Input Tariff Liberalization and Gender Disparities: Evidence from China

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Abstract

Using China's WTO accession as a natural experiment, we show that input tariff liberalization generates higher income for Chinese manufacturing workers but widens gender income gap. The widened gender income gap is not due to longer working hours by men but an increase in gender wage inequality. We also find that input tariff reductions worsen manufacturing workers' health, and this adverse effect is more pronounced for women. The worsening of gender disparities, however, applies mainly to the unskilled. Finally, we also find that input tariff reductions incentivize women to obtain more education and result in a reduced gender education gap.

Keywords: *input tariff liberalization, gender disparity*, *health, education, China*

JEL classification: *F1, I1, J2, J3*

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1 Introduction

How does input tariff liberalization in a large developing country affect men and women differently? In addition to income and wage inequality, can input tariff liberalization also have an impact on other dimensions of gender disparity such as health and education?

This study aims to contribute to the literature by empirically investigating the above important yet under-researched questions. A large number of studies have documented significant distributional effects in developing countries following trade liberalizations (Goldberg and Pavcnik, 2007). The vast majority of these studies, however, examine changes in the skill premium while relatively less attention has been paid to gender disparities (Juhn et al., 2013, 2014). Moreover, the limited existing studies that explore the trade effects on gender disparities focus their attention mainly on gender income or wage inequality. The differential effects of trade shocks on other important dimensions of well-being such as working time, health, and education remain underexplored.

To fill these research gaps, we employ rich data from China; the world's largest exporting economy and a country with the world's largest manufacturing population, to carry out our empirical study. Like many other developing nations, China has historically been a patriarchal society. As shown in Table 1, even before its accession to the WTO, there were sizable gender gaps in income, hourly wage, and education in China. Understanding the effects of trade liberalization on gender disparities in China thus remains an important issue, and the findings can have implications for long-term development in China and other developing economies (Duflo, 2012).

China's WTO accession also offers a natural experiment for our empirical analysis of input tariff shocks. An interesting feature of China's imports is that they are dominated by intermediate inputs, which account for over 90% of China's total imports (e.g., Fan et al., 2015, 2020).[1] The reductions in China's import tariffs after its WTO accession thus applied mainly to intermediate inputs. As illustrated in Figure 1, China's import tariff on intermediate inputs experienced a sharp decline over the period of 1997-2015. The average import tariff on intermediate inputs was reduced from 12.9% in the pre-WTO period to 5.7% in the post-WTO era. This feature allows us to examine an input tariff channel, which complements other channels of trade liberalization, such as export expansion and import competition, explored in the existing literature. Moreover, since the liberalization in input tariff is a nation-wide policy event, it is exogenous to individuals and firms. Nevertheless, there are substantial variations in Chinese prefectures' exposures to this shock due to regional differences in the initial industry composition of labor (see Figure 2). Our empirical strategy hence takes advantage of these regional variations to identify the effects of input tariff reductions on a variety of measures of gender disparity.

Following Amiti and Konings (2007) and Topalova (2010), we construct a prefecture-level input tariff shock measure using Chinese provincial-level input-output table and the prefecture-level initial industry composition of labor. We then link the input tariff shock to a set of measures of gender disparity in our empirics. We start our analysis by first examining the effect on gender income inequality. Utilizing both the China Health and Nutrition Survey (CHNS) and the Urban Household Survey (UHS), we report consistent evidence of a widened gender income gap. While input tariff reductions raise both genders' incomes, the increase for female workers is significantly smaller. When decomposing income into hourly wage and working time, we find that the widened gender income gap is not due to a relative increase in male workers' working time but a result of a large increase in gender wage inequality. These findings are consistent with a more elastic labor supply of women than men documented in the literature (e.g., Wachter, 1972; Lloyd and Niemi, 1978;

[1] Final consumption goods account only for about 4% of China's total import value. The rest is intermediate and capital goods, and the latter is also typically considered as intermediate inputs.

Killingsworth and Heckman, 1986; Kaene, 2011; McClelland and Mok, 2012). As demonstrated in Appendix Figure 1, with a flatter labor supply curve, a positive labor demand shock following trade liberalization has a larger positive effect on equilibrium working hours but a smaller positive effect on equilibrium wage for female workers.

Both a lower income and longer working hours can adversely affect health (e.g., Berniell and Bietenbeck, 2020; Hamermesh et al., 2017; Rod et al., 2017). Our next step, therefore, is to explore the effect on gender health disparity. Consistent with the findings in the medical research, we find that input tariff liberalization indeed worsens the gender health gap. Compared to male workers, female workers are more likely to experience illness or injury in general in Chinese prefectures more exposed to the trade shock. When analyzing different disease types separately, we find that, compared to male workers, female workers are less likely to suffer from muscle pains or fractures which are typically associated with heavy physical work conducted by male workers. Female workers, however, have a significantly higher probability of suffering from other types of diseases.

To ensure the robustness of our findings, we conduct a variety of sensitivity analyses including controlling for additional interaction effects, excluding outliers, controlling for prefecture linear trends, and placebo tests. Next, since the literature has identified education as a crucial determinant of the distributional effects of trade liberalization, we also explore its role in determining the effects on gender disparities. By dividing our full sample into a skilled subsample and an unskilled subsample based on workers' education level, we show that the widened gender income and health gaps apply mainly to the unskilled.

The subsample results imply that education can be an effective way of alleviating the gender disparity caused by trade liberalization. If this is the case, we should expect women to be more incentivized to obtain education after the trade shock. The final part of our study puts this hypothesis into a test. Using the Chinese Population Census data, we find that input tariff liberalization has a positive effect on education attainment in China, and this effect is indeed more pronounced for women. This finding is robust to alternative measures of education attainment and samples. Therefore, while input tariff liberalization worsens gender disparity in the relative near term, its long-term impact is likely to be alleviated by this education effect.

We contribute to the relevant literature in several aspects. First, our study belongs to the broad literature on the distributional effects of trade liberalization. Existing studies in this literature have documented that globalization can have a causal effect on income inequality in various countries (e.g., Feenstra and Hanson, 1999; Goldberg and Pavcnik, 2007; Han et al., 2012; Helpman et al., 2010) via different mechanisms (e.g., Amiti and Davis, 2012; Brambilla et al., 2012; Bustos, 2011; Goldberg and Pavcnik, 2005; Verhoogen, 2008).[2] While the majority of these contributions focus on how trade shocks affect the skill premium, our work is more related to a small but growing strand of studies that examine the impacts of trade liberalization on gender inequality (e.g., Aguayo-Tellez et al., 2013; Juhn et al., 2013, 2014; Ozler, 2000; Wang et al., 2022). Previous work in this narrower strand of literature has investigated several channels through which trade liberalization can impact gender inequality. We add to it by exploring the effects of a new channel, input tariff reductions, on gender inequality. In addition, while previous work focuses primarily on gender income inequality, we provide complementary evidence on other dimensions of gender disparity, including working time, health, and education attainment.

Second, our study also contributes to the recently-emerged literature on trade and health. We depart from existing studies in two aspects. First, the majority of the existing contributions explore the health effects of import competition (e.g., McManus and Schaur, 2016; Pierce and Schott, 2016) or export expansion (e.g., Bombardini and Li, 2020;

[2] Goldberg and Pavcnik (2007) and Pavcnik (2017) provide excellent reviews of this literature.

Hummels et al., 2016; Oster, 2012). We study the health effects of input tariff liberalization. Second, while existing studies focus on the average level of health, we provide new findings on gender health disparity.

Third, our work complements the literature on the distributional effects of China's WTO accession. Han et al. (2012) find that the WTO accession was significantly associated with rising wage inequality. Han et al. (2016) study the role of market structure in determining the distributional effects of trade liberalization in China. Fan et al. (2020) show that the WTO accession widened both the income and health gaps between the skilled and the unskilled manufacturing workers in China. These existing studies examine mainly the inequality based on different skill levels. We contribute by offering new insights on gender disparities.

Finally, our paper is also related to the literature that examines the effects of greater access to imported intermediate inputs. Most existing studies in this literature focus on the impacts on firm performance measures, including total factor productivity (e.g., Amiti and Konings, 2007; Halpern et al., 2015; Kasahara and Rodrigue, 2008), product scope (Goldberg et al., 2010), and quality (e.g., Bas and Strauss-Kahn, 2015; Fan et al., 2015, 2018). We add to this literature by offering new results on gender disparities.

The rest of the paper is organized as follows. Section 2 describes our data, and Section 3 discusses our empirical strategy. Section 4 reports the main results on gender disparities in income, wage, working time, and health. Section 5 conducts further analysis on education attainment. Concluding remarks are provided in Section 6.

