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ABSTRACT

How Do Households Adjust to Trade Liberalization? Evidence from China's WTO Accession*

We investigate the impacts of trade liberalization on household behaviors and outcomes in urban China, exploiting regional variation in the exposure to tariff cuts resulting from WTO entry. Regions that initially specialized in industries facing larger tariff cuts experienced relative declines in wages. Households responded to this income shock in several ways. First, household members worked more, especially in the non-tradable sector. Second, more young adults co-resided with their parents, and thus household size increased. Third, households saved less. These behaviors significantly buffered the negative wage shock induced by trade liberalization.

JEL Classification: F14, F16, J20, R23

Keywords: household adjustments, trade liberalization, WTO

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1 Introduction

It is generally recognized that trade liberalization can bring about substantial adjustments in the labor market. Many studies have consistently shown that regions or industries exposed to import competition induced by trade liberalization experienced relative declines in labor market conditions.[1] It is natural to ask how people adjust to such labor market shocks. However, most of the existing literature on this topic focuses on the responses of individual workers and pays little attention to the adjustments of households. Many important economic decisions, such as labor supply, living arrangements, and saving, are made jointly by household members. Understanding how these behaviors change in response to trade liberalization has direct implications for the impact of trade on household welfare.

In this paper, we systematically examine the effects of trade liberalization on local labor market outcomes and household behaviors, including wages, labor supply, living arrangements, income, consumption, and savings. China provides a suitable setting in which to conduct such a study. First, China entered the WTO in December 2001 and thus arguably provides a case wherein we can study exogenous tariff changes to identify the effects of trade liberalization. Second, China's urban household survey data cover all prefectures in China during the period before and after WTO entry. The repeated cross sectional data provide extensive information at both the individual and household levels, enabling us to investigate household responses in a variety of dimensions. Third, given the persistent attention in the literature on the distributive effects of trade liberalization in developing countries, investigating China provides valuable evidence by itself.

We match the household survey data to the tariff data at the prefecture level and adopt the "local labor market approach" that has recently been popularized in the literature to investigate the effects of regional tariffs on household behaviors and outcomes.[2] The identification is based on the variation in tariff changes across industries and the variation in pre-WTO industry employ-

[1] Industry-level studies include Revenga (1997); Attanasio et al. (2004); Goldberg and Pavcnik (2005). Regional-level studies include Hasan et al. (2007); Topalova (2010); Kovak (2013); Hakobyan and McLaren (2016); Dix-Carneiro and Kovak (2015, 2017a,b).

[2] See Hasan et al. (2007); Edmonds et al. (2010); Topalova (2010); McCaig (2011); Autor et al. (2013); Kovak (2013); Dix-Carneiro and Kovak (2015, 2017a,b); Costa et al. (2016); Hakobyan and McLaren (2016).

ment composition across Chinese prefectures. Our main specifications control for prefecture fixed effects, year fixed effects, and demographic variables (including individual gender, age, and education) so that our identification is actually based on the outcome differences across prefectures with smaller and larger tariff cuts before and after WTO entry. Consistent with the existing literature, we find strong evidence that regions that initially specialized in industries facing larger tariff cuts experienced relatively larger wage declines than other regions. Specifically, a one-percentage-point reduction in the regional tariff is associated with a relative wage decline of 1.8 percent.

Using the same methodology, we investigate a series of outcomes to show how households respond to the adverse labor markets shocks caused by tariff cuts. First of all, the labor supply of household members increased significantly, especially in the non-tradable sector. A regional tariff reduction of one percentage point increases the probability of working by 0.42 percentage points on average. This response is most pronounced among women and the elderly, leading to a changed labor supply arrangement within households. This finding is consistent with the "added worker effect" noted in the literature, in which the labor supply of wives and the elderly responds to the wage shocks of the major wage earner (Blundell et al., 2008, 2016).

In addition, consistent with Kaplan (2012), who argues that the option of co-residing with parents provides adult children with a valuable insurance channel against labor market risks because of reduced living costs and shared public goods, we find that regional tariff reduction is associated with a relative increase in the probability of parental co-residence. On average, a one-percentage-point regional tariff cut increases the probability of parental co-residence by 0.5 percentage points. In addition, the parental co-residence incidence rate increased only among households whose heads are parents aged 50 years and above, suggesting that it is the children who move to reside with their parents and not vice versa.

Finally, to examine the role of saving, we investigate household income and consumption, and we find that a one-percentage-point regional tariff reduction decreases household income and consumption per capita by 1.2 percent and 1.0 percent, respectively. The results are robust to controlling for household size and structure. Therefore, the smaller effects on consumption suggest

that households lower their saving rate to offset the adverse income shock caused by tariff cuts. Meanwhile, we do not find significant evidence for the effects of regional tariffs on incidence or quantity of financial loans and private transfers.

The above results suggest that labor supply, parental co-residence, and saving behaviors play an important role in buffering the impact of adverse labor market conditions caused by lowered regional tariff levels. For example, our back-of-envelope calculation shows that regional per capita wage income reduction would be 15-30 percent larger had labor supply not responded to the regional tariff cuts. Moreover, if saving were held constant, the reduction in consumption would be 15-35 percent larger.

