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World Development Vol. 44, pp. 256–266, 2013

0305-750X/$ - see front matter

http://dx.doi.org/10.1016/j.worlddev.2012.11.007

Globalization and Gender Wage Inequality in China

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Summary. — This paper uses an enterprise-population-level dataset to investigate the link between globalization and gender inequality in the Chinese labor market. We find that foreign and exporting firms employ more female workers than domestic nonexporters. Foreign participation and export orientation within the same region and industry significantly encourage female employment and reduce the gender wage gap. Furthermore, we show that while a large gender wage gap exists for foreign and exporting firms, it mainly reflects the difference in gender productivity. Gender wage discrimination is observed only among private nonexporting firms. Overall, our results highlight the importance of globalization in encouraging female employment and reducing gender discrimination.

Key words — globalization, gender wage inequality, Asian, China

1. INTRODUCTION

The gender wage gap is significant and pervasive in many countries despite substantial advances in women's education and participation in the labor market. Globalization is widely considered one of the most important driving forces of economic growth and social change; as such, its effect on gender wage inequality has been thoroughly deliberated by academic researchers and policymakers.

Previous studies have identified several channels through which globalization may affect gender inequality in the labor market. First, globalization provides women with more employment opportunities, especially in developing countries. As many transition economies open up to international trade and foreign direct investment (FDI), cheap female labor results in a dramatic increase in the number of women employed by foreign-invested and export-oriented industries (Cagatay & Berik, 1991; Joekes, 1995; Ozler, 2000; Standing, 1999; Wood, 1991). Globalization has both inter-industry and intra-industry effects, and may shift industry structures to favor sectors in which women have been traditionally employed (Wood, 1991). It may also increase female labor demand through the substitution of "cheap" female labor for male labor within an industry (Standing, 1989, 1999). However, Joekes (1995) argues that the movement toward or away from feminization of the labor force is not uniform across countries. Given the gender gap in education and on-the-job training, the trend of feminizing manufacturing employment may be reversed as production moves up the skill ladder in the later stages of export promotion (Fussell, 2000; Ghosh, 2001; Joekes, 1995, 1999).

Expanding female employment may not necessarily reduce the gender wage gap. Neoclassical trade theory predicts that trade will benefit the abundant factors of production. Therefore, assuming unskilled female labor is abundant, a great demand for less skilled labor may increase women's wages and reduce the gender wage gap. However, globalization may induce large influxes of women away from the household or unpaid work to foreign-invested and export-oriented industries, leading to a female labor surplus and widening the gender wage gap, particularly in developing countries. These adverse effects of globalization may be worsened as male and female workers compete to meet the rising demand for less skilled labor, holding down one another's wages as a result (Seguino, 2005). The effects of globalization also depend on the bargaining power of female labor. For example, women usually have much more household responsibility than men and thus prefer temporary and home-based work. Thus, unskilled female workers are more likely to be in temporary jobs with less bargaining power. The feminist literature on export-oriented industries identifies the crowding of women into unskilled, low-paying, high-turnover jobs and employers' discrimination against women in predominantly female occupations (industries) as explanations for gender wage inequality. Seguino (2000) shows that globalization increases capital mobility, and that the concentration of women in globalized industries where capital is mobile may contribute to a larger gender gap and to weakening the bargaining power of female labor. To compete in the global market, foreign and exporting firms search for greater flexibility and lower costs, and take advantage of cheap female labor in developing countries.

Second, globalization increases competitive pressure, thus reducing gender discrimination in wages and employment. Based on the economics of discrimination (Becker, 1957),

* We would like to thank Oliver Coomes and three anonymous referees for their insightful comments and suggestions. Funding from University of International Business and Economics is gratefully acknowledged. Lai acknowledges the financial support of Research Grants Council of Hong Kong (PolyU5448/10H). Final revision accepted: November 13, 2012.

gender discrimination is a preference with a significant efficiency cost. As market competition increases, nondiscriminating firms should expand, while discriminating firms should contract and may not even survive in the long run. For example, Black and Brainard (2002) report that US industries, which are subject to more competition through international trade, have experienced greater reductions in earnings and employment disparities between men and women.

There are other channels through which the effects of globalization indirectly affect gender inequality in the labor market, including economic growth, investment in the human capital of girls, technology improvements, and household decisions. For example, Munshi and Rosenzweig (2006) examine how globalization in India has made its schooling options favorable for girls. The global outsourcing in booming sectors such as software and services has provided opportunities for women and increased their returns to education in English. The authors find that the increase in English-based education for girls is much faster than for boys among the lower castes. Girls are more likely to be educated in English and thus are in a better position to take advantage of the job opportunities created by globalization. The evidence for the effect of industrial upgrading on gender inequality is mixed. Some studies show that female labor is complementary to technology upgrading. For example,

Galor and Weil (1996) and Welch (2000) explore the notions that women have the advantage in cognitive *versus* physical skills and that technology advances consequently increase the relative demand for women. Other studies have shown that industrial upgrading has negative effects on gender inequality. Fussell's (2000) study in Mexico shows that technological upgrading increases the demand for skilled male labor, and that multinational assembly plants take advantage of female employees with low levels of human capital and a great need for stable employment. Braunstein and Brenner (2007) show that FDI has beneficial effects on both male and female wages in China. Women experienced larger gains from FDI than men in 1995. However, the gender-based wage advantage was reversed by 2002 due to industrial upgrading and gender-based employment segregation.

This paper contributes to the literature by providing an enterprise-population-wide study of the link between globalization and gender inequality in the Chinese labor market. Previous studies have focused mainly on the inter-industry effect that globalization shifts industry structures and reallocates resources across sectors with different female intensities. However, there is also substantial firm heterogeneity within industries and regions, and globally integrated firms may behave differently in the labor market. Our study focuses on the intra-industry effects of globalization. To determine the channels through which globalization affects gender inequality in the labor market, we first examine the link between firms' international exposure and female employment. After controlling for regional and industrial effects and various firm attributes, we find that the shares of female workers in both exporters and foreign-invested enterprises (FIEs) are significantly higher than those in domestic nonexporting firms. Furthermore, we show that the regional and industrial presence of exporters and foreign firms have positive spillover effects on female employment. These findings support the beneficial effect of globalization on female employment.

In addition, we explore the effect of globalization on gender wage differences. Our results indicate that female employment share is negatively related to average wage, implying a significant gender wage gap. Moreover, we find that exporting and foreign firms have larger gender wage gaps than domestic nonexporters. This considerable gender wage differential is consistent with recent empirical studies (e.g., Blau & Kan, 1997; Bishop, Luo, & Wang, 2005; Zhang & Dong, 2008). However, the perceived gender wage gap in exporters and foreign firms cannot be directly interpreted as evidence for gender wage discrimination, as it may be attributed to the existence of a comparable gender productivity gap. We find that computer usage and employee training significantly increase gender wage differentials for foreign exporters, which implies that one possible source of the large gender productivity gap is within-firm gender segregation. Global production sharing may induce female workers to concentrate in low value-added, low-tech and low-training tasks such as pure assembly activities in a global production chain.