2 Data

2.1 Data Sources

Our study employs three main individual-level survey datasets, including the CHNS, the UHS, and the Chinese Population Census. CHNS is an international collaborative project by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health (NINH) at the Chinese Center for Disease Control and Prevention (CCDC). This survey uses a multistage, random cluster process to draw samples. It is conducted once every 2 or 3 years with a total of 10 waves in total, including 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011 and 2015. The data is mainly pooled cross-section in nature.

This survey contains detailed individual characteristics, including age, gender, education, time allocation, wage, occupation, and employer ownership status. It also covers rich information about individual health conditions, including illness and injury status, types of illness, disease history, smoking behavior, and possession of health insurance. Due to the severe missing data problem in early waves, we only use waves 1997 and after in our analysis.

Since the impacts of input tariff shocks fall mainly on the manufacturing sector (Fan et al., 2020), we focus on manufacturing workers in the CHNS data[3]. In addition, we restrict individuals' age in the range of 16 (the minimum legal working age in China) to 60 for men and 55 for women (the retirement ages for workers in China). Finally, to isolate the effect of informal jobs, we also exclude individuals whose weekly working hours are less than 10. Part A of the Data Appendix in Online Appendix describes the details of the sample selection criteria. The final CNHS sample we use in our main regressions includes around 7000 individuals working in the manufacturing sector. In addition, we also use individuals in the agricultural sector and the service sector for placebo tests.

A limitation of the CHNS data is that it covers only 52 prefectures of 11 Chinese provinces, and the sample sizes of the surveys are hence relatively small. To ensure the

[3] Individuals whose occupations are coded as 6 or 7 (see Panel A of Appendix Table 1 for the full industries code).

robustness of our findings, we also use another dataset, the UHS, in our analysis. The UHS is the official source of the living indicators for urban households in China, and the surveys are conducted by China's National Bureau of Statistics. The data is also mainly pooled cross-section in nature. The main advantage of the UHS data is its wide coverage. It covers 242 prefecture-level cities in 31 Chinese provinces. There are, however, two main disadvantages of the UHS data. First, and most important, it only contains individuals' yearly income while provides no information on hourly wage, working time, or health. As a result, we can only use it to examine income inequality. Second, compared to the CHNS data, the UHS contains less information on individual characteristics. It covers only some basic individual characteristics such as gender, age, and education level, as well as employment information such as working status, occupation, and sector.

In the UHS data, we also focus on workers in the manufacturing sectors from 16 to 55 (for females) or 60 (for males) years old.[4] Detailed sample selection criteria are provided in Part B of the Data Appendix. Our final UHS sample contains which contains about 92,000 individuals working in the manufacturing sector for the years 1999 - 2008.

The third dataset we use is obtained from the 1‰ random-sampled microdata from the 2000 and 2010 Chinese Population Census and the 2005 mini-Census, which cover almost all prefectures in China. We use this dataset to analyze the effects of input tariff shocks on education attainment. Details of the Census samples are discussed in Part C of the Data Appendix. Unfortunately, since the Census data does not include detailed and consistent measures for income, wage, working hours, and health conditions, we thus are not able to conduct the above-mentioned analyses using the Census data.

2.2 Measure of input tariff shock

We construct the prefecture-level input tariff shock measure following the approach of

[4] Individuals whose occupations are coded as 3 (see Panel B of Appendix Table 1 for the full industries code).

Amiti and Konings (2007) and Fan et al. (2020). First, we use the SITC code as the intermediary to match the HS code with the IO industry code. We then compute a sector-level output tariff by taking an average of the HS 6-digit code within each 2-digit IO industry code. Next, we use China's 2002 provincial-level input-output table to calculate the weighted input tariffs at the province level. Specifically, we compute the province-sector input tariffs as follows:

$$\tau_{i,s,t}^{input} = \sum_{k} a_{i,s,k} \tau_{k,t}^{output}$$

where $\tau_{k,t}^{output}$ is the output tariff on sector k in year t, and $a_{i,s,k}$ is the percentage of sector s's total costs spent on inputs supplied by industry k in province i.

Finally, using the Annual Survey of Industrial Firms in China, we construct prefecture-level input tariff shock as the following:

$$tariff_{p,t} = \frac{\sum_s Worker_{p,s,0} \tau_{i,s,t}^{input}}{Total\ Worker_{p,0}}$$

where $Worker_{p,s,0}$ is the number of workers in sector s and prefecture p at the beginning of our sample period and $Total\ Worker_{p,0}$ is the total number of workers in prefecture p at the beginning of our sample period. The two numbers are computed using firm-level data from the Annual Survey of Industrial Firms in China. The sector labor share has large cross-prefecture variations, indicating large geographical differences in industry distribution. By construction, an input tariff reduction will lead to a fall in our shock measure.

Figure 2 shows the regional exposures to the input tariff change over the period of 1997-2007. It is evident that there are large variations in the exposures to the trade shock across Chinese prefectures.

2.3 Outcome variables and control variables

Our study focuses on several key labor market outcomes including individuals' income, hourly wage, working time, health, and education attainment. To test the income effect of input tariff liberalization, we use manufacturing workers' yearly income (in natural log) as the dependent variable. We use both the CHNS data and the UHS to examine the income effect. To examine the impacts on wage and working time, we resort to the CHNS data, which provides information on manufacturing workers' hourly wages and weekly hours worked. We use a natural log transformation for these two variables in the regressions.

We also rely on the CHNS data to examine the effect of input tariff reductions on worker health. Our primary measure of workers' health status is a binary variable that takes the value of one if an individual has experienced illness or injury in the past four weeks and zero otherwise. The CHNS also provides information on types of illness. We use this information to construct two different categories of illness. The first category is muscle pain and fracture, which is often associated with heavy physical work by male workers. The second category includes all other diseases including headache, dizziness, fever, sore throat, cough, stomachache, asthma, rash, dermatitis, eye/ear disease, and heart disease.

Finally, to analyze the impact on individuals' education attainment, we use the Census data for young individuals from 16 to 25 years old. We construct two measures. One measure is the education level a young individual has obtained.[5] The other measure is a binary variable that takes the value of one if the individual is currently studying at school and zero otherwise.

We include two different sets of control variables in our regressions, one at the individual-level and the other at the prefecture-level. The individual-level controls are obtained from the CHNS, the UHS, and the Census data. The prefecture-level data used in our study are obtained from various Statistics Yearbooks at the national, provincial, and

[5] The education level ranges from 0 to 7: 1 = "Graduate from primary school", 2 = "Drop out from junior middle school", 3 = "Graduate from junior middle school", 4 = "Drop out from high school", 5 = "Graduate from high school", 6 = "Drop out from college", 7 = "Graduate from college or above", 0 = "Otherwise"

prefecture levels, the WITS (World Integrated Trade Solution) database, and the Census. Online Appendix Table 2 reports the variable definitions and data sources, and Online Appendix Tables 3 - 5 report the summary statistics for the CHNS, the UHS and the Census samples, respectively.

3 Empirical strategy

We employ the following benchmark empirical specification to examine the effects of input tariff reductions on a variety of measures of gender disparity in China:

$$y_{it} = \alpha Tariff_{p,t-1} + \beta Tariff_{p,t-1} * Female_i + \gamma X_{it} + \delta X_{p,t-1} + \lambda_t + \lambda_p + \epsilon_{it} \quad (1)$$

where i and t represent the individual and year, respectively. y_{it} is a measure of individual i's labor market outcome, such as income, wage, health, etc. $Tariff_{p,t-1}$ is the input tariff shock measure, and $Tariff_{p,t-1} * Female_i$ is our main variable of interest. The estimated coefficient on this interaction term captures the differential effect of trade liberalization on male and female workers.

X_{it} is a comprehensive set of individual-level controls. In the income, wage, and working time regressions, X_{it} includes gender, years of education, age, age square, residential status, marital status, minority status occupation type dummies, and employer ownership dummies. In our health regressions, we control further for individual disease history, smoking behavior, possession of medical insurance, and an abnormal BMI-index dummy.

We also include a set of prefecture-level controls, $X_{p,t-1}$, in our regressions. Specifically, we control for other trade-related policy shocks, including output tariff shocks, $Tariff\_Output$, the eliminations of trade uncertainty (e.g., Handley and Limão, 2017; Pierce and Schott, 2016, 2020) and export licenses (Bai et al., 2017) and the changes of quotas due to the expiration of global MFA.[6] In our health regressions, we also include in $X_{p,t-1}$, a prefecture-level measure of air quality to capture the effect of air pollution on health. Finally, we also include the year fixed effects, λ_t, and the prefecture fixed effects, λ_p, in all regressions to account for yearly shocks common to all individuals and all time-invariant differences across prefectures.