We conduct a series of robustness checks to address potential problems with identification. To address the endogeneity issue of the tariff cut, we use the maximum allowable tariff rates as an instrument for actual tariffs and find fairly consistent results. In addition, to alleviate the concern that the identified effects could be driven by potentially differential time trends across different regions, we plot the differences in the outcome variable between regions with larger and smaller tariff cuts over time and find that they present parallel trends before WTO entry. Further placebo tests suggest a rather weak correlation of pre-WTO changes in outcomes with the post-WTO tariff cuts in the local regions. Furthermore, to control for potential confounding factors, we additionally include a wide range of variables in regressions, such as non-tariff barriers, FDI restrictions, export expansion, consumption prices, minimum wages, housing prices, and privatization of state-owned-enterprisesand. We find that there is no material change. Finally, cross-region migration is a potential issue because it may be correlated with both outcomes and regional tariffs. To address this issue, we first regress regional migration on local tariff changes and find small and insignificant coefficients, indicating that regional migration is not driven by regional tariff cuts. Then, we restrict our sample to the households living in their current prefecture since 2001 and find that our baseline results are still robust. In sum, we conclude that cross-region migration should not be the first order issue in this study.

Our work contributes to the emerging literature on the regional impact of trade liberalization,

as seen in Topalova (2010); Kovak (2013); Dix-Carneiro and Kovak (2015, 2017a,b); Hakobyan and McLaren (2016). Our main contribution is to extend the focus of interest from labor market variables to a wide range of household-level behaviors and outcomes. The broad scope of analysis allows us to provide a systematic portrait of how households adjust to trade liberalization. In addition, we emphasize the role of households in insuring individuals against the labor market shocks triggered by trade liberalization, a point that is largely ignored in the previous literature.

This paper is also related to the flourishing literature on estimating the economic impact of China's trade liberalization, especially the impact due to the country's WTO entry. On the one hand, in contrast to the current literature examining the consequential effects on labor markets in the rest of the world, such as the US (Autor et al., 2013; Pierce and Schott, 2016) and Europe (Utar, 2014), we investigate how China's own labor market is responding to this event and show that the adjustment costs of trade liberalization through tariff reduction are also pervasive. On the other hand, in contrast to the established literature on the impact of WTO entry on China itself (Brandt et al., 2017; Yu, 2015; Fan et al., 2015), which mostly focuses on firm-level outcomes, we explore household behavioral responses and outcomes.

Finally, these findings also contribute to the ongoing labor and household literature on how households respond to income shocks (Blundell et al., 2008; Kaplan, 2012; Gorbachev, 2016; Blundell et al., 2016). We contribute to the current literature by exploring the adverse labor market conditions caused by tariff cuts as exogenous shocks, and we consistently find that household behaviors play an important role in consumption smoothing.

The rest of the paper is organized as follows. Section 2 describes the data and constructs the regional tariff measure. Section 3 conducts the descriptive analysis and provides graphical evidence. Section 4 introduces the empirical strategy and presents the main estimation results. Section 5 conducts robustness checks. Section 6 conducts back-of-envelope calculations to quantify the role of households in insuring individuals against the labor market shocks induced by trade liberalization. The final section concludes.

2 Data

2.1 Urban Household Surveys

The data used in this study are from the Urban Household Surveys (UHS) conducted by China's National Bureau of Statistics. The UHS is based on a probabilistic sample and stratified design. We use UHS data for several reasons. First of all, the UHS is the official source of the basic indicators for urban households in China. The aggregated data of the UHS are published in the China Statistical Yearbook, and the surveys cover all prefectures for a long period of time, both pre- and post- WTO accession. In addition, the UHS provides detailed individual-level information, including demographic information such as gender, age, and education level, as well as employment information such as working status, occupation, industry, working hours, and wage.

Furthermore, the UHS provides information on the relationship of each household member with the household head, which enables us to investigate the household structure and to identify whether the household head lives with their children or parents.

Finally, the UHS also provides detailed information about household characteristics, household income, and consumption expenditures. The data are collected over the course of the year. Households are asked to keep a record of their income and expenditures, and that record is collected every quarter by a surveyor. For each household, the final data are aggregated at the year level.

Because China entered the WTO in December 2001, we use the data collected from 1999 to 2008. We only include household members aged 20 years and above. Unfortunately, the structure of the UHS does not allow us to track households over time. The sample we use contains repeated cross-sectional data covering 179 prefectures/cities in 18 provinces.[3] In total, the sample contains over 590,000 individuals and 210,000 households.

Table 1 reports the summary statistics for the key variables during the period 1999-2008. Panel A shows the mean and standard deviation for individual-level variables. Specifically, 71 percent

[3]The 18 provinces are the following: Beijing, Shanxi, Liaoning, Heilongjiang, Henan, Sha'anxi, Gansu, Shandong, Shanghai, Jiangsu, Anhui, Zhejiang, Jiangxi, Hubei, Guangdong, Sichuan, Chongqing, and Yunnan. These provinces cover China's eastern, middle, and western areas and accounted for 75% of China's urban population in 2008.

of the individuals are working, among which 17 percent are working in a tradable sector while 53 percent work in a non-tradable sector. However, for those aged below the government mandatory retirement age (i.e., 60 years old for men and 55 for women), the working proportion is 85 percent, which is much higher than for those past retirement age.

At the household level, the average household size is slightly below 3, as shown in Panel B. We define a parental co-residence dummy that equals 1 if adult children or their spouses live with their parents. The incidence of parental co-residence is 31 percent on average. Because of different co-residence patterns among households, we further divide the sample by household age. Among the households with a head aged over 50, almost half are cases of parental co-residence, and almost all these co-residence cases are household heads living with their adult children. By contrast, when the household head's age is below 50, the rate of parental co-residence is much lower. Among these co-resident households, half of household heads are co-residing with their parents and the other half with their children.