To test the existence of possible gender wage discrimination, we follow Dong and Zhang (2009) in simultaneously gauging the wage and productivity differentials between female and male workers in exporting, nonexporting, domestic, and foreign firms. Our econometric framework enables us to statistically test the existence of gender wage inequality and, more importantly, to determine whether the observed wage inequality can be attributed to a productivity differential. We find strong evidence for the existence of wage discrimination against female workers in Chinese manufacturing industries. However, the wage and productivity differentials vary considerably across ownership structures and trade orientations. There is significant gender discrimination in private nonexporting firms, and the gender wage gaps of exporting and foreign firms reflect gender productivity differences.

This study has two main findings. First, globalized firms provide women with more job opportunities. Foreign participation and export orientation within the same region and industry significantly encourage female employment and reduce the gender wage gap. Foreign and exporting firms show no significant gender wage discrimination. Second, foreign and exporting firms have larger gender wage and productivity gaps than domestic nonexporters. This may reflect within-firm gender segregation and the "crowding" of female labor into low value-added, low-tech, and low-training tasks in the global production chain.

The remainder of this paper is structured as follows. Section 2 provides the background of gender wage inequality in China. Section 3 investigates the role of globalization in determining the female employment share. The link between globalization and the gender wage gap is examined in Section 4. Section 5 tests the existence of gender wage discrimination in foreign and exporting firms. Section 6 concludes the paper.

2. GENDER WAGE INEQUALITY IN CHINA

Given its enormous labor force, massive economic reforms, and deep-rooted Confucian patriarchy, China has been at the center of empirical research on gender discrimination in transition economies. Here, we briefly review the important policy changes and closely related empirical studies on gender wage inequality in China (for more detailed reviews, refer to Dong & Zhang, 2009; Shen & Deng, 2008; Zhang, Han, Liu, & Zhao, 2008).

Under strong central planning from 1949 to 1978 and the egalitarian ideology of a "socialism of equality," the Chinese government was once committed to eliminating gender differentials in the labor market, promising equal pay for male and female workers (Liu, Meng, & Zhang, 2000; Meng & Miller, 1995), arguably at the cost of market efficiency (Knight & Song, 2003). China's female labor force participation rates

were above 70% in the late 1980s and 1990s, exceeding those of its Asian neighbors, other developing countries, and socialist nations (Maurer-Fazio, Hughes, & Zhang, 2007). Since 1979, China has embarked on large-scale economic reforms, gradually granting firms more managerial autonomy in hiring decisions and compensation structures. The enactment of the nationwide Labor Law in 1995 notably gave employers increasing discretion and flexibility in their labor market decisions. These massive economic reforms have intensified market competition (Naughton, 1995) and thus may reduce gender-based discrimination in the labor market. However, given China's abundant labor pool and ingrained Confucian patriarchal social norms, the loosening of the Chinese government's iron grip on the economy may also encourage a resurgence of workplace gender discrimination (Hughes & Maurer-Fazio, 2002; Knight & Song, 2003; Ng, 2004). Moreover, the gender wage gap may widen to reflect the gender differences in human capital endowments as a result of labor market liberalization and the contraction of socialist egalitarianism.

These two apparently opposite effects of economic reform on gender wage inequality are echoed by conflicting empirical evidence. Some researchers have documented a declining trend in gender wage disparity in the post-reform Chinese economy. For instance, Liu et al. (2000) show that gender-based discrimination in the overall gender wage differential declines substantially across ownership sectors, from state to private. Hughes and Maurer-Fazio (2002) and Gustafsson and Shi (2000) also report a smaller gender wage differential in China compared with other developing countries. In contrast, other researchers have reported increases in gender wage disparity during the economic reform. Among others, Maurer-Fazio, Rawski, and Zhang (1999), Maurer-Fazio and Hughes (1999) and Bishop et al. (2005) report evidence of a widening gender wage gap in China's urban labor market during the late 1980s and early 1990s. Xu, Tan, and Wang (2006) reveal a considerable gender wage gap (32%) in a local case study. However, Rozelle, Dong, Zhang, and Mason (2002) find no significant effect of economic reform on gender wage discrimination in China from 1988 to 1995, and are supported by the finding of a stable gender wage gap reported by Shu and Bian (2003). A sizable income disparity across the different types of ownership further stimulates the debate. For instance, Maurer-Fazio et al. (1999) show a smaller gender wage gap among collectively-owned enterprises (COEs). Dong and Zhang (2009) document that unskilled female workers in state-owned enterprises (SOEs) have historically received wage premiums and emphasize the female wage subsidies resulting from the government's commitment to women's emancipation. However, Shen and Deng (2008) point out that the growing but rather scattered literature on gender wage inequality in post-reform China demands further empirical investigation. We contribute to this on-going debate by furnishing the first enterprise-population-wide study to systematically examine the link between globalization and gender wage discrimination across ownership structures and export orientations.

China's transition from a planned economy to a market-oriented economy has been accompanied by rapid economic globalization. The Chinese government has enthusiastically promoted international trade and FDI inflow over the last three decades. As a result, China's international trade expanded 75.5 times from 1979 to 2009.[1] By 2010, China was the second-largest importer and had overtaken Germany as the world's largest merchandize exporter, accounting for almost 10% of the world's total exports. As a driving force of economic globalization, FDI has further strengthened China's integration with the global economy. In fact, FIEs account for more than 50% of China's exports and 60% of China's imports, and contributed more than 40% of China's gross domestic product growth in 2003 and 2004 (Whalley & Xin, 2010). In 2009, China registered $90 billion worth of FDI inflows despite the global economic downturn and was ranked the world's second largest FDI recipient after the United States. In particular, international trade and FDI have increased employment and significantly improved the productivity of Chinese enterprises by introducing advanced technologies, changing production structures, and exploiting various comparative advantages. Given the profound economic and cultural effects of China's opening-up policy, it is of particular interest to examine the relationship between globalization and the gender wage disparity.