4 Main Results

4.1 Some preliminary data patterns

Before showing the regression results, we first present some preliminary data patterns. Table 1 conducts a simple mean comparison of the outcome variables across gender groups before and after the WTO accession. The last column of this table summarizes the difference-in-differences (DID) results. The first two rows report incomes (in natural log) in different periods using the CHNS and the UHS data, respectively. The income values obtained from the CHNS data are in constant 2015 value, and those from the UHS data are in constant 2008 value. To ensure the results are not driven by the extreme value, we winsorized the data by 1% in each tail. The results show that, even before the WTO accession, there existed a large gender gap in real average yearly income (in constant 2015 value or constant 2008 value), and this income gap widened further after WTO accession. For example, according to the CHNS data, before the WTO accession, the gender income differential was 0.168 (approximately 872 Yuan), which was about 12.7% of female workers' average yearly income in that period. The income differential increased to 0.305 (approximately 5340 Yuan) and accounted for 33.6% of female workers' average yearly income after the WTO accession.

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[6] The output tariff shock is constructed as $Tariff\_Output_{p,t} = \frac{\sum_s Worker_{p,s,0}\tau_{k,t}^{output}}{Total\ Wor\quad_{p,0}}$.

Rows (3) and (4) show the results on hourly wage and working time (also in natural log), respectively. We observe a similar pattern for the hourly wage. Male workers earned a higher wage before the WTO accession, and wage inequality widened further after the WTO accession. As for working time, before the WTO accession, females spent less time on work than males, but the trend was reversed after WTO accession. Taken together, these patterns seem to suggest that the increased income gap was not due to a relative increase in male workers' working time but a worsened wage inequality.

The medical literature has documented the causal effects of income and working time on health (e.g., Berniell and Bietenbeck, 2020; Hamermesh et al., 2017; Rod et al., 2017). Row (5) hence compares the gender health gaps before and after the WTO accession. We find that there was no sizeable gender difference in health conditions before the WTO accession. Male workers actually had a slightly higher probability of experiencing sickness or injury. However, after the WTO accession, female workers had a much higher chance of getting sick or injured. The next two rows further decompose sickness and injury into two types, one for muscle pain and fracture and the other for other diseases, which includes headache, dizziness, fever, sore throat, cough, stomachache, asthma, rash, dermatitis, eye/ear disease, and heart disease. The results from this decomposition indicate that male workers had a higher chance of getting muscle pain and bone fractures after WTO while female workers are more likely to suffer from other diseases. This is consistent with the fact that male workers are more likely to do heavy physical work.

Finally, the last two rows report the before-after comparison of the gender education gaps using the Census data. The results show that the gender disparity in education narrowed after the WTO accession.

4.2 The effect on income

After presenting some basic data patterns, we now turn to the formal regression analysis. We first investigate how the input tariff shocks affect manufacturing workers' income. We do so by estimating Equation (1) using yearly income (in natural log) as the dependent variable and report the estimation results in the first two columns of Table 2. In Column (1), we use the CHNS data and regress the dependent variable on our input tariff shock measure, the female dummy, and their interaction term, controlling for individual characteristics, a set of other trade policy variables at the prefecture-level, along with prefecture and year fixed effects.

The estimated coefficient on the input tariff shock measure is negative and statistically significant, indicating a significantly positive effect of input tariff reductions (a fall in Tariff) on male manufacturing workers' income. However, the coefficient on our variable of main interest, Tariff*Female, is significantly positive, suggesting a significantly smaller effect on female workers' income and thus a widened gender income gap. The estimated interaction effect is also quantitatively sizable. A one-standard-deviation reduction in our prefecture-level input tariff is associated with an increase in the gender income gap of 680 yuan in constant 2015 value.[7] Since the coefficient on the interaction term is smaller than that on the input tariff variable, the overall result implies that, in absolute terms, input tariff reductions still increase female workers' income.

As for control variables, we find that having a longer education year or being married is associated with a significantly higher income. The coefficient on age is significantly positive but that on the age square is significantly negative. We also find that output tariff reductions, the elimination of policy uncertainty and quotas significantly increase the income in the manufacturing sector. Other controls are statistically insignificant.

A limitation of the CHNS data is that it covers only 52 prefectures of 11 Chinese provinces. To ensure the robustness of results, we also make use of the UHS data which

[7] This effect is computed as [exp(0.852*0.06)-1]*exp(9.470)≈680, where 0.06 is the standard deviation of the input tariff shock variable.

covers 242 prefectures in all 31 Chinese provinces. As discussed in Section 2.1, a disadvantage of the UHS data is that it contains less information on individual characteristics. As a result, we can only include age, age square, and education level as individual-level controls in the regression.

Column (2) of Table 2 reports the results from the UHS data. They are consistent with those obtained from the CHNS sample. The reductions of input tariff are associated with higher incomes for all workers, but the beneficial income effect is significantly smaller for female workers resulting in an increased gender income inequality. The increase in gender income inequality is also economically meaningful: a one-standard-deviation reduction in our input tariff shock measure increases the gender income difference by 385-yuan in constant 2008 value.[8]

4.3 The effects on hourly wage and working time

To further explore whether the increase in gender income disparity is driven by wage or working time, we separately examine hourly wage and working time. We replace the dependent variable in Equation (1) with these two variables and report the regression results in Columns (3) and (4) of Table 2, respectively. In Column (3), the estimated coefficient on input tariff is significantly negative but that on the interaction term is positive and statistically significant. Quantitatively, the estimated effect on the input tariff measure is larger than the interaction effect. The overall evidence in Column (3) hence indicates that input tariff reductions increase wages for both male and female workers, but the effect is significantly weaker for the latter, resulting in an increase in gender wage gap.

In Column (4), we find that input tariff reductions have no significant effect on male workers' working time as the coefficient on the input tariff shock measure is negative but

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[8] Since the UHS data does not provide corresponding CPI data for different regions like CHNS, we adjust the income in UHS data by the CPI in national level to the last wave (2008). $[\exp(1.077*0.035)-1]*\exp(9.212) \approx 385$, where 0.035 is the standard deviation of the input tariff shock variable.

insignificant. However, the negative and significant coefficient on the interaction term suggests that input tariff reductions significantly increase female workers' working time relative to that of male workers. Taken together, the results in Columns (3) and (4) suggest that the worsening of gender income inequality found in Columns (1) and (2) is not due to a longer working time of male workers but a large gender wage gap. Although female workers' working time increased relative to male workers, their relative income declined.

4.4 The effect on health

Our results in Table 2 show that input tariff liberalization not only reduced female workers' relative income but also increased their relative working time. Since a low income has a negative effect on workers' nutrition, and a long working time can also adversely affect health. Both tend to worsen the gender health gap. We thus examine in this subsection how input tariff reductions affect manufacturing workers' health and the gender health gap.

The results are reported in Table 3. In Column (1), we estimate Equation (1) using our main measure of worker health condition, a binary indicator of experiencing illness or injury in the past four weeks, as the dependent variable. In addition to the controls used in the previous regression, here we also add individual health-related variables and a prefecture-level measure of air quality as additional controls. These individual health-related include disease history, smoking behavior, abnormal BMI index and medical insurance.

We find that input tariff reductions also result in gender health inequality as the estimated coefficient on the interaction term between the input tariff shock measure and the female dummy is significantly negative. The estimated effect on the gender health gap is also quantitatively substantial: a one-standard-deviation reduction in our input tariff shock measure is associated with a 2.4-percentage-point gender gap in the probability increase of getting illness or injury.[9] This is a large effect as the average rate of getting sick or injured

[9] $[\exp(0.359*0.06)-1]*\exp(0.087) \approx 0.0238$

is less than 9 percent in our sample.

The next two columns of Table 3 decompose the general measure of sick and injury into two different types. Column (2) examines the effect on the likelihood of experiencing muscle pain or fracture, and Column (3) investigates the effect on experiencing other diseases. The results in Column (2) show that, interestingly, although input tariff reductions significantly increase both male and female workers' likelihood of getting muscle pain and fracture, this adverse effect is actually significantly smaller for female workers. On the contrary, the findings in Column (3) suggest that input tariff liberalization has a significantly larger adverse effect on female workers' likelihood of getting other diseases. The heterogeneous effects on different types of illness are consistent with the fact that male workers are more likely to do heavy physical work, where muscle pain and fracture are more likely to occur.

4.5 Robustness Checks

In this subsection, we conduct a battery of sensitivity analyses to ensure the robustness of our main findings. We first check if our results are sensitive to controlling for the interaction effects between input tariff and other individual characteristics. For example, if the female workers are relatively younger and have lower education than male workers on average, then our results may potentially reflect the difference in age or education rather than gender. To address this concern, we create interaction terms between our input tariff shock measure and the individual's age, age square, and years of education. We then re-estimate main regressions while including these interaction terms as additional controls. The results are reported in Table 4, and they show that controlling for additional interaction effects does not alter our findings.