In the sample, annual household income per capita is 11.2 thousand yuan, which is significantly higher than the annual consumption per capita of 7.4 thousand yuan. This implies an average saving rate of 28 percent.

2.2 Regional tariff construction

The key independent variable used in our subsequent analysis is the regional tariff. We construct the regional tariff for each prefecture city and year as follows:

$$Tariff_{ct} = \sum_{j \in \Omega_{Tr}} \lambda_{jc,1998-2001} \tau_{jt} \tag{1}$$

where subscriptions c, j, and t represent city, industry, and year, respectively. τ_{jt} is the tariff rate of industry j in year t.[4] $\lambda_{jc,1998-2001}$ is the share of industry j in tradable sector employment of city c during the pre-WTO years (i.e., 1998-2001).[5] The results are consistent if we use different

[4]We define a local labor market as a prefecture city. The majority of China's regional policies, including transportation planning, are conducted at prefecture city level.

[5]Following Kovak (2013), we only include the tradable sector (mining and manufacturing) in the regional tariff construction. The regional tariff in earlier works such as Topalova (2010) includes the non-tradable sector and sets

weighting schemes, such as employment weights in 2001 and the labor-share adjusted weights as in Kovak (2013).[6] We define each industry at the 4-digit Chinese Industry Classification (CIC) level (453 industries). To calculate these employment weights, we use the Annual Survey of Industrial Firms (ASIF) from the National Bureau of Statistics.[7]

Tariff data between 1998-2007 are from China's Customs. The original data are at the HS 8-digit level, and we map them to 4-digit CIC industries. Table A1 shows that tariff cuts vary substantially across industries. The largest tariff cuts occurred in industries such as beverage, furniture, tobacco, and textile manufacturing, while industries such as mining had almost no tariff changes.[8]

It should be emphasized that the measure weighting the tariffs by local industry employment share only captures the potential labor market effects of tariffs; the measure ignores the effects of tariffs on consumption prices and thus the cost of living (Porto, 2006; Fajgelbaum and Khandelwal, 2016; Han et al., 2016). However, unless the consumption structure and production structure are systematically correlated across cities, we can still consistently estimate the impact of tariff through the labor market channel. In the robustness section, we control for the consumption price effects by including a regional consumption-weighted tariff.

Figure 1 shows the median and various percentiles of the regional tariffs during 1998-2007.

the tariff changes in the non-traded sector to zero. Kovak (2013) argues that when the price of non-tradable goods responds to the price changes of the tradable goods, a more theoretically consistent way of constructing the regional tariff is to exclude the non-traded goods sector and to calculate the employment weights using only the traded goods sector.

[6]Results are shown in the robustness section. Another concern of using the initial weights is that an industry's employment share may change with trade liberalization after WTO accession. In the results available upon request, we regress an industry's employment share in a city against the industry-level tariff, and we find that the industry employment share does not vary systematically with tariffs. This is consistent with the ample evidence of a lack of labor reallocation across manufacturing industries in other developing countries (Goldberg and Pavcnik, 2007)

[7]The Annual Survey of Industrial Firms covers all state-owned firms and all non-state firms with sales revenue above 5 million Yuan in China's industrial sector, which includes mining, manufacturing and utilities. The firms included in the survey accounted for 91% of China's aggregate output in the industrial sector in 2004, a year during which we can compare the aggregates of the ASIF with the industrial census data. The data report the firm's city code, industry affiliation at the level of the 4-digit CIC classification, and total employment. We aggregate the data to the city-industry-year level to calculate the employment share used to construct the regional tariffs. In the robustness section, we also calculate the employment weights using the 1995 Industrial Census data in 1995, which covers all firms in the industrial sector.

[8]We do not consider the tariffs in agricultural goods because only 2% of individuals work in the agricultural sector in our urban sample. Dropping the agricultural sector has no material impacts on the results, as shown in the robustness section.

The median regional tariff went down from 15 percent in 1998 to 9 percent in 2007, a 40% drop. The largest tariff cut occurred in 2002, the year immediately after China's WTO entry. Tariffs continued to decline in the next two years but remained almost unchanged afterwards. As is the case in many other developing countries, the dispersion of tariffs also declined, as the cities with higher initial tariffs experienced larger tariff cuts.

Figure 2 shows the geographical distribution of regional tariff cuts from 1998 to 2007. Tariff cuts exhibit substantial heterogeneity across cities, ranging from 1.2 percentage points in Qi Tai He to 23.6 percentage points in Shi Yan, as shown in Table A2 in the appendix. This heterogeneity stems from the variation in tariff cuts across industries and the variation in the pre-WTO industry mix of employment across cities. The cities that specialized in the industries with large tariff cuts experienced larger regional tariff reductions. The wide distribution of regional tariff cuts provides valid variation for accurate identification.

In our baseline specification, we set the tariff rate during 1998-2001 to be constant at the year average because the pre-WTO tariff during 1998-2001 shows very little change and is more subject to endogeneity issues. However, as we will show later in the robustness check section, using the actual tariff does not change our basic results.

3 Descriptive Evidence for the Effects of Regional Tariff

We present both graphical and econometric evidence to examine the notion that regional tariffs have significant effects on individual and household outcomes such as labor supply, wage, and household consumption. This section provides the descriptive analysis, and the next section presents the formal econometric analysis.

To get a sense of the relationship between tariffs and our main outcome variables, we plot the city-level changes in outcome variables between 2002 and 2006 against the changes in regional tariffs between 2001 and 2005. A significant correlation provides suggestive evidence regarding the effects of regional tariffs. The outcome variables examined here include labor market outcomes

such as wage and labor supply, household structure (including household size and parental co-residence), and household finance, including household income and consumption per capita.