Economic globalization and the elimination of gender wage discrimination have both been long-term commitments for the Chinese government. A few empirical studies have evaluated the effect of globalization on gender wage inequality in China. For example, Braunstein and Brenner (2007) combine household survey data with province-level macro data and investigate the effect of FDI on male and female wages in urban China. They show that women experienced larger gains from FDI than men in 1995, but that the gender-based wage advantage reversed by 2002. The driving force was industrial upgrading that interacted with gender-based employment segregation. Zhang and Dong (2008) were the first to use firm-level data to analyze wage discrimination in developing countries and transition economies. They use a survey of 1500 firms to compare female-male gaps in productivity and wages and find no evidence of gender wage discrimination in foreign and exporting firms. Dong and Zhang (2009) test the gender wage discriminations in both export-oriented and non-export-oriented firms and find no evidence of discrimination for either firm type. Our study contributes to this strand of literature by providing the first enterprise-population-level analysis of both the employment and wage effects of globalization on female workers. We link inter-firm variations in gender inequality with firm, regional, and industrial globalization levels. Different from those of Dong and Zhang (2009), our results imply significant gender wage discrimination by private nonexporters, but no discrimination by foreign and exporting firms.

3. GENDER COMPOSITION OF EMPLOYMENT

Our study is based on the first national economic census conducted by the National Bureau of Statistics of China (NBSC). Conducted in 2004, it provides the most comprehensive cross-sectional data for Chinese enterprises. The summary statistics of this dataset are outlined in the *China Economic Census Yearbook* (NBSC, 2006). The census covers 5.17 million legal entities, including organizations and enterprises with the legal capacity to enter into agreements or contracts, assume obligations, incur and pay debts, sue and be sued in their own right, and be held responsible for their actions. International organizations in China were excluded from the census. These legal entities employ about 212.6 million people. About 97% of the legal entities are domestic (i.e., about 5.02 million entities). One hundred and ten thousand state-owned entities account for 29% of the total employment, while 40,000 collectively owned entities account for 8%; 2.03 million private entities account for 25%, and 2.84 million other domestic entities account for 27%. Hong Kong, Macao, and Taiwan (HMT) invest in about 74,000 entities and account for 6% of the total

employment. About 78,000 foreign legal entities account for 5% of the total employment. The manufacturing sector data indicate that 1.33 million manufacturing enterprises account for 38% of the total employment. The manufacturing sector has played a key role in China's international trade and has been the major recipient of FDI inflows. In the manufacturing sector, state-owned enterprises account for 6% of the total manufacturing employment, while collectively owned enterprises account for 7%; private firms account for 37%; domestic joint ventures (DJVs) (publicly listed firms, limited liability enterprises, and domestic cooperative enterprises) account for 25%; HMT-invested enterprises (HMTIEs) account for 13%, and foreign firms account for 12%.

The census reports firm-level gender composition. Female workers comprise 35.4% of the manufacturing sector workforce, whereas the average female employment share is 44.7% in FIEs and 52.1% among exporters. Figure 1 shows the female employment share in each of the 29 manufacturing industries. We find that the female employment share is highest in the textile, garment, leather, fur, down, stationary, education, sporting goods, electric equipment, electronics, and telecommunications industries, and is lowest in the furniture, petroleum processing, nonmetal mineral product, ferrous metal, and nonferrous metal industries (in descending order). Furthermore, female employment shares are significantly higher in FIEs and exporting firms than in domestic nonexporters in almost all industries. Therefore, Figure 1 suggests that firms that are recipients of FDI and/or engage in exporting tend to hire more female workers.

Figure 2 shows the distribution of the employment shares of FIEs, HMTIEs, and exporters across the manufacturing industries. The employment shares of FIEs and exporters are highest for the stationary, educational, sporting goods, electric equipment, electronics, telecommunications, textile, garment, leather, fur, and down industries. FIEs and exporters have the lowest employment shares in the beverage, petroleum processing, and nonmetal mineral product industries. This is consistent with the pattern shown in Figure 1 and suggests that the FDI- and export-intensive industries have high female employment shares.

Figures 1 and 2 show large shares of female employment in globally integrated industries, including both unskilled-labor-intensive industries such as the garment and textile industries, and capital- and skill-intensive industries such as the electronics and telecommunication industries. Recent studies have suggested that the sophistication in China's export basket and the similarity of China's exports to those of Organisation for Economic Co-operation and Development (OECD) countries have significantly increased over time (Rodrik, 2006; Scott, 2006). This may raise the concern that the trend of feminizing manufacturing employment may be reversed as production moves up the skill ladder in the later stages of export promotion, given the gender gap in education and on-the-job training (Fussell, 2000; Ghosh, 2001; Joekes, 1995, 1999). However, Branstetter and Lardy (2006) argue that China's increasing export sophistication is mainly due to processing trades and foreign direct investment. Processing trades account for more than half of China's international trade, and the majority of processing traders are foreign firms. Branstetter and Lardy (2006) show that China imports high value-added intermediate inputs, especially from advanced East Asian countries. Most high-tech product exports are assembled by foreign firms that source parts and components from their home countries. China specializes in low value-added "assembly service" instead of manufacturing high-tech products, consistent with its comparative advantage of unskilled labor abundance. Thus, even in capital- and skill-intensive industries, global outsourcing still generates a large amount of job opportunities for low-skilled and undertrained female workers.

To examine the link between globalization and gender employment composition, we estimate the following equation:

$$\begin{aligned} Female\_share_i = \beta_0 + \sum \alpha_j Ownership_{j,i} + +\beta_1 Exporter_i \\ + \beta_2 Skill\_share_i + \sum \delta_m Province_{m,i} \\ + \sum \theta_n Sector_{n,i} + \varepsilon_i, \end{aligned} \quad (1)$$

where $Female\_share_i$ is the proportion of female workers of enterprise i, and $Exporter_i$ is a dummy variable that is equal to 1 if enterprise i exports and 0 otherwise. The five ownership dummy variables identify SOEs, COEs, private enterprises, HMTIEs and FIEs.[2] The reference category is DJVs, which include publicly listed firms, limited liability enterprises, and domestic cooperative enterprises. $Skill\_share_i$ indicates the proportion of skilled labor in the total employment of enterprise i. A skilled laborer is defined as an employee with at least a college education. $Province_{m,i}$ is a dummy variable