Second, to address the concern on the exogeneity of input tariff changes, we follow the existing literature (e.g., Fan et al., 2020; Goldberg and Pavcnik, 2005; Kovak, 2013) and examine the relationship between the weighted average input tariff changes and weighted average initial input tariffs across prefectures. A negative relationship between the two would indicate that the reductions were determined mainly by the pre-liberalization tariff levels rather than political economy considerations. To check if this is the case, we plot in Figure 3 a prefecture's change in input tariff from 1997 to 2007 against its pre-WTO tariff rates in 1997. Panel A of Figure 3 shows the relationship for all Chinese prefecture cities, and Panel B illustrates the pattern using the prefectures included in the CHNS sample. It is evident in both panels that prefectures with higher initial input tariffs experienced more significant cuts. Only one prefecture city, Shiyan, seems to deviate from this negative linear relationship. We hence conduct an additional robustness check by excluding this outlier prefecture from our CHNS sample. As shown in Panel A of Table 5, our main findings still hold after dropping this outlier.

Another potential concern of our results is whether they are sensitive to controlling for prefecture-specific linear trends. We conduct this exercise in Panel B of Table 5. The results suggest that controlling for prefecture-specific linear trends does not affect our main findings either. Next, we also follow Erten and Leight (2021) and Fan et al. (2020) and conduct a test for pre-trends by evaluating the correlations between initial tariffs and outcomes in different years. Specifically, we replace the interaction term with a series of interaction terms between the initial tariff shock in 1997 and the survey wave dummies. Since the initial tariff shock has no time variation, its interaction with the 1997 dummy is omitted due to including prefecture fixed effects in the regression. The estimated coefficients for the rest of the interaction terms are demonstrated graphically in Figure 4. The post-WTO coefficients are consistently significant and large in magnitudes. The graphical patterns are thus consistent with view that initial tariffs are uncorrelated with pre-WTO outcomes, but predictive of those in the post-WTO period.

Finally, we also perform a set of placebo tests to rule out the possibility that our findings are driven by some prefecture-level unobservable factors that influence all individuals. If the effects on wages, health conditions, and working time are indeed caused by input tariff shocks, they should affect mainly workers in the manufacturing sector. Table 6 shows the placebo test results. Panel A considers workers in the agriculture sector.[10] We find that the interaction term of input tariff shock and the female dummy is statistically insignificant in all columns, indicating no whatsoever effect on the gender gaps for individuals in the agricultural sector. Panel B considers those in the service sector. We find that input tariff reductions have no differential effects on working time or health for service workers. Moreover, in this sector, input tariff reductions actually increase female workers' income and wage relative to those of male workers.

5 The Role of Education

Existing studies in the literature identify education as a crucial determinant of the distributional effects of trade liberalization. Hence, in this section, we conduct two additional sets of analyses related to education. First, we examine whether education also plays a role in determining the effects of input tariff liberation on different measures of gender disparity. Second, we test further the effect of input tariff reductions on Chinese youth's education attainment.

5.1 Heterogeneity: the role of education

This subsection explores whether the effects of input tariff liberation on gender disparities vary across different education levels. To do so, we divide the CHNS sample into two subsamples based on manufacturing workers' level of education. Workers who have a

[10] Since quite a few individuals in the agriculture sector do not have a formal wage like those in the manufacturing or service sector, we defined their yearly income based on their income from farming, fishing, and raising livestock and calculate their hourly wage by dividing their incomes by their working time.

high school education or above are considered as skilled and those without a high school diploma are included in the unskilled category. We then run our main regressions in these two subsamples.

Table 7 presents the subsample regression results. Columns (1) and (2) compare the effects on yearly income for skilled and unskilled workers. The results show that the increase in gender income disparity is mainly caused by the differential effects on the unskilled. The coefficients on input tariff shock and its interaction with the female dummy are insignificant in the skilled subsample, meaning input tariff reductions have no significant effect on gender income disparity for skilled workers. These coefficients, however, turn significantly negative and significantly positive in the unskilled sample. That is, for the unskilled, input tariff reductions significantly increase male workers' income but the effect on female workers' income is significantly weaker, implying a widened gender income disparity.

Next, we decompose income into hourly wage and working time. The results in Columns (3) and (4) show that, for both skilled and unskilled workers, input tariff reductions lead to a larger gender wage disparity as the coefficients on the interaction term are significantly positive with similar magnitude in both columns. The results in Columns (5) and (6), however, suggest that, only in the unskilled subsample, input tariff reductions increase female workers' relative working time.

Finally, we compare the effects on worker health for the skilled and unskilled in the last two columns of Table 7. The interaction term is found to be insignificant in the skilled subsample but significantly negative in the unskilled subsample. This finding suggests that the input tariff reductions lead to a larger gender health disparity only for the unskilled. Overall, the results in Table 7 show that workers' education plays an important role in determining the effects of input tariff shocks on gender disparities. While the input tariff reduction puts female workers at a disadvantage in general, its impacts fall mostly on the unskilled.

5.2 The effect on education attainment

Our results in Table 7 show that the gender income and health disparities are more prevalent for unskilled workers, which may incentivize females to invest more in their human capital. To check whether this is the case, we examine in Table 8 the effects of input tariff reductions on individuals' education attainment using the Census data. We construct two different measures of education. Panel A uses a binary variable that takes the value of unity if the individual is currently at school and zero otherwise as the outcome variable, and the dependent variable in Panel B is the level of education. In Panel A, we consider two samples. Columns (1) – (3) use a sample of all young individuals whose ages are between 16 and 25 while Columns (4) – (6) utilize a sample of all young individuals whose ages are between 18 and 25. Since China implements a nine-year compulsory education policy, the two samples are used to examine the likelihood of currently attending high school or above and college or above, respectively.

In Panel B, we also consider two samples. Columns (1) – (3) use again the sample of all young individuals whose ages are between 16 and 25, while Columns (4) – (6) consider only manufacturing workers.[11] In each panel, we use the baseline specification of Equation (1) in Columns (1) and (4) but exclude the education level from the list of control variables. In Columns (2) and (5), we also control for the interaction terms: $Tariff * Age$ and $Tariff * Age\ Square$. Finally, following the strategy in Panel B of Table 5, we additionally control for the prefecture linear trend as a robustness check and present the results in Columns (3) and (6).

In all columns, we find that the coefficients on our variable of interest,

[11] By definition, manufacturing workers cannot be at school. So we cannot use the manufacturing sample in Panel A.

$Tariff * Female$, are significantly negative. That is, input tariff reductions reduce the education gap between men and women in China. This is consistent with our speculation that female workers have a higher incentive to obtain more education after the input tariff liberation. This finding also has an interesting long-run implication. Since the input tariff reductions increase the gender disparities mainly only for the unskilled, the fact female workers are getting more education may help to narrow these disparities in the long term. Moreover, there is also evidence that input tariff reductions increase Chinese young men's education attainment, as the coefficients on the input tariff shock measure are mostly negative and significant.

6 Conclusions

This paper examines the impacts of input tariff liberalization on gender disparities using China's WTO accession as a natural experiment. By exploiting the regional variations in the exposures to the input tariff shocks, we first show that input tariff reductions result in higher incomes for all manufacturing workers, but the positive income effect is significantly smaller for females. Further analysis on hourly wage and working time reveals that the increase in the gender income gap is not due to a relative increase in male workers' working time but a widened gender wage gap instead. These findings are consistent with a more elastic labor supply of female workers.

Since both income and working time can have health consequences, we then move one step forward to investigate the impact of input tariff liberalization on the gender health gap. The results suggest that female manufacturing workers in prefectures with more exposure to input tariff reduction shocks experienced a higher likelihood of suffering from illness or injury than male workers. We then divide illness into two broad categories, muscle pain and fracture and other diseases. The first type of illness is typically associated with heavy physical work while the second type is common to all other types of work. The results show that, compared to male workers, female workers are less likely to suffer from muscle pains and fractures but have a significantly higher probability of suffering from other types of disease.

We then investigate the heterogeneous effects on skilled and unskilled workers and find that the widened gender income and health gaps apply mainly to the unskilled. Finally, we also analyze the effects of input tariff reductions on individuals' education attainment. We find that both men and women respond to the trade shock by investing more in education, and the effect is more pronounced for females. Since education helps to alleviate the gender disparities, this finding implies that the worsening of the gender disparities due to the trade shock is likely to be less dramatic in the long term due to this education effect.

Our study enriches the growing literature on trade liberalization and gender inequality. We explore a new channel of trade liberalization, namely, input tariff reductions, through which trade liberalization can influence gender inequality. In addition to examining gender income and wage gaps, we also provide new evidence on health and education. Our work also contributes to the literature on trade and health. In particular, we offer new findings on how trade liberalization can influence the gender health gap. Finally, this study also complements the literature on the distributional effects of China's WTO accession. While most existing contributions in this literature focus on the skill premium, we show that China's WTO accession also has significant effects on gender disparities.