Wage It has been extensively established in the literature that trade liberalization – in terms of lower tariff rates – affects labor market outcomes. We first examine the correlation between the regional tariff and the wage rate among the working population and present it in Panel A of Figure 3. The circle area represents the sampling size of each city in the UHS data. The pattern in Figure 3a shows that a larger regional tariff cut is associated with relatively lower wage growth. The slope suggests that a one-percentage-point decrease in the regional tariff leads to a 2.9 percent decline in the wage rate. These results support the predictions of the existing trade models regarding the relationship between regional tariffs and wages (Kovak, 2013). These results are also consistent with the evidence found in other developing countries such as India and Brazil (Topalova, 2010; Kovak, 2013; Dix-Carneiro and Kovak, 2017a).

Employment and Labor Supply It is extensively documented in the labor literature that individual/household labor supply responds to income shocks (Blundell et al., 2016; Gorbachev, 2016). By contrast, evidence on how the labor supply responds to trade liberalization is scarce (Arkolakis and Esposito, 2014). Given the substantial effects of tariff cuts on wages, it is natural to also ask how the labor supply responds to tariff cuts. To examine this, we create a dummy variable for individual working status that equals 1 if the individual is working at the time of the survey and 0 otherwise. Then, we conduct the parallel analysis as shown in Panel A.

Interestingly, we find that larger tariff cut is associated with more people working, suggesting a larger increase in labor supply. The slope of linear fitted line suggests that a percentage point cut of regional tariff is significantly associated with a 0.42 percentage point increase in the probability of working.

Generally, the observation that trade liberalization lowers wages indicates a negative shock in labor demand. On the other hand, it is also possible that people tend to work more in response to a lower wage rate. For example, the female labor supply may increase in the event of negative

wage shocks to the husband, which is known as the "added worker effect" in the labor literature (Stephens, 2002; Gorbachev, 2016; Blundell et al., 2016). Therefore, it is an empirical question how trade liberalization in terms of a lower tariff affects the proportion of people working. The pattern in Panel B suggests that the added worker effect dominates the labor demand effect.[9]

Note that the increased labor force participation found in our paper does not contradict the increase in unemployment in response to import competition, as documented in the existing literature (Autor et al., 2013; Dix-Carneiro and Kovak, 2017a) because unemployment does not include people who are not in the labor force. However, it is important to specifically investigate the pattern shown in Panel B. For example, whose labor supply increased during the episode of trade liberalization? In which sector did the labor supply increase? We will return to these questions in the next section.

Household Structure and Living arrangements Young adults often need to decide whether to live with their parents. The literature on co-residence typically finds that the option to co-reside with parents provides important insurance against labor market risks (Kaplan, 2012). This is especially important in China, given the high parental co-residence rate. Because youth are more likely to live with their parents in order to share living expenditures in the event of adverse labor market conditions, it is natural to expect that the income shocks induced by tariff cuts would also affect people's parental co-residence decisions.

Therefore, we construct two variables to examine the co-residence decision. The first variable is log household size, which is the number of family members aged above 20. The second variable is a co-residence dummy, which equals one if parents and adult children live in the same household.

Following the same strategy, we further examine these outcomes. Because of different living arrangement patterns between younger and older households, as shown in summary statistics, we only include those households with heads aged 50 years or above. Among these households, larger regional tariff cuts are significantly associated with relatively larger increases in household size

[9]In unreported regressions, we find that the regional unemployment rate is not significantly affected by regional tariffs.

and co-residence probability, as shown in Panels C and D, respectively. As a comparison, we also conduct the analysis for the households with younger heads and do not find any significant correlations. We will return to this topic in more detail in the regression analysis section.

Household Finance We also examine the correlations of tariff cuts with household income and consumption per capita. Specifically, the slope of the fitted lines suggests that a percentage point cut in the regional tariff is associated with a 0.83 percent and 0.72 percent decline in household income and consumption, respectively. The slope for household consumption is smaller, suggesting that households lowered their saving rates in order to smooth consumption.

To obtain a more complete picture, we will further examine the other household finance outcomes in the next section. These outcomes include private transfers, borrowing and lending behaviors.

Examining the individual/household behavioral responses to regional tariff cuts primarily yields the impression that households adjust to the adverse labor market shocks caused by trade liberalization by altering their labor market participation decisions, household co-residence decisions, and household finance behaviors. However, such a simple correlation may not be sufficiently convincing, as there are many other confounding factors. In addition, in Figure 3, we only use data from two years, and thus we should question whether the effects are consistent in the whole sample. We also need a more complete analysis before reaching any conclusions, as many questions remain to be answered.

4 Econometric Evidence for Household Adjustments

4.1 Empirical Strategy

We conduct the following regression to investigate the effects of the regional tariff:

$$Y_{ict} = \alpha + \beta * Tariff_{c,t-1} + \gamma D(city_c, year_t, age_{it}, gender_i, educ_i) + \varepsilon_{it} \quad (2)$$

We conduct the regressions at the individual or household level. The subscriptions i, c, and t, represent individual or household, city, and survey year, respectively. The dependent variable is the interested outcomes mentioned above, such as wage, labor supply, household size, co-residence indicator, household income per capita, or household consumption per capita.

$Tariff_{c,t-1}$ stands for the regional tariff level of prefecture/city c in year $t-1$. Our main identification is based on the differential exposure of cities to tariff cuts after WTO entry. The coefficient, beta, is of central interest because it captures the effects of the regional tariff on outcome variables.