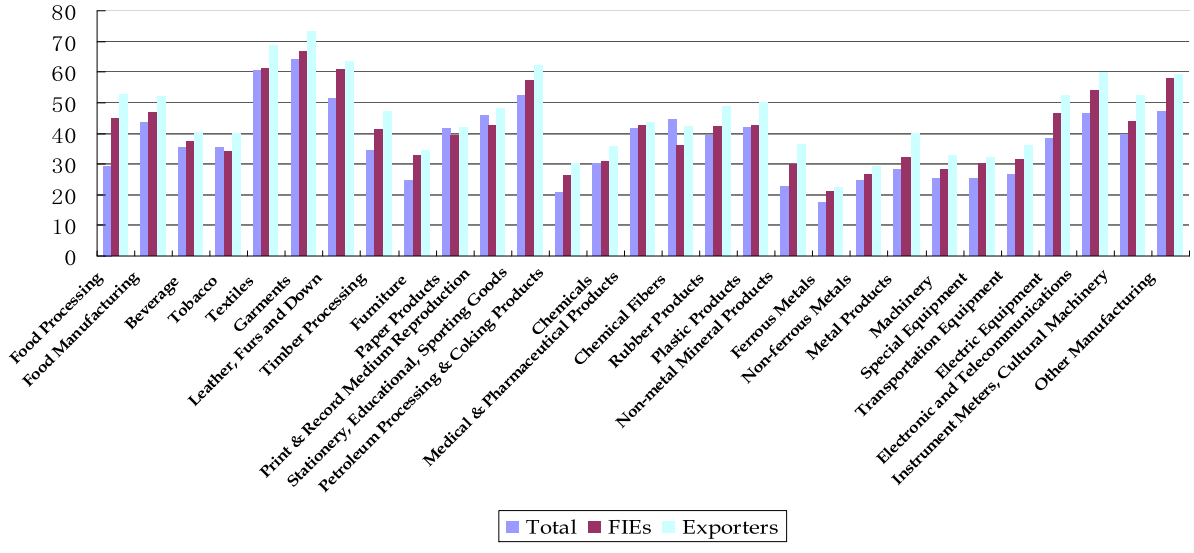

Figure 1. *Female employment share across industries.*

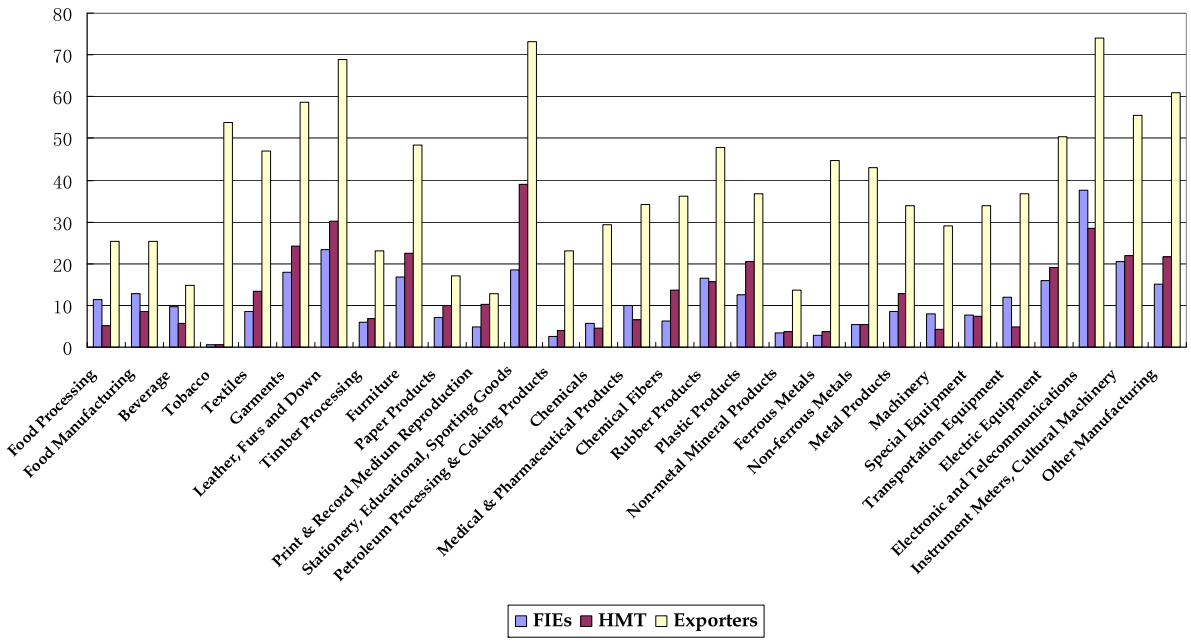

Figure 2. *Employment share of foreign-invested enterprises and exporters in two-digit industrial employment.*

that captures region-specific gender composition differentials, taking the value of 1 if enterprise i is located in province m. $Sector_{n,i}$ is an industry dummy variable that captures industry-specific differentials. It is equal to 1 if enterprise i operates in industry n and 0 otherwise. ε_i is the error term. [3]

The Tobit model results are reported in Column 1 of Table 1. [4] After controlling for regional and industrial fixed effects, the coefficient of *Exporters* is positive and statistically significant at the 1% level. This result suggests that, all things being equal, the female employment share is 13% higher in exporting firms than in nonexporting firms. Column 1 further shows that FIEs and SOEs have the highest female employment shares, whereas private firms and HMTIEs have the lowest. The female employment share in foreign firms is 0.7% higher than that of DJVs. The results also indicate a negative relationship between the share of skilled labor ($Skill\_share_i$) and female employment, suggesting that the sizable differences in employment gender composition across firms may be partially attributable to the skill composition differentials. Firms with lower skill compositions tend to have higher shares of female labor, implying that women in the labor force may be less educated than men.

To investigate the interaction between foreign ownership and exports, we add six interaction terms into Eq. (1). The reference category comprises DJVs that do not export. The results in Column 2 of Table 1 show that exporters hire more female workers than nonexporters in all ownership categories. The result supports the notion that internationally integrated firms tend to offer more job opportunities for women.

Globalization may also affect gender inequality by intensifying regional and industrial competition and thus increasing the cost of gender discrimination in employment. To examine this channel, we further control for two factors. First, we control for the regional and industrial foreign presence, which is defined as the share of FIEs' employment in the total employment of the same province and two-digit manufacturing industry. Second, we control for the regional and industrial export orientation, which is defined as the ratio of the employment of exporting firms to the total employment of the same province and industry. These two variables aim to capture the effect of globalization on local markets. A large foreign presence or export orientation will increase competitive pressure on local firms. The estimation results are reported in Column 3 of Table 1. They suggest significant and positive spillovers from global-integrated firms to female employment in local markets. A 10% increase in regional and industrial foreign employment shares raises the female employment shares of local firms by about 0.7%, and a 10% increase in regional and industrial exporters' employment shares increases the female employment share by about 0.2%. Thus, our analysis highlights the statistical and economic importance of globalization in promoting female employment. Consistent with the economics of discrimination (Becker, 1957) and the US empirical evidence (Black & Brainard, 2002), we find that globalization reduces gender employment disparity by increasing local market competition levels, making gender discrimination in employment more costly.

As a robustness check, we further control for other potential determinants such as firm age, firm size, and the capital labor ratio. Firm size is measured by the total sales logarithm, and the capital labor ratio is calculated as the fixed assets divided by the total employment. Column 4 of Table 1 suggests that older, larger, and more labor-intensive firms have higher female employment shares. After controlling for various firm attributes and regional and industrial effects, the link between globalization and female employment remains statistically significant. Column 4 consistently shows that foreign and exporting firms not only hire more female employees, but also generate positive spillovers to female employment in the local market.

