during the Southern Tour and about 102% of the overall changes during the WTO accession. This is related to the privatization of SOEs in the early 1990s and the structural change in SOEs in the late 1990s (Editorial Committee of the CPC Central Committee Literature, 1993).

The link between foreign investment and the skill premium has been addressed in previous literature. For example, Feenstra and Hanson (1997) find that the growth of FDI in Mexico is positively correlated with the relative demand for skilled labor and that growth in FDI in high-exposure Mexican regions can account for more than 50% of the increase in skilled labor wage share in the late 1980s. We confirm the role of foreign investment in the rising relative demand for skill in urban China.[21]

5. Conclusion

Using the Chinese Urban Household Survey data for 1988–2008, we examine the impact of globalization on wage inequality for a large developing country (China). Exploring the differential impact of two major trade liberalization shocks (the 1992 Southern Tour and the 2001 WTO accession), we analyze whether regions more exposed to globalization experienced larger changes in wage inequality relative to regions less exposed to globalization.

Two main findings emerge. First, we find that China's WTO accession contributed to rising within-region wage inequality in exposed regions by causing relatively faster real wage growth at higher quantiles of the wage distribution. By decomposing the changes in wage inequality, we show that rising returns to observed skills contributed substantially to rising wage inequality after the WTO accession. In contrast, unobserved skills have contributed considerably to rising wage inequality after the Southern Tour. Second, we find that trade liberalization raised within-region inequality by raising the returns to education. Specifically, the WTO accession raised the college premium and the Southern Tour raised the high school premium in exposed regions of urban China. This increase in the skill premium was partially driven by the reallocation of labor to the foreign sector after trade liberalization but mostly by skill upgrading within SOEs.

Income inequality has become the most challenging problem confronting China nowadays. The present paper shows that workers in the different quantiles of wage distribution in urban China experience different effects of trade liberalization. In particular, workers in the higher quantiles of wage distribution benefit more from globalization than do workers in the lower tails of the wage distribution. This results in widening wage inequality among workers in urban China. With the continuing trend of globalization, more policies seem necessary to redistribute the gains of liberalization while the overall Chinese economy reaps the efficiency gains.

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:10.1016/j.jinteco.2011.12.006.

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