The covariates $D(.)$ is the temporal, geographical, and demographic control; it includes dummies of prefecture, survey year, gender (male/female), and education level (junior high or below, senior high, and college or above). In addition, it also includes interactions between year and age to allow heterogeneity across birth cohorts. Moreover, we include gender dummy interaction with all the covariates to control for male-female differences. For household level regressions, we use the demographic characteristics of the household head. The standard errors are clustered at the prefecture level.

Two important points about interpretation should be noted. First, because the constructed regional tariff measure captures the labor market effects, the identification strategy captures the impact of tariff cuts on outcomes through the labor market channel. Our estimation equation should be viewed as a reduced-form relationship between various household outcomes and wage shocks caused by a lower tariff. Second, because our identification is based on a difference-in-differences (DID) framework, the identified effects should be interpreted as relative effects across different regions rather than overall effects at the national level.

4.2 Caveats about Identification

Heterogeneous trends First, unbiased estimation relies on the assumption that the time trends of outcomes in regions with larger tariff cuts would parallel those in other regions had China not entered the WTO. For example, if individual wages are expected to fall relatively because of unobserved factors that are correlated with regional tariff cuts, our estimates would overestimate

the effects of regional tariffs. Although we cannot rule out this possibility completely, we plot the time trends of the outcome variables before and after the WTO entry in regions with both larger and smaller tariff cuts, and we find that the time trends of outcomes are parallel for cities with large and small tariff cuts before WTO entry. In addition, the changes in outcomes prior to WTO entry are insignificantly associated with local tariff cuts across cities after WTO entry. These findings help to alleviate the above concern. We will return to this topic in Section 5.

Confounding factors In addition, some confounding factors should be addressed. First of all, it is not only tariffs that changed when China entered the WTO. Non-tariff barriers and FDI restrictions are lowered, and exports to other countries also expanded dramatically. The effects of tariff cuts will be biased if regional tariffs are correlated with these shocks. To address this issue, we include proxies for non-tariff barriers, FDI restrictions, and export expansions in our regressions, and we find no material changes in the effects of tariffs.

China also experienced many changes in its domestic economic policies and conditions during this period. Among these changes, minimum wages, housing prices, and the privatization of the state-owned enterprises (SOEs) should be the most relevant and salient changes for the purposes of our study. If minimum wages increased more in regions with smaller tariff cuts, the identified effects may pick up the effects of the wage policy. Alternatively, if booms in regional housing prices and the extent of privatization are associated with tariff cuts, it is also difficult to conclude that the identified effects in equation (2) are merely from tariffs. Therefore, to alleviate these concerns, we also include the regional minimum wage level, the housing prices, and the regional employment share of the SOEs in the regressions for additional controls, and we find the results are robust. Section 5 presents this analysis in more detail.

Endogeneity of tariff cuts Tariffs might be endogenous because of political considerations and contemporary economic conditions(Grossman and Helpman, 1994). This is not a major concern in the Chinese context because the Chinese government had very little policy discretion over the extent of tariff cuts in each industry. Tariffs across all tradable industries are required to be reduced

to a certain level after a country enters the WTO. To visualize this, Figure 4a plots the regional tariff changes between 1998 and 2007 and the initial tariff rate in 1998; it shows an almost one-to-one relationship between the regional tariff change and the initial tariff rate in 1998. In other words, the post-WTO tariff rates converged to the same low level regardless of the initial tariff level.

To further address the endogeneity issue, we follow Brandt et al. (2017) and use the maximum allowable tariff rate as an IV for the actual tariff rate. We then create an IV for the regional tariff rate using the pre-WTO employment share. China's WTO accession agreement specifies the entry tariff rate, target rate and target year, and most of these were determined in 1999. The entry rate is the tariff rate at the time of accession; the target rate is the reduced rate that must be achieved in the target year. Our IV assumes that after entry to the WTO, China could maintain the entry rate until it switched to target rate in the target year.[10] Figure 4b plots the accession tariff changes at the prefecture level against the changes in the actual tariff before and after the WTO entry; it shows a strong positive correlation (rho = 0.96), which suggests that China consistently followed the initial agreements to reduce tariffs. In our paper, we provide results from both OLS and two-stage least squares (2SLS).

Expectations It took a long time for the Chinese government to negotiate with other WTO countries regarding its entry. Target tariffs were determined in 1999, three years before China's actual entry. Therefore, it is possible that firms and households in China expected the tariff cuts before the country actually entered the WTO. We argue that this cannot be the first order issue in this study. First, if regions with larger tariff cuts formed accurate expectations and started to adjust to the expected lower tariff before the WTO entry, we would underestimate the effects by conducting regressions as in equation (2). Second, if firms and households started to alter their behaviors before the WTO entry, it is likely that the outcome changes before joining the WTO would be associated with actual tariff cuts after 2002. However, we do not find significant evidence for this, as shown by our placebo tests, which we will discuss in Section 5.

[10]The accession tariff data are only available since 2002. We set the accession tariff during 1998-2001 as the 2002 value.

Migration. Migration would be a concern. For example, the effects of tariffs would be the cause of the moving migrants rather than the actual effects on wages for those who stayed behind. To rule out this possibility, we examine whether the migration flows are correlated with regional tariff cuts, and we only find that the association is rather weak and statistically insignificant. In addition, we also confine our analysis to households who had remained in the local prefecture since 2001, the year before China's WTO entry, and we find almost no change in our results.