Finally, the potential limitations of this dataset are worth mentioning. First, the census data are cross-sectional, implying that the globalization effect can only be captured by different international exposure across firms. As a result, we are not able to assess the dynamic effect of globalization on gender inequality over time. Second, the census provides only firm-level data, and thus we cannot control for the attributes of individual employees in the way studies that use matched employee-employer data can. Third, instead of identifying the causality, our analysis, based on the cross-sectional data,

Table 1. *Determinants of female employment share*

	(1)	(2)	(3)	(4)
Constant	0.291*** (152.4)	0.294*** (153.0)	0.281*** (136.1)	0.235*** (105.2)
SOEs	0.007*** (3.73)	0.010*** (4.93)	0.010*** (4.98)	0.002 (0.81)
COEs	0.005*** (5.26)	0.002** (2.25)	0.002** (2.28)	0.007*** (6.99)
Private firms	−0.012*** (−15.60)	−0.016*** (−19.41)	−0.016*** (−19.47)	−0.010*** (−12.58)
HMTIEs	−0.014*** (−10.39)	−0.023*** (−13.18)	−0.024*** (−13.37)	0.018*** (9.91)
FIEs	0.007*** (4.75)	−0.001 (−0.47)	−0.002 (−1.26)	0.032*** (17.64)
Exporters	0.130*** (149.0)			
Skill	−0.091*** (−69.80)	−0.090*** (−69.15)	−0.090*** (−69.01)	−0.061*** (−42.77)
DJV × exporter		0.095*** (38.81)	0.094*** (38.59)	0.049*** (21.95)
SOEs × exporter		0.061*** (9.62)	0.061*** (9.534)	0.014** (2.329)
COEs × exporter		0.121*** (39.13)	0.121*** (39.05)	0.071*** (24.90)
Private firms × exporter		0.137*** (110.2)	0.136*** (109.5)	0.088*** (76.51)
HMTIEs × exporter		0.141*** (64.80)	0.141*** (64.84)	0.053*** (25.26)
FIEs × exporter		0.138*** (61.81)	0.137*** (61.37)	0.062*** (28.52)
Regional and industrial foreign presence			0.072*** (14.93)	0.090*** (19.29)
Regional and industrial export orientation			0.015*** (5.53)	0.028*** (10.52)
Firm age				0.001*** (25.46)
Firm size				0.007*** (47.80)
Capital intensity				−0.0001*** (−72.51)
Industry dummy variables	Yes	Yes	Yes	Yes
Province dummy variables	Yes	Yes	Yes	Yes
Pseudo R^2	0.39	0.39	0.39	0.74
No. of obs.	1312,865	1312,865	1312,865	1169,950

Note: In Column 1, the benchmark ownership category group is a domestic joint venture. In Columns 2–4, the benchmark ownership category group is a nonexporting domestic joint venture. The *t*-statistics are reported in parentheses.
** Significance at the 5% level.
*** Significance at the 1% level.

provides consistent evidence of a positive link between globalization and female employment.

4. GENDER WAGE GAP

In Section 3, we present strong evidence that globalization is positively related to female employment. To further investigate the relationship between globalization and gender wage differentials, we estimate the following equation:

$$\begin{aligned} w_i = {} & \beta_0 + \beta_1 Age_i + \beta_2 Size_i + \beta_3 CapitalIntensity_i \\ & + \sum \alpha_j Ownership_{j,i} + \beta_4 Exporter_i + \beta_5 Skill\_Share_i \\ & + \beta_6 Female\_Share_i + \sum \delta_j Ownership_{j,i} \\ & \times Female\_Share + \beta_7 Exporter_i \times Female\_Share_i \\ & + \sum \delta_m Province_{m,i} + \sum \theta_n Sector_{n,i} + \varepsilon_i, \end{aligned} \quad (2)$$

where w_i is the logarithm of the average wage level, which is calculated as the total wage bill of enterprise i divided by its total employment;[5] Age_i is the age of enterprise i, calculated as 2004 minus the year of establishment of the firm; $Size_i$ is the logarithm of the total sales in enterprise I; and $CapitalIntensity_i$ is the capital-labor ratio, calculated as the fixed assets of enterprise i divided by its total employment. The definitions of the other variables are the same as in Eq. (1). The key variables in this specification are the interaction terms between the ownership variables, export dummy and female employment share, which capture the gender wage gap across ownership and export status.

Column 1 of Table 2 reports the regression results for the wage equation in the Chinese manufacturing sector. The estimates suggest that larger, more capital-intensive, and more skill-intensive firms offer higher wages. Exporting firms pay higher wages than nonexporters. Across different ownership structures, we find that workers in FIEs enjoy a 24% higher average wage than workers in DJVs, the reference category. Private firms and COEs have the lowest wage levels. The estimated coefficient of the female employment share is significant and negative. This implies a significant gender wage gap. "Female-intensive" firms pay lower wages after controlling for regional and industrial effects, skill composition, and other firm characteristics. The wage ratio of female to male workers is measured under the assumption that the average wage of a firm is a geometrically aggregated average of the male and female wages. Zhang and Dong (2008) similarly report a negative association between wages and the share of female workers in a firm's labor force. However, the negative relationship between female employment share and wages should not be directly interpreted as evidence of gender wage discrimination, as the negative link may simply reflect the productivity difference between the male and female workers.

Column 1 of Table 2 also suggests that there are considerable gender wage gap variations across ownership and export status. The estimated coefficient of the interaction term between the export dummy and female employment share is negative and statistically significant, implying that, *ceteris paribus*, exporters have a larger gender wage gap than nonexporters. Across different ownerships, FIEs and SOEs have the largest gender wage gaps, while COEs and private firms have the smallest.

The question naturally arises: why do foreign and exporting firms have larger gender wage gaps than domestic nonexporters? There are two possible explanations. First, globalization indeed encourages gender discrimination such that foreign and exporting firms discriminate against female workers more severely in terms of wages than domestic nonexporters.