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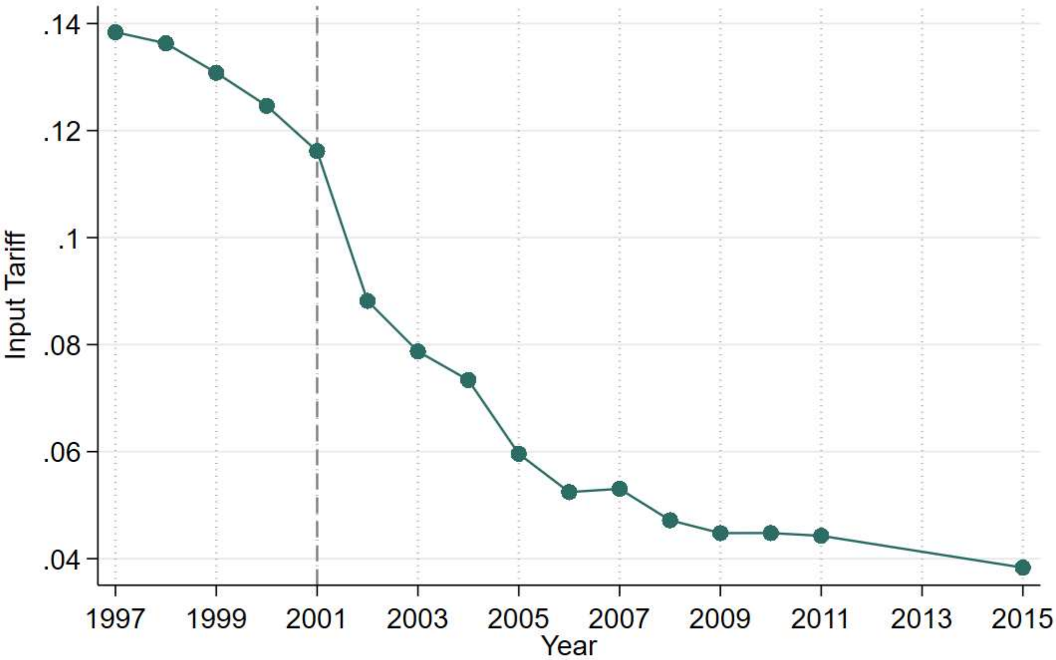
Figure 1 Input Tariff Trend