4.3 Effects on Labor Market Outcomes: Wage and Labor Supply

We start our empirical analysis with the impact of tariff reduction on wages. We estimate equation (2) at the individual level. The dependent variable is log individual real yearly wage. Panel A and Panel B report the OLS and 2SLS results, respectively. In Column (1) of Table2, we obtain a positive and significant coefficient of the regional tariff variable. The magnitude suggests that a one-percentage-point reduction in the regional tariff is associated with a 1.8 percent reduction in wages. During 1998-2007, the difference in the regional tariff change between the cities in the 25th percentile and 75th percentile of the tariff change distribution is 4 percentage points. Based on our estimate, wage growth of the cities in the 25th percentile of the tariff change distribution is 7 percentage points (1.76*0.04) lower than that of the cities in the 75th percentile during our sample period.

In Columns (2) and (3), we estimate the wage effects for workers in the tradable and non-tradable sectors separately. As expected, the effects are larger in the tradable sector, with a coefficient of approximately 2. For the non-tradable sector, tariff cuts also lead to wage reduction, but the magnitude is only about two-thirds of that of the tradable sector. The significant wage effects in the non-tradable sector are consistent with the recent evidence documented for other countries such as Brazil and the US(Kovak, 2013; Hakobyan and McLaren, 2016; Dix-Carneiro and Kovak, 2017a). The results also suggest that labor may reallocate between tradable and non-tradable sectors in response to trade reform, as we will show shortly. Panel B reports the IV results. The previous conclusions still hold qualitatively, though the magnitude is a bit larger than the results

using OLS.

To strengthen the validity of our wage results and to explore the possible mechanisms underlying the wage adjustment, we investigate the response of firms to tariff cuts; to do so, we use the Annual Survey of Industrial Firms. The details are reported in Appendix A3. We find that industries or regions with larger tariff cuts indeed experienced slower growth of firm-level wages. This corroborates our findings from the household survey data that regional tariff reduction reduced regional wages. To explore the underlying mechanism of the wage reduction, we further investigate the impacts of tariff reduction on firm-level investments, sales, and profits. The results show that tariff reduction, either at the industry or regional level, is associated with reductions in firm investment, sales, and profit. In addition, using the same firm-level data as ours, Brandt et al. (2017) find that tariff reduction in China reduced output prices and markups of Chinese manufacturing firms. In summary, these results suggest that import competition from tariff cuts induced a short-run negative impact on firms, which was ultimately transmitted to workers through lower wages.

The next three columns examine the effects on working status. In addition to whether the individual is working or not, we further distinguish whether the individual is working in a tradable or non-tradable sector. By construction, the coefficients in columns 5 and 6 add up to that in Column (4).

In Column (4) of Panel A, a one-percentage-point tariff reduction increases the probability of working by 0.42 percentage points. However, the effects are highly heterogeneous in the tradable and non-tradable sectors. The probability of working in the tradable sector decreases by 0.43 percentage points, while that in the non-tradable sector increases by 0.85 percentage points. Therefore, while regions with larger tariff reduction experienced relative increases in labor participation, the overall increase is composed of an employment contraction in the tradable sector and a larger offsetting employment expansion in the non-tradable sector. This employment shift may be due to either the reallocation of the existing workforce from the tradable sector to the non-tradable sector, or it may be due to the net exit of workers from the tradable sector and net entry of new workers

into the non-tradable sector.[11] The estimation results with 2SLS show a similar pattern.

In Column (7), we investigate the intensive margin response of the labor supply, i.e., how working hours respond to trade reform. We regress the log of working hours in the last month against the regional tariff, and we consistently find that a regional tariff cut also leads to a relative increase in working hours. The coefficient suggests that a one-percentage-point tariff reduction increased working hours by 1.42%

To investigate which segments of the population are more likely to show an increased labor supply in the case of a lower regional tariff, we estimate the labor supply and wage response separately for each gender and each age group (20-29; 30-39; 40-49; 50-59; 60+) in Table 3. First, we find that regional tariff reduction in general leads to larger wage losses for males but stronger labor supply increase for females. The labor supply coefficients of females are 2-5 times larger than those of males, depending on the age group. This is consistent with the "added worker effect" described in the labor literature, in which wives' labor supply increases in response to husbands' negative wage shocks (Stephens, 2002; Gorbachev, 2016; Blundell et al., 2016). In addition, the labor supply of the elderly also increased. Finally, the employment adjustment of males exhibits more "churning", that is, reallocation from the tradable to non-tradable sectors. This can be seen in columns 3 and 5, in that the contraction of tradable sector employment and the expansion of non-tradable sector employment are often of similar magnitude, leading to less net labor supply increase in Column 1. For females, in contrast, labor supply adjustment is mainly characterized by new entry into the labor market, as can been from columns 2 and 4, where the employment expansion of the non-tradable sector is much larger than the employment contraction of the tradable sector, resulting in a large net entry in column 2.

To provide more direct evidence for the "added worker effect", Appendix Table A4 estimates how the regional tariff affects the labor supply pattern for husbands and wives. Consistently, the results show that a larger regional tariff cut is associated with fewer households in which only the husband is working and more households with both the husband and wife working, suggesting that

[11] Existing works, such as Dix-Carneiro and Kovak (2017a) and Costa et al. (2016), also find employment shifts from the tradable sector to the non-tradable sector in response to intensified import competition in the tradable sector.

more wives participate in the workforce when there is a larger regional tariff cut.