Table 2. *Gender wage gap*

	Full sample		Foreign exporters	
	(1)	(2)	(3)	(4)
Female share	-0.199*** (-29.97)	-0.224*** (-30.02)	-0.154*** (-4.63)	-0.237*** (-10.95)
SOEs × female share	-0.128*** (-4.31)	-0.124*** (-4.18)		
COEs × female share	0.029*** (3.39)	0.031*** (3.64)		
Private firms × female share	0.038*** (5.51)	0.037*** (5.45)		
HMTIEs × female share	-0.087*** (-6.78)	-0.093*** (-7.23)		
FIEs × female share	-0.092*** (-7.07)	-0.105*** (-8.01)		
Exporter × female share	-0.038*** (-5.26)	-0.047*** (-6.49)		
Regional and industrial foreign presence		0.088*** (5.26)		
Regional and industrial export orientation		-0.063*** (-8.48)		
Regional and industrial foreign presence × female share		0.063** (2.25)		
Regional and industrial export orientation × female share		0.060*** (4.46)		
Computer usage			0.025*** (3.09)	
Computer usage × female share			-0.045*** (-3.93)	
Training				0.110*** (4.56)
Training × female share				-0.132*** (-2.97)
Firm age	0.0001 (0.50)	0.0001 (0.60)	0.011*** (11.96)	0.011*** (11.63)
Firm size	0.101*** (300.4)	0.101*** (300.4)	0.101*** (33.65)	0.072*** (22.99)
Capital intensity	0.0004*** (45.82)	0.0004*** (45.82)	0.0003*** (11.52)	0.0003*** (11.65)
Skill share	0.422*** (108.4)	0.423*** (108.5)	1.017*** (35.87)	1.145*** (34.07)
SOEs	0.126*** (10.83)	0.125*** (10.74)		
COEs	-0.010*** (-2.67)	-0.011*** (-2.83)		
Private firms	-0.008** (-2.52)	-0.008** (-2.56)		
HMTIEs	0.108*** (16.05)	0.110*** (16.32)		
FIEs	0.235*** (33.20)	0.238*** (33.45)		
Exporter	0.018*** (4.42)	0.023*** (5.48)		
Constant	1.451*** (270.3)	1.452*** (251.7)	1.526*** (36.59)	1.842*** (40.43)
Industry dummy variables	Yes	Yes	Yes	Yes
Province dummy variables	Yes	Yes	Yes	Yes
No. of obs.	1162,356	1162,356	26,880	19,493
R^2	0.266	0.266	0.416	0.424

Note: The benchmark ownership category group is a domestic joint venture. The *t*-statistics are reported in parentheses.
** Significance at the 5% level.
*** Significance at the 1% level.

Second, there is a greater gender productivity gap in foreign and exporting firms that justifies the perceived gender wage gap.

For the first explanation, we defer the tests for the existence of gender wage discrimination to Section 5. From a taste-based perspective, gender discrimination is a preference with a significant efficiency cost (Becker, 1957; Gunderson, 2006). If employers prefer male employees and pay equally productive female employees lower wages, they cannot keep highly productive female workers. Hence, under global competitive pressure, discriminating firms may have to contract and may not survive in the long run. Through this channel, globalization should reduce the room for gender discrimination by increasing its cost. To examine this channel, we further include regional and industrial foreign presence and export orientation and their interaction terms with female employment share into the regression. The constructions of regional and industrial foreign presence and export orientation are the same as those described in the previous section. Column 2 of Table 2 reports the regression estimates. The results suggest that foreign presence has positive wage spillovers and significantly reduces gender wage gaps in local markets. Further, export orientation delivers negative wage spillovers and also reduces gender wage gaps. We thus find that the increasing competition introduced by globalization plays a significant role in reducing gender wage gaps. This is consistent with previous findings that international trade and FDI lessen gender wage disparities, particularly in industries that face intensified competition caused by globalization (e.g., Artecona & Cunningham, 2002; Black & Brainard, 2002; Fontana & Wood, 2000; García-Cuéllar, 2000, chap. 1; Oostendorp, 2009).

To shed light on the second explanation, we need to understand the potential reasons why foreign and exporting firms have large gender productivity gaps. It is a well-established fact that occupational gender segregation is an important source of gender wage gaps. Focusing on transition economies, Ogloblin (1999) analyzes Russian household survey data and finds that occupational segregation explains a large proportion of gender wage gaps. Jurajda (2003) analyzes matched employer-employee datasets from the Czech Republic and Slovakia and finds that occupational segregation is related to over one-third of the overall gender pay gap. Fernandez-Mateo and King (2011) provide a comprehensive review of the gender sorting mechanism and explain why women are placed in lower-quality jobs based on firm-specific human capital, future turnover, or commitment expectations and the sequential nature of the hiring process. In the previous section, we show that foreign and exporting firms tend to hire more female workers than domestic nonexporters. However, female workers may be disproportionally assigned to low value-added, unskilled labor-intensive tasks such as pure assembly activities. These jobs

and tasks require less firm-specific training. The processing trade accounts for more than half of China's total exports, and the majority of processing exporters are foreign-invested enterprises specializing in low value-added assembly activities in global production chains.

Due to the limitations of the data, we know only a firm's total wages instead of the wages for different occupations (or tasks) within the firm. As such, we cannot identify within-firm gender distributions across different occupations. To provide some insight into this issue, we focus on foreign exporters and examine the effect of computer usage and training on the gender wage gap. Computer usage is measured by a logarithm (1 + the number of computers). Training is measured by the training expenditure per worker, calculated as the total training expenditure of a firm divided by the total employment.

Column 3 of Table 2 shows that computer usage is positively associated with the average wage level, as the coefficient of *Computer usage* is positive and significant at the 1% level. However, the coefficient of the interaction between computer usage and female employment share is negative and statistically significant, suggesting that computer usage widens the gender wage gap. This finding is inconsistent with the argument that female labor is complementary to technology upgrading (Galor & Weil, 1996; Welch, 2000). Instead, technology upgrading is more likely to increase the gender productivity gap if women are less likely to be assigned to high-tech tasks. In our regression, we use the employees' education attainment to control for the firms' skill compositions. However, productivity (and thus wages) also depends on on-the-job training and access to firm-specific human capital. Column 4 of Table 2 shows that the per-worker training expenditure is positively associated with the average wage level, but significantly increases the gender wage gap, as the coefficient of the interaction term, *Training* × *Female_share*, is negative and statistically significant at the 1% level. This implies that investment in on-the-job training is biased toward male employees. Taken together, this evidence is consistent with our conjecture that female employees are disproportionally assigned to low value-added, low-tech, and low-training tasks in foreign and exporting firms. The possible within-firm segregation of jobs or tasks may also be a result of the unequal household responsibility between women and men. The literature argues that female laborers are less likely to be assigned jobs that require high levels of firm-specific human capital because employers expect their future turnover to be higher than that of men (e.g., Becker, 1985; Loprest, 1992). In China, many migrant female employees only work temporarily in assembly factories located in coastal areas before they quit their jobs and return to their hometowns to get married and raise children. Global production sharing or global outsourcing provides a large amount of temporary and low-skilled tasks for female workers in developing countries.