Source: WITS, 2002 IO table and ASIF

Figure 2 Chinese Prefectures' Exposures to Input Tariff Shock

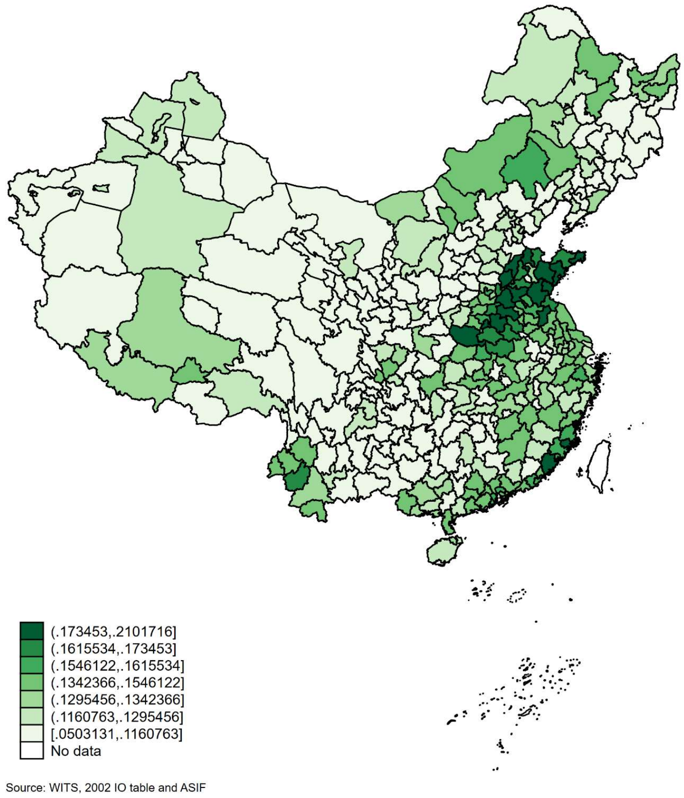


Figure 3 Tariff Change and Initial Tariff Level

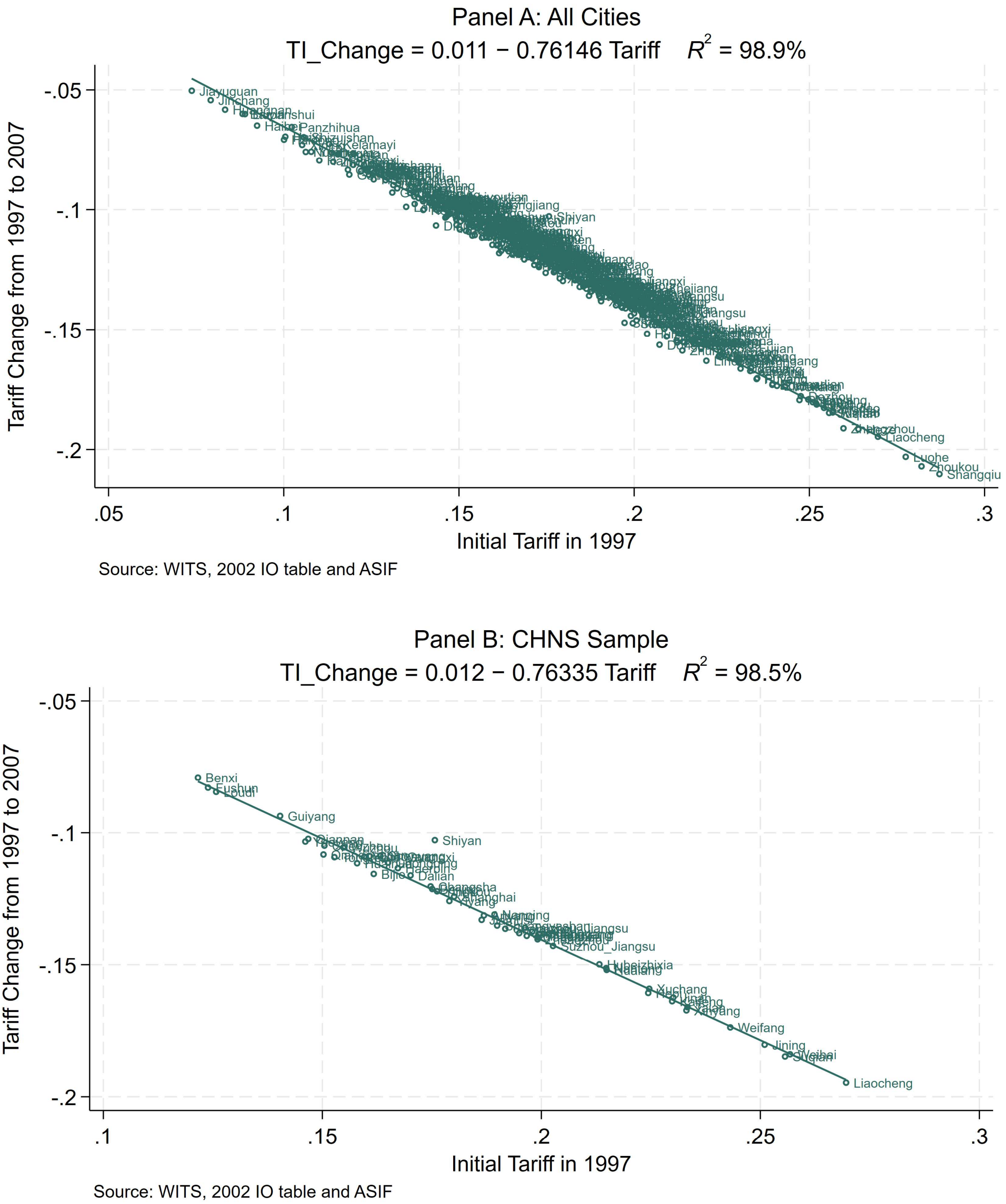


Figure 4. Estimated DID Coefficients

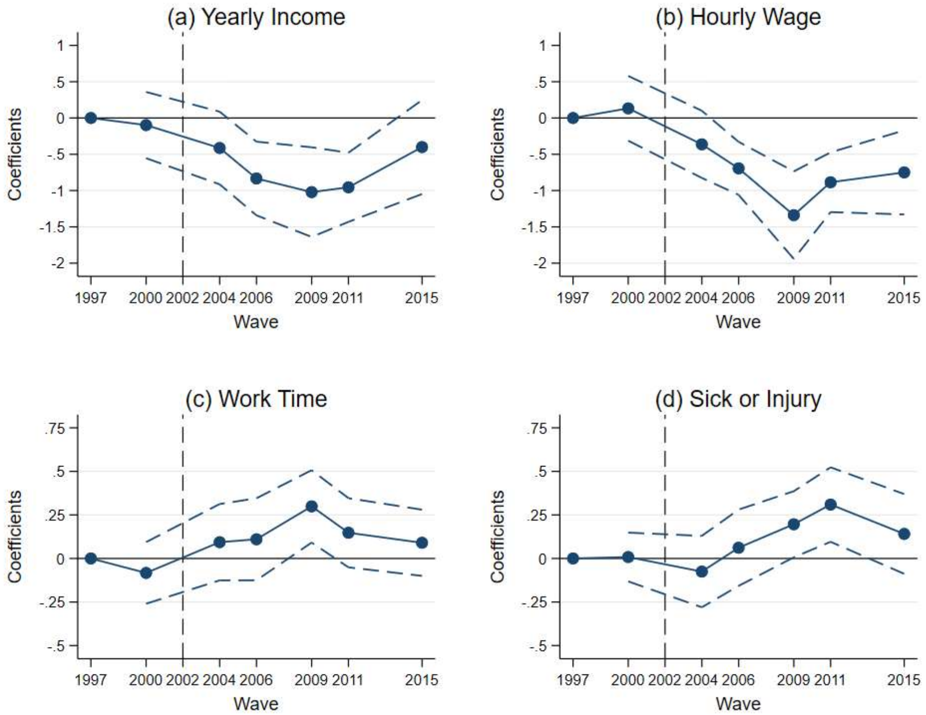


Table 1 Before and After Mean Comparisons

Variables	Before WTO			After WTO			Change
	Male	Female	Difference	Male	Female	Difference	DID
(1) Log(Yearly Income (CHNS))	8.991	8.823	0.168	9.881	9.576	0.305	0.137
(2) Log(Yearly Income (UHS))	8.821	8.577	0.245	9.423	9.124	0.299	0.054
(3) Log(Hourly Wage)	1.360	1.209	0.151	2.261	1.922	0.339	0.248
(4) Log(Working time)	3.808	3.781	0.028	3.857	3.890	-0.033	-0.061
(5) Sick or Injury	0.056	0.050	0.006	0.098	0.123	-0.024	-0.03
(6) Muscle Pain or Fracture	0.036	0.037	-0.001	0.084	0.058	0.026	0.027
(7) Other Diseases	0.051	0.041	0.009	0.121	0.151	-0.029	-0.038
(8) Level of Education	3.224	3.089	0.135	3.789	3.751	0.038	-0.097
(9) Currently at School	0.212	0.182	0.031	0.336	0.320	0.016	-0.015

Table 2 The Effect on Income, Wage, and Working Time

	(1) Income_CHNS	(2) Income_UHS	(3) Hourly Wage	(4) Working Time
Tariff	-2.776**	-3.071***	-2.580**	-0.584
	(1.266)	(1.077)	(1.036)	(0.389)
Tariff*Female	0.852***	1.077***	1.224***	-0.408***
	(0.318)	(0.141)	(0.298)	(0.108)
female	-0.343***	-0.338***	-0.382***	0.035**
	(0.042)	(0.013)	(0.035)	(0.015)
eduyear	0.014***	0.042***	0.008**	-0.005***
	(0.004)	(0.001)	(0.003)	(0.001)
age	0.028***	0.088***	0.025***	-0.007***
	(0.008)	(0.003)	(0.006)	(0.003)
agesquare	-0.000***	-0.001***	-0.000***	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
urban	0.050		0.093**	-0.003
	(0.051)		(0.045)	(0.028)
married	0.079**		0.042*	0.032***
	(0.032)		(0.025)	(0.012)
minority	-0.016		0.008	0.006
	(0.040)		(0.042)	(0.018)
Tariff_Output	2.519**	6.266***	1.713	1.477***
	(1.226)	(1.136)	(1.109)	(0.339)
Exportpolicyuncertainty	0.189***	-0.023	0.190***	-0.021
	(0.065)	(0.021)	(0.060)	(0.025)
Tradelicensepolicy	0.303	-0.013	0.102	0.116
	(0.293)	(0.020)	(0.285)	(0.111)
Quotapolicy	-0.152***	-0.007	-0.164***	0.006
	(0.056)	(0.011)	(0.052)	(0.022)
Constant	8.365***	6.054***	0.760**	3.844***
	(0.344)	(0.149)	(0.352)	(0.131)
Observations	5,909	92,087	5,844	6,761
R-squared	0.465	0.441	0.557	0.160
Occupation Type	Y	Y	Y	Y
Employer Ownership	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y

Notes: All regressions include output tariff shock, a set of individual characteristics, other trade policy shocks, a constant, prefecture fixed effects, and year fixed effects. Column (1) shows the effect on yearly income with the CHNS sample, and Column (2) shows the result on yearly income with the UHS sample. Column (3) shows the effect on hourly wage, and Column (4) shows the result on working time. Standard errors clustered at the prefecture-year level are in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 3 Benchmark Results on Health

	(1)	(2)	(3)
	Overall	By Disease Type	
	Sick or Injury	Muscle Pain or Fracture	Other Diseases
Tariff	-0.365	-0.703**	-0.051
	(0.385)	(0.284)	(0.399)
Tariff*Female	-0.359***	0.153**	-0.386***
	(0.113)	(0.074)	(0.110)
Female	0.057***	-0.027**	0.061***
	(0.018)	(0.012)	(0.017)
Disease History	0.116***	0.024*	0.140***
	(0.022)	(0.014)	(0.022)
Smoking	0.003	-0.000	0.008
	(0.009)	(0.008)	(0.010)
Abnormal BMI	0.003	0.022***	-0.001
	(0.007)	(0.007)	(0.007)
Health Insurance	0.016*	-0.005	0.016*
	(0.010)	(0.008)	(0.009)
Log(Air Quality Index)	0.043	0.045*	-0.006
	(0.044)	(0.026)	(0.046)
Observations	7,207	7,207	7,207
R-squared	0.051	0.053	0.066
Individual Controls	Y	Y	Y
Other Trade Policy	Y	Y	Y
Occupation Type	Y	Y	Y
Employer Ownership	Y	Y	Y
Year FE	Y	Y	Y
Prefecture FE	Y	Y	Y

Notes: All regressions include a constant, the full set of control variables in the benchmark regression of Table 2, occupation type dummies, employer ownership dummies, prefecture fixed effects, and year fixed effects. To ensure the effects are not driven by the individuals' initial health conditions, we additionally control four health-related variables. Outcomes are namely the dummy for all types of sickness or injury mentioned in the survey, the dummy for muscle pain or bone fracture, and the dummy for all other diseases. Standard errors clustered at the prefecture-year level are in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 4 Controlling for Additional Interaction Effects

	(1) Income	(2) Hourly Wage	(3) Working Time	(4) Sick or Injury
Tariff	-5.028**	-2.442	-0.623	-2.126***
	(2.336)	(1.810)	(0.855)	(0.805)
Tariff*Female	0.704**	1.137***	-0.361***	-0.315***
	(0.331)	(0.302)	(0.110)	(0.115)
Tariff*Age	0.234*	0.086	-0.014	0.063
	(0.124)	(0.093)	(0.043)	(0.040)
Tariff*Age Square	-0.003**	-0.001	0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)
Tariff*Education	-0.161***	-0.162***	0.005	0.048**
	(0.053)	(0.047)	(0.020)	(0.020)
Observations	5,909	5,844	6,761	7,207
R-squared	0.467	0.558	0.161	0.053
Individual Controls	Y	Y	Y	Y
Other Trade Policy	Y	Y	Y	Y
Occupation Type	Y	Y	Y	Y
Employer Ownership	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y

Notes: All regressions include a constant, prefecture fixed effects, year fixed effects, a set of individual characteristics, and trade policy shocks. To isolate the effects from the interaction between tariff change and individual characteristics, we additionally control three interaction terms: Tariff*Age, Tariff*Age Square and Tariff * Education. Standard errors clustered at the prefecture-year level are in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 5 Excluding Outlier and Controlling for Prefecture Linear Trend

	(1) Income	(2) Hourly Wage	(3) Working Time	(4) Sick or Injury
		Panel A: Exclude Outlier		
Tariff	-2.928**	-2.813***	-0.632	-0.351
	(1.262)	(1.035)	(0.396)	(0.384)
Tariff*Female	0.854***	1.211***	-0.414***	-0.374***
	(0.321)	(0.301)	(0.109)	(0.113)
Observations	5,713	5,646	6,540	6,976
R-squared	0.465	0.560	0.159	0.053
		Panel B: Prefecture Linear Trend		
Tariff	-0.811	-0.331	0.222	-2.131*
	(3.622)	(2.714)	(1.196)	(1.131)
Tariff*Female	0.736**	1.129***	-0.382***	-0.336***
	(0.327)	(0.310)	(0.118)	(0.123)
Observations	5,909	5,844	6,761	7,207
R-squared	0.479	0.566	0.170	0.060
Individual Controls	Y	Y	Y	Y
Other Trade Policy	Y	Y	Y	Y
Occupation Type	Y	Y	Y	Y
Employer Ownership	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y