The aforementioned results on labor supply have several important implications. First, our results suggest that changes in wage reduction and labor supply should be considered together. For example, wage reduction in the non-tradable sector may be caused not only by lowered prices, as suggested in previous literature(Kovak, 2013) but also by increased labor supply among the female population. It is important to distinguish between the two because of the totally different welfare implications. Second, changes in labor supply arrangements within households is an important dimension with which to understand the effects of tariff reduction on regional employment. For example, if lower labor demand for males induced more females to enter the workforce, aggregate employment may increase in response to tariff cuts. Third, the increased labor supply has direct implications for understanding the impact of trade liberalization on household income and consumption. Increasing labor supply is an important channel used by household members to offset the negative income shocks caused by import competition. We will demonstrate this later.

4.4 Effects on Household Size and Parental Co-residence

This section investigates how the regional tariff affects household structure. Table 4 reports the regression results for household structure on regional tariffs. reports the regression results for household structure on regional tariffs. Consistent with the pattern in Panels C and D in Figure 3, we find that a lower regional tariff is associated with a higher probability of parental co-residence as well as larger household size. According to the estimate of column 1 in Panel A, a one-percentage-point regional tariff cut increases the probability of co-residence by 0.5 percentage points and increases household size by 0.27 percent. Therefore, cities in the 25th percentile of the tariff change distribution experienced a 2-percentage-point larger increase in co-residence probability than did cities in the 75th percentile during our sample period. Given that the average probability of co-residence is approximately 0.3, the effect of tariff cuts is substantial. Considering different living arrangements between households with younger and older heads, in the next two columns, we split the sample into two groups based on whether the household head is aged 50 or above.

The impact of tariffs on household size and co-residence is much smaller in the households with a younger household head.

Because parental co-residence could refer to either a household head living with their children or with their parents, the last two columns distinguish between the two. The results suggest that a lower regional tariff only affects the co-residence of household heads and their adult children. As household heads are defined as those who play the major role in household decision making, more household heads living with their adult children suggests that it is the children who move to co-reside together with parents, not vice versa. Therefore, consistent with Kaplan (2012), these results show that youth are more likely to stay in their parents' home when facing tougher labor market conditions induced by trade liberalization.

However, there are also other possibilities. For example, fertility behaviors may be affected by trade liberalization. For example, young couples will move to live with their parents so that the elderly can help care for children. Although we cannot rule out all the other possibilities, we try to further clarify this issue by investigating how the regional tariff affects the age structure in Appendix Table A5. The results suggest insignificant effects on the proportion of those aged below 16 in households. Meanwhile, a lower regional tariff leads to a lower proportion of those aged over 60, which is consistent with more adult children co-residing with their parents.

The consequential effects of trade liberalization on household structure are important to understanding consumption behaviors within households. For example, because of larger households and economies of scale, the impact of regional tariffs on household income and consumption should be partly explained by changed household structures. This observation is especially important when interpreting the results. For example, the lower consumption per capita caused by a lower regional tariff, as shown in Panel F in Figure3, could be caused by larger households and lower demand. Because of this, in the next section, where we discuss the effects on household income and consumption, we provide results with and without household structure (including size, co-residence, and age structure) controlled.

4.5 Household Income, Consumption, and Saving

We estimate how household income and consumption respond to trade liberalization in Table 5. In the first two columns, we regress log real household income per capita against regional tariffs. We find a coefficient of 1.17 in Column (1) of Panel A, which is smaller than the wage effects in Table 2 (the coefficient for wage effects is 1.76). Columns 3 and 4 estimate the consumption effects, with the dependent variable being log real household consumption per capita. Column (3) in Panel A shows a positive coefficient of 1.03. As expected, a regional tariff cut causes a relative decline in household consumption per capita through the labor income channel. In summary, the magnitude of the consumption effects is much smaller than that of the wage effects, and it is also smaller than the household income effects.

By definition, saving equals income minus consumption. The smaller magnitude of the consumption effects than the household income effects implies that households must have reduced their saving in order to smooth consumption. In the last two columns, we find that the saving rate declines in response to tariff cuts, although the estimated coefficients are only statistically significant with 2SLS.

We also investigate other incomes and expenditures in the appendix. Appendix Table A6 shows the estimation results of the transfers. Note that transfer income from the government or other households could be an important source of insurance against negative income shocks. However, we do not find any evidence that any transfers from the government offset the relatively negative wage shocks. To the contrary, public transfer income exacerbates the negative wage shock rather than reducing it. One explanation is that during our sample period, China had yet to establish a complete welfare system, and the trade-adjustment assistance programs that are common in developed countries still do not exist in China today. Another explanation is the increased labor supply from the elderly. When more elderly people participate in the labor force and earn labor income to smooth household consumption, they receive smaller pensions from the government. In an unreported regression, we find that individual working status could explain many of the effects of tariffs on received public transfers. Appendix Table A7 examines the effect of tariff cuts on household-

level borrowing and lending, as households can also insure against negative income shocks by borrowing more from or lending less to other households. However, we do not find any significant evidence of these practices. Because wage income accounts for over 70 percent of household income and transfers account for 20 percent, these results suggest that lowered household income is mainly driven by the lowered wage income of the households.

5 Pre-trends Examination and Robustness Checks

In this section, we first conduct placebo tests to rule out the possibility that the results are driven by spurious pre-trends. Then, we run several robustness checks to ensure that our results are insensitive to confounding policies, measurement of regional tariffs, alternative samples, and migration issues.

5.1 Pretrends examination

Our main identification is based on the variation in regional tariffs across cities over time. Unbiased estimation of the difference-in-differences framework requires that the time trends of outcome variables in regions with larger tariff cuts would be parallel with those in other regions if China had not lowered tariffs. However, this may not be taken for granted. We conduct the pre-trends examination as follows.