5. GENDER WAGE DISCRIMINATION

Thus far, we have established that (1) there is a positive relationship between globalization and female employment and (2) foreign and exporting firms have large gender wage gaps. Gender wage gaps are not necessarily the result of employer discrimination against female workers. As argued by Blau & Kan, 1992, 1997) among others, a gender wage gap may be justified by the productivity and human capital differentials between female and male workers. One cannot fully assess the causes of a perceived gender wage gap without properly accounting for these factors.

To test for the existence of gender wage discrimination, we follow Dong and Zhang (2009) in jointly estimating the following wage and production equations:

$$\begin{aligned}\ln(W) &= \lambda_0 + \ln\left[\left(1-\frac{L_f}{L}\right)\left(1+(\eta-1)\frac{M_{us}}{L_m}\right)\right.\\ &\quad\left.+\phi\frac{L_f}{L}\left(1+(\eta-1)\frac{F_{us}}{L_f}\right)\right]+X'\lambda+u,\\ \ln(Q) &= \gamma_0+\alpha\ln\left[\left(1-\frac{L_f}{L}\right)\left(1+(\mu-1)\frac{M_{us}}{L_m}\right)\right.\\ &\quad\left.+\rho\frac{L_f}{L}\left(1+(\mu-1)\frac{F_{us}}{L_f}\right)\right]+\alpha\ln(L)+\beta\ln(K)+Z'\gamma+v,\end{aligned} \tag{3}$$

where the firm subscript is omitted for simplicity; $\ln(W)$ is the logarithm of the average wage level of the enterprise; L_f is the size of the female labor force; L is the total labor; M_{us} is the male unskilled labor; F_{us} is the female unskilled labor; ϕ is the wage ratio of female to male labor; η is the wage ratio of unskilled to skilled labor; ρ is the productivity ratio of female to male labor; μ is the productivity ratio of unskilled to skilled labor; Q is the enterprise's value added; L is the total employment; and K is the total fixed assets. X and Z contain other firm characteristics, including ownership, firm age, size, capital labor ratio, province, and industry dummies. The definitions of these variables are the same as in Eq. (2). Finally, λ_0 and γ_0 are constant terms, and u and v are error terms. [6]

Compared with the conventional residual wage gap analysis, a major advantage of Dong and Zhang's (2009) method is that it attenuates the potential omitted variable bias (Altonji & Blank, 1999), as workers' unobserved productivity characteristics tend to affect wage and productivity in a similar manner. Therefore, while the two wage equations (Eqs. (2) and (3)) are conceptually the same, Eq. (3) offers a structural framework that allows us to estimate the gender wage ratio jointly with the productivity equation so that we are able to address Blau & Kan's (1992, 1997) concern that gender wage gaps may be justified by the productivity differential between female and male workers.

It is of particular interest to estimate ϕ, the wage ratio of female to male employees, and ρ, the marginal productivity of female to male workers. A value of ϕ that is less than 1 would imply lower wages for female workers than for comparable male workers, whereas $\rho < 1$ would indicate that women are less productive than men in the labor market. Therefore, another advantage of Dong and Zhang's (2009) method is that it not only allows the simultaneous determination of wage and productivity differences between genders (i.e., ρ and ϕ), but also provides a statistical test for the existence of gender wage discrimination. The null hypothesis of an absence of gender wage discrimination can be formulated as $\phi = \rho$, which means that the wage gap merely reflects the gender productivity difference between female and male workers. Rejection of the null hypothesis provides statistical evidence for gender wage discrimination (i.e., $\phi < \rho$) or evidence that supports wage subsidies for female employees (i.e., $\phi > \rho$).

The wage and production equations share a common set of firm-level characteristics, such as ownership, size, market share, and capital intensity. The selection of explanatory variables is consistent with empirical studies and takes into account various industrial and regional effects. Furthermore, certain unobserved factors that are subsumed in the error terms u and v may drive wages and productivity simultaneously. To recognize the potential correlation between the error terms, we assume that they have a bivariate normal distribution as follows:

Table 3. *Simultaneous estimation of wage and productivity*

	All firms (1)	Exporters (2)	Nonexporters (3)	FIEs (4)	SOEs (5)	COEs (6)	Private firms (7)	Private nonexporters (8)	Private exporters (9)
Wage ratio of female to male workers (ϕ)	0.795*** (0.004)	0.774*** (0.007)	0.818*** (0.006)	0.674*** (0.012)	0.685*** (0.035)	0.871*** (0.015)	0.842*** (0.006)	0.843*** (0.007)	0.848*** (0.012)
Test for gender differences in wage $\phi = 1$ (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	0.000
Productivity ratio of female to male workers (ρ)	0.942*** (0.047)	0.881*** (0.065)	0.990*** (0.065)	0.836*** (0.120)	1.070*** (0.380)	0.749*** (0.112)	1.060*** (0.067)	1.106*** (0.107)	0.988*** (0.103)
Test for gender difference in productivity $\rho = 1$ (*p*-value)	0.217	0.067	0.878	0.172	0.854	0.025	0.370	0.323	0.906
Test for equality of gender gaps in wages and productivity $\rho = \phi$ (*p*-value)	0.001	0.279	0.010	0.356	0.239	0.269	0.003	0.014	0.170
No. of obs.	233,035	72,740	160,295	26,552	8137	21,841	108,955	85,769	23,186
Correlation of error term r	0.096	0.119	0.086	0.124	0.089	0.096	0.090	0.079	0.122

Note 1: The values in parentheses are the standard errors of the estimated parameters.
Note 2: The likelihood ratio test is used to test the equality of the gender gaps in wages and productivity.
Note 3: Our correlation estimates are much smaller than those of Dong and Zhang (2009). This reflects the richness of our explanatory variables (i.e., province and sector dummies) to capture more common variations of the two equations. As a consequence, the correlation in the error terms is smaller.
*** Significance at the 1% level.

$$\begin{bmatrix} u \\ v \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \delta_u^2 & r\delta_u\delta_v \\ r\delta_u\delta_v & \delta_v^2 \end{bmatrix}\right),$$

where r is the correlation between error terms and δ_u and δ_v are the standard deviations of u and v, respectively. The wage and productivity equations are then estimated simultaneously with the maximum likelihood method, which improves the efficiency of the parameter estimates and allows the existence of gender wage discrimination to be tested directly (i.e., $\phi = \rho$).