Notes: All regressions include a constant, prefecture fixed effects, year fixed effects, a set of individual characteristics, and trade policy shocks. All regressions in Panel A exclude the outlier city, Shiyan, from the sample. The regressions in Panel B conduct an analysis by additionally controlling the prefecture-wave fixed effect. Outcomes are namely the yearly income, the hourly wage, the weekly working time, and the dummy for sick or injured. Standard errors clustered at the prefecture-year level are in parentheses in Panel A and at the prefecture level are in parentheses in Panel B. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 6 Placebo Tests

	(1) Income	(2) Hourly Wage	(3) Working Time	(4) Sick or Injury
		Panel A: Agriculture		
Tariff	4.353**	2.789	-0.237	-0.970***
	(2.001)	(15.159)	(2.758)	(0.363)
Tariff*Female	-0.483	-2.694	0.082	0.038
	(0.442)	(1.648)	(0.343)	(0.065)
Observations	12,649	5,627	7,343	14,878
R-squared	0.267	0.317	0.190	0.047
		Panel B: Service		
Tariff	-5.422***	-5.238***	0.825	-0.517
	(1.609)	(1.371)	(0.755)	(0.687)
Tariff*Female	-1.169**	-1.279**	-0.048	-0.008
	(0.542)	(0.506)	(0.236)	(0.122)
Observations	2,688	2,669	4,088	4,736
R-squared	0.406	0.499	0.103	0.057
Individual Controls	Y	Y	Y	Y
Other Trade Policy	Y	Y	Y	Y
Occupation Type	Y	Y	Y	Y
Employer Ownership	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y

Notes: All regressions include a constant, a full set of control variables, occupation type dummies, employer ownership dummies, prefecture fixed effects and year fixed effects. Panel A is for the agriculture sector, and Panel B is for the service sector. Outcomes are the yearly income, the hourly wage, the weekly working time, and the dummy for sick or injury from Columns (1) to (4) for both panels. Standard errors clustered at the prefecture-year level are in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 7 Heterogeneity: Skilled vs. Unskilled

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Income		Hourly Wage		Working Time		Sick or Injury	
	Skilled	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled	Unskilled
Tariff	-1.422	-3.017**	-0.006	-3.074***	-1.341***	-0.345	-0.486	-0.350
	(1.715)	(1.405)	(1.409)	(1.093)	(0.505)	(0.516)	(0.635)	(0.474)
Tariff*Female	0.511	1.014***	1.115**	1.266***	-0.203	-0.444***	-0.262	-0.382***
	(0.455)	(0.375)	(0.476)	(0.330)	(0.198)	(0.134)	(0.180)	(0.132)
Observations	1,910	3,999	1,886	3,958	2,089	4,672	2,172	5,035
R-squared	0.511	0.448	0.609	0.534	0.167	0.159	0.063	0.057
Individual Controls	Y	Y	Y	Y	Y	Y	Y	Y
Other Trade Policy	Y	Y	Y	Y	Y	Y	Y	Y
Occupation Type	Y	Y	Y	Y	Y	Y	Y	Y
Employer Ownership	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y	Y	Y	Y	Y

Notes: All regressions include a constant, prefecture fixed effects, year fixed effects, a set of individual characteristics, and trade policy shocks. Columns (1), (3), (5) and (7) are for individuals with a high school education level or above, and Columns (2), (4), (6) and (8) are for the otherwise. Standard errors clustered at the prefecture-year level are in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Table 8 The Effect on Education Attainment

	(1) Baseline	(2) Additional Interaction Terms	(3) Control Linear Trend	(4) Baseline	(5) Additional Interaction Terms	(6) Control Linear Trend
	Panel A: Currently at School					
	Age 16-25			Age 18-25		
Tariff	-1.751***	6.905***	-3.337***	-1.811***	0.736	-3.042***
	(0.242)	(1.960)	(1.263)	(0.266)	(2.519)	(1.141)
Tariff*Female	-0.240***	-0.262***	-0.241***	-0.142***	-0.157***	-0.144***
	(0.025)	(0.025)	(0.022)	(0.025)	(0.025)	(0.022)
Observations	2,527,910	2,527,910	2,527,910	2,016,620	2,016,620	2,016,620
R-squared	0.344	0.351	0.346	0.260	0.269	0.263
	Panel B: Education Level					
	Age 16-25			Age 16-25 (Manu)		
Tariff	1.394	42.513***	-10.118***	-7.932***	-22.763***	-22.348***
	(1.262)	(4.561)	(2.958)	(1.434)	(5.104)	(5.745)
Tariff*Female	-1.460***	-1.422***	-1.466***	-0.949***	-1.021***	-1.034***
	(0.139)	(0.137)	(0.100)	(0.232)	(0.241)	(0.253)
Observations	2,527,910	2,527,910	2,527,910	354,700	354,700	354,700
R-squared	0.303	0.304	0.306	0.173	0.173	0.179
Individual Controls	Y	Y	Y	Y	Y	Y
Tariff Age Inter	N	Y	N	N	Y	N
Other Trade Policy	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y	Y	Y

Notes: All regressions include a constant, the full set of control variables (except for marital status) of Table 2, prefecture fixed effects and year fixed effects. The outcome of Panel A is the dummy of whether currently at school or not; the outcome of Panel B is the education level. The sample for Columns (1) – (3) of both panels is the individuals between 16 to 25. The sample for Columns (4)-(6) of Panel A is the individuals between 18 to 25, and the sample of Panel B is for the individuals between 16 to 25 in the manufacturing sector. Columns (1) and (4) follow the benchmark specification as Table 2; Columns (2) and (5) control two interaction terms (Tariff * Age, Tariff * Age Square) additionally; Columns (3) and (6) additionally control for the prefecture-year fixed effect. Standard errors clustered at the prefecture-year level are in parentheses for Columns (1), (2), (4) and (5), and at the prefecture level are in parentheses for Columns (3) and (6). ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

Online Appendix (Not for Publication)

Data Appendix

Part A. The CHNS Sample

Panel A of Appendix Table 1 provides a list of occupations in the CHNS. Among the 13 occupations, we use individuals whose occupations are coded as 6 or 7 as manufacturing workers in our main analysis. We exclude individuals under 16 or above 55 (60) for females (males), and individuals whose weekly working hours are less than 10. In our robustness checks, we consider individuals whose occupations are coded as 5 as workers in the agriculture sector and those coded as 11 as workers in the service sector.

Part B. The UHS Sample

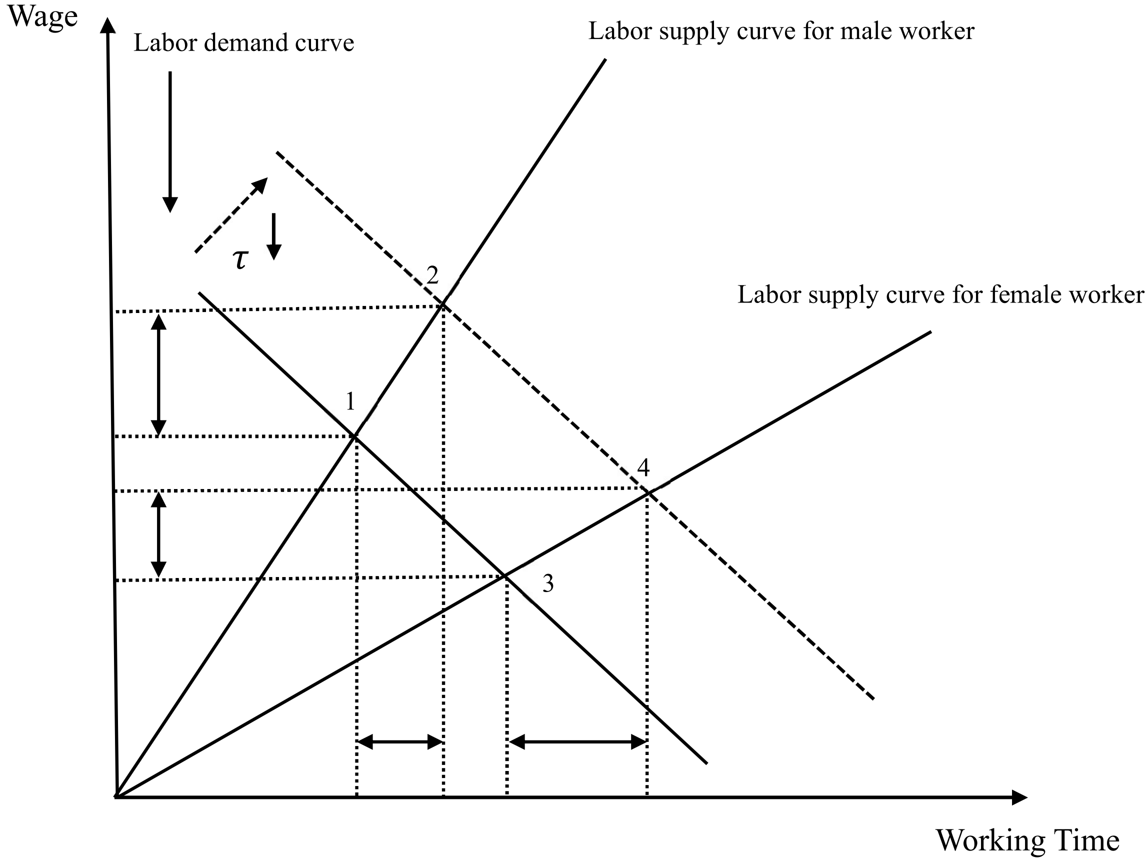
Panel B of Appendix Table 1 provides a list of occupations in the UHS. Among the 16-20 industries available[12], we restrict our sample to the workers in the manufacturing sector (Code = 3). We also exclude individuals under 16 or above 55 (60) for females (males) and those who did not report any job information from the sample.