Our primary focus is to statistically examine the relationship between the gender wage ratio ϕ and the marginal productivity ratio ρ. The estimates of ϕ and ρ and the related test results are reported in Table 3.[7] Column 1 shows that the average wage for female workers is 79.5% that of male workers across all manufacturing firms. As the null hypothesis of equal wage, i.e., $\phi = 1$, is rejected ($p = 0.00$), we confirm the existence of a gender wage gap in the manufacturing sector. In addition, Column 1 shows that the productivity ratio of female to male workers (ρ) is 94.2%, which is not significantly different from 0 and exceeds the wage ratio by 14.7%. As the null hypothesis that the gender wage ratio is equal to the gender productivity ratio, i.e., $\phi = \rho$, is rejected at the 1% level, our results indicate that female workers are paid considerably less than male workers despite a similar productivity level. Therefore, wage discrimination against women contributes to the large gender wage differential in the manufacturing sector.

We now turn to the effects of exports on the gender wage and productivity gaps. The results for exporting and nonexporting firms are reported in Columns 2 and 3, respectively. For both exporters and nonexporters, the null hypothesis of gender equality in wages is rejected at the 1% significance level, whereas the hypothesis of equal productivity between genders cannot be rejected at the 10% level. Hence, female workers earn less although they are as productive as their male counterparts in both exporting and nonexporting firms. Among nonexporters, the gender productivity ratio (99.0%) exceeds the gender wage ratio (81.8%) by 17.2%, which is significantly different from 0 (p-value = 1%). In contrast, the hypothesis that the gender wage ratio is equal to the productivity ratio, i.e., $\phi = \rho$, cannot be rejected for exporting firms at a conventional significance level (p-value = 27.9%). Therefore, this difference between exporting and nonexporting firms underlies the effect of trade liberalization in curtailing discrimination against women in the labor market.

We use the wage and productivity equations for the different ownership subsamples to determine how the gender effects vary across ownership structures. The results are reported in Columns 4–7 for FIEs, SOEs, COEs, and private firms, respectively.[8] A unified gender wage ratio is rejected in all ownership categories. For productivity, a significant gender difference is observed only among COEs. In other ownership groups, the estimated productivity ratio of female to male workers is not significantly different from 1 ($p > 0.05$). Turning to potential gender discrimination, the null hypothesis of an absence of gender wage discrimination, i.e., $\phi = \rho$, is rejected at the 1% level only for private firms. For FIEs, SOEs, and COEs, equality of the gender wage and productivity ratios cannot be rejected at the 10% level (p-value > 23%). However, for private firms, the productivity between men and women is similar (a productivity ratio of 1.06), but women are paid significantly less (a wage ratio of 0.842). This indicates significant gender discrimination in private firms, which account for more than 40% of the companies in the manufacturing industries. We further split the private firm sample into private exporters and private nonexporters, and report the estimation results in Columns 8 and 9.[9] The results indicate significant gender

discrimination only among private nonexporting firms. Taken together, our results reveal the marked effects of exporting and FDI in reducing gender-based discrimination toward female workers. Our results are also consistent with the previous finding (Dong & Zhang, 2009) of the absence of significant gender wage discrimination in SOEs.

In summary, we substantiate the finding of the previous section by demonstrating a considerable gender wage differential in China's manufacturing sector, as the gender wage ratio of 1 (i.e., $\rho = 1$) is consistently rejected for firms with different trade orientations and ownership structures. As we explore the cause of the gender wage differential, our results reveal that the gender wage gap mainly reflects a gender productivity difference in both exporting firms and FIEs. In contrast, among private nonexporting firms, the wage gap cannot be justified by the productivity differences between genders.

6. CONCLUSION

Using an enterprise-population-level dataset, we investigate the effects of globalization (i.e., international trade and FDI) on female employment, gender wage differentials, and gender discrimination. Our results suggest that globalization is positively linked to female employment. In particular, we find that foreign and exporting firms tend to hire more female workers than domestic nonexporters. Our results also suggest that regional and industrial foreign participation and export orientation encourage female employment and reduce gender wage gaps considerably as a result of intensified labor market competition, which raises the cost of gender discrimination. Furthermore, we find that while foreign and exporting firms have larger gender wage gaps than domestic nonexporters, the gaps primarily reflect gender productivity differentials, as female workers are more likely to be assigned to low-tech and low-training jobs. Overall, we identify significant gender wage discrimination only among private nonexporting firms.

Trade and foreign direct investment are two engines of China's high-speed growth over decades. From a policymaker's point of view, it is important to evaluate the income distribution effect of the "open door" policies. Our study emphasizes the beneficial effects of globalization on the reduction of gender inequality. We show that integration into the global economy leads to more job opportunities for unskilled female workers and that global competitive pressure reduces the room for gender discrimination. Women's economic wellbeing will increase when they move out from the traditional agriculture sectors or unpaid household work to manufacturing jobs. We also find a large gender productivity gap within foreign and exporting firms, possibly due to within-firm segmentation of occupations or tasks. When female workers are concentrated in low-tech and low-wage tasks such as pure assembly in the global production network, the gender income disparity is certainly widened. Our study thus suggests that the Chinese government should devote more resources to help female workers enhance their education and receive on-the-job training in an effort to increase their competitiveness at the high end of the skill spectrum.

Due to the limitations of the data, we cannot directly examine within-firm wage distributions and occupational segmentation. As this study uses a cross-sectional dataset, we are unable to investigate the dynamic effect of globalization on gender inequality, which could be an interesting topic for future research.

NOTES

1. In 1979, China's trade with the world was $29.234 billion. This total increased to $2207.2 billion in 2009. Source: International Financial Statistics Yearbook and China's Customs Statistics.

2. State-owned limited liability enterprises and joint ventures between SOEs are classified as SOEs. Joint ventures between COEs and domestic cooperative enterprises are treated as COEs. DJVs include shareholding companies and limited liability enterprises.

3. Shanghai is consistently used as the base province, while rubber products are the base industry.

4. In our sample, a small proportion of firms report no female employees. Because the dependent variable is censored at 0, we adopt a Tobit model in our estimation.

5. Labor compensation includes not only basic wage, but also various nonwage compensations. For example, Dong and Zhang (2009) use total labor compensation instead of basic wage. However, due to the limitations of the data, we lack a more sophisticated measure of the total labor compensation.

6. Because value-added information is only available for the large- and medium-sized firms (with sales above 5 million yuan), the sample in this estimation is reduced to 230,000 firms.

7. For brevity, we omit other parameter estimates that are broadly consistent with those of Dong and Zhang (2009) and are available upon request.

8. The subsample result for HMTIEs is not reported, as HMTIEs in China are not usually treated as "foreign." A significant proportion of HMT capital is "round-tripping" domestic capital that originates in mainland China and flows back as FDI through Hong Kong to obtain the benefits of favorable policies.

9. To check for robustness, a similar analysis is also conducted for SOEs, FIEs and COEs. Although insignificant, the gender wage ratio is less than the gender productivity ratio among the SOE, FIE and COE nonexporter samples, suggesting that international trade helps to reduce gender discrimination.

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