Part C. The Census Sample

We consider three different samples from the Census data. The first sample includes all individuals whose ages are between 16 to 25 while the second sample contains individuals whose ages are between 18 to 25. The last sample contains only manufacturing workers whose ages are between 16 to 25. The summary statistics of these two samples are shown in Panels A, B, and C of Appendix Table 5.

[12] For the waves until 2005, there are 16 industries available; For the waves since 2006, there are 20 industries. But the code for manufacturing sector is always 3 in our sample waves.

Appendix Figure 1 Gender Difference in Labor Supply



Appendix Table 1 Industries Code

Panel A: CHNS Code

Code	Description of occupation
1	Senior professional technical workers (professor, doctor, lawyer, etc.)
2	General professional technical workers (teacher, nurse, editor, etc.)
3	Officials and administrators (government workers)
4	Office workers (secretary, clerk)
5	Farmers, fishers, hunters
6	Experienced factory workers
7	Less experienced factory workers
8	Military officers and high-ranked police officers
9	Soldiers and low-ranked police officers
10	Drivers
11	Service workers (barber, cook, shop assistant, etc.)
12	Athletes, actors, performers
13	Others

Panel B: UHS Code

Until 2005		Since 2006	
Code	Industry Type	Code	Industry Type
1	Agriculture, forestry, animal husbandry and fishery	1	Agriculture, forestry, animal husbandry and fishery
2	Extractive industry	2	Extractive industry
3	Manufacturing industry	3	Manufacturing industry
4	Electricity, gas and water production and supply industry	4	Electricity, gas and water production and supply industry
5	Construction industry	5	Construction industry
6	Geological survey industry, water management industry	6	Transportation, storage and post and telecommunications
7	Transportation, storage and post and telecommunications	7	Information transmission, computer services and software industry
8	Wholesale and retail, catering industry	8	Wholesale and retail industry
9	Financial Industry	9	Accommodation and catering industry
10	Real Estate industry	10	Financial Industry
11	Social Services	11	Real Estate industry
12	Health, sports and social welfare industry	12	Rental and business services
13	Education, culture and arts and radio, film and television industry	13	Scientific research, integrated technical services and the geological survey industry
14	Scientific research and integrated technical services	14	Water, environment and public facilities management industry
15	Government institutions and social organizations	15	Residential services and other services

16	Others	16	Education
		17	Health, social security and social welfare industry
		18	Culture, Sports and Entertainment industry
		19	Government institutions and social organizations
		20	International organizations

Appendix Table 2 Variable Definitions and Data Sources

Variables	Definitions	Data Sources
Log(Income(CHNS))	Annual wage income plus bonus winsorized 1% in each tail and adjusted by regionally different CPI to 2015 price level in RMB in log	CHNS
Log(Income(UHS))	Annual working income winsorized 1% in each tail and adjusted by national CPI to 2008 price level in RMB in log	UHS
Log(Working Time)	Log weekly hours worked	CHNS
Log(Hourly Wage)	Average hourly wage winsorized 1% in each tail and adjusted by regionally different CPI to 2015 price level in log	CHNS
Sick or Injury	Dummy for sickness or injury in the last four weeks	CHNS
Diseases by Type	A dummy for muscle pain or fracture, and a dummy for other diseases including headache, dizziness, fever, sore throat, etc.	CHNS
Education Completion	The education level completed	2000, 2005 and 2010 China (mini) Census
Currently at School	Dummy for whether currently at school for education or not	2000, 2005 and 2010 China (mini) Census
Education, Age, Female, Married, Urban, Minority	Years of education, age, female, married, urban and minority dummy	CHNS, UHS, Census
Occupation Type, Employer Ownership	Categories for occupation types and types of employer ownership	CHNS, UHS
Disease History	Dummy for been diagnosed with high blood pressure, diabetes, myocardial infarction, apoplexy, or bone fracture in the past	CHNS
Smoking	Dummy for smoking behavior	CHNS
Medical Insurance	Dummy for possession of any health insurance	CHNS
Abnormal BMI	Dummy for BMI larger than 24 or smaller than 18.5	CHNS
Trade Policy Shocks	Output tariff, elimination of export uncertainty, export quota policy, and export licenses	Fan et al. (2020)

Appendix Table 3 Summary Statistics of the CHNS Sample

Variables	Mean	SD	Min	Median	Max
Tariff	0.098	0.060	0.027	0.070	0.270
Sick or Injury	0.087	0.282	0.000	0.000	1.000
Muscle Pain or Fracture	0.062	0.241	0.000	0.000	1.000
Other Diseases	0.101	0.301	0.000	0.000	1.000
Log(Yearly Income(CHNS))	9.476	0.823	3.761	9.498	12.292
Log(Working Time)	3.845	0.282	2.303	3.871	4.836
Log(Hourly Wage)	1.847	0.755	-0.381	1.811	5.444
Female	0.335	0.472	0.000	0.000	1.000
Education Year	9.027	2.763	0.000	9.000	18.000
Age	37.212	10.645	16.000	38.000	59.000
Urban	0.368	0.482	0.000	0.000	1.000
Married	0.787	0.409	0.000	1.000	1.000
Minority	0.088	0.283	0.000	0.000	1.000
Disease History	0.066	0.248	0.000	0.000	1.000
Smoking	0.349	0.477	0.000	0.000	1.000
Abnormal BMI	0.343	0.475	0.000	0.000	1.000
Medical Insurance	0.609	0.488	0.000	1.000	1.000
Tariff_Output	0.118	0.067	0.033	0.080	0.295
Export Policy Uncertainty	0.299	0.783	-0.543	0.000	3.297
Trade License Policy	0.018	1.077	-1.952	0.808	0.808
Quota Policy	0.407	1.128	-0.424	-0.023	4.098
Log(Air Quality Index)	4.466	0.404	3.151	4.482	5.260

Appendix Table 4 Summary Statistics of the UHS Sample

Variables	Mean	SD	Min	Median	Max
Tariff	0.094	0.035	0.023	0.087	0.198
Log(Yearly Income(UHS))	9.197	0.797	2.303	9.222	11.327
Female	0.418	0.493	0.000	0.000	1.000
Education Year	11.511	2.490	0.000	12.000	16.000
Age	41.008	8.633	16.000	41.000	59.000
Tariff_Output	0.111	0.040	0.037	0.102	0.230
Export Policy Uncertainty	0.324	0.911	-0.669	0.000	4.656
Trade License Policy	-0.302	1.120	-2.106	-0.399	0.808
Quota Policy	0.217	1.313	-0.424	-0.381	9.915

Appendix Table 5 Summary Statistics of the Census Sample

Variables	Panel A: Sample 1 (Age 16-25)				
	Mean	SD	Min	Median	Max
Female	0.497	0.500	0	0	1
Age	20.47	2.880	16	16	25
Urban	0.842	0.682	0	0	2
Minority	0.103	0.304	0	0	1
Education Level	3.416	1.603	0	0	7
Currently at School	0.253	0.434	0	0	1
Variables	**Panel B: Sample 2 (Age 18-25)**				
	Mean	SD	Min	Median	Max
Female	0.501	0.500	0	0	1
Age	21.47	2.311	18	18	25
Urban	0.841	0.686	0	0	2
Minority	0.102	0.303	0	0	1
Currently at School	0.167	0.373	0	0	1
Variables	**Panel C: Sample 3 (Age 16-25 and in Manufacturing)**				
	Mean	SD	Min	Median	Max
Female	0.518	0.500	0	0	1
Age	21.21	2.546	16	16	25
Urban	0.799	0.772	0	0	2
Minority	0.0551	0.228	0	0	1
Currently at School	3.428	1.382	0	0	7