First, we use the UHS data for the pre-WTO period (i.e., 1997-2001), calculate the changes in outcome variables at the city level between 1997 and 2001, and then plot these changes against the post-WTO tariff changes between 2001 and 2005. The outcome variables include labor supply, wage, parental co-residence, household income per capita, and household consumption per capita. It would be a concern if the outcome changes in the pre-WTO period are systematically correlated with the tariff cuts in the post-WTO period.

Figure 5 shows that there is no such pattern for these outcomes. Specifically, the correlations between the pre-WTO outcome changes and the post-WTO tariff changes are rather weak. These

results suggest that the outcome trends between larger tariff cut cities and other cities would not significantly differ had there not been WTO accession.

We further investigate the pre-trends in Figure 6 by examining how the outcome difference between the cities with different tariff exposure evolves over time. Specifically, we create a dummy variable indicating whether the regional tariff cut is large or small according to the median of the regional tariff reduction. We regress the outcome variable against the interaction between this dummy variable and the year dummies, and we plot the coefficient for each year in Figure 6. The coefficients reflect the outcome difference between the large tariff cut regions and the small tariff cut regions in each year compared to the reference year (1999). We can see that the patterns we documented in the previous sections only occurred after WTO entry. For example, wages, household income and consumption started to fall in the large tariff cut regions relative to other regions only after 2002, and labor supply, co-residence and household size also started to rise only after 2002. This further precludes the possibility of spurious pre-trends in driving our results.

5.2 Controlling for Potentially Confounding Factors

Non-tariff barriers In addition to tariff reduction, China also substantially reduced various non-tariff barriers (NTBs). One potential confounding factor in our analysis is the relaxation of import license control. Every year, China Customs announces a list of products requiring an import license. Because the total number of licenses is subject to government control, the license essentially serves as a quota. Drawing on annual circulars of the Ministry of Foreign Trade and Economic Cooperation and the Ministry of Commerce, we construct a city-level measure of import license control as the share of products produced in a city that are under import license control. The details of the measure's construction are described in Appendix A2. The average city-level measure of import licenses declined by 6.5 percentage points during 1998-2007. We include this measure in the regression to control for the impact of import licenses.

FDI restrictions Another major form of liberalization accompanying China's WTO entry is that of FDI liberalization policies. FDI restrictions took various forms, such as higher initial capital requirements, less favorable tax treatment, more complicated business registry and approval procedures, and in the case of joint ventures, the requirement of majority shareholding by a Chinese party. These restrictions were largely removed immediately following China's WTO accession. Based on FDI restriction data from the Catalogue for the Guidance of Foreign Investment Industries issued by the Ministry of Commerce of China,[12] we construct a city-level FDI restriction measure as the share of industries that are either "prohibited" or "restricted" in the Catalogue. See details in Appendix B. Notably, because the Catalogue covers all industries, including services, our city-level FDI restriction measure captures FDI liberalization not only in tradable but also non-tradable sectors. The average city-level FDI restriction declined by 2 percentage points during 2001-2006.

Export shocks China's WTO entry is also associated with a remarkable export boom. We conduct two exercise to control for the impact of exports. First, Handley and Limao (2017); Pierce and Schott (2016) have found that tariff uncertainty reduction resulting from the US granting permanent normal trade relations (PNTR) to China after China's WTO entry has substantially increased Chinese exports. Thus, we construct regional-level tariff uncertainty measures to capture the export effects. See Appendix B for details. We interact this variable with a post-WTO dummy that equals 1 for years later than (including) 2002. Theoretically, cities facing larger tariff uncertainty pre-WTO will experience larger reductions in tariff uncertainty after China's WTO entry. Therefore, we expect exports to grow faster in these regions in the post-WTO years. Second, we directly control for an regional export measure, constructed following Autor et al. (2013).

[12]The Catalogue is a major source of reference for the government in approving foreign investment projects. The Catalogue lists the industries in "encouraged," "restricted" or "prohibited" categories. The unlisted industries are considered "allowed". Investments in the "prohibited" industries are completely banned, while those in the "restricted" industries are subject to the various forms of restrictions mentioned above. The Catalogue is amended every 3 to 5 years. For our sample period, we use the Catalogue issued in 1997, 2002 and 2004.

Consumption prices Tariff can affect households by affecting consumption prices in addition to affecting wages. Our estimates of labor market effects will be biased if regional consumption and production patterns are correlated. In order to alleviate this concern, we include into the regression a regional consumption-weighted tariff, constructed by weighing the tariff of each product with the product's expenditure share in the region's consumption basket. The details of the construction of the consumption-weighted tariff is reported in Appendix B.

Minimum wage policies Another confounding factor is the minimum wage policy. The prefecture governments set the minimum wage on a yearly basis, which may impact the wages and consumption of households. If a larger tariff cut is associated with slower minimum wage growth, the identified effects in our previous estimation may be biased. We collect the minimum wage from all cities after 1998 from City Statistical Yearbooks.

Housing prices Housing prices affect many dimensions of household behaviors, including labor supply, co-residence, consumption, and savings. To ensure that our results are not driven by changing housing prices, we control for an index of housing prices at the city level obtained from Fang et al. (2016).

Privatization China experienced a massive privatization of its state-owned enterprises (SOE) during 1998-2005. The employment share of SOEs in the urban economy decreased from 44% in 1998 to 24% in 2005. While the privatization of the SOEs may have substantial labor market consequences on China's aggregate economy, it will bias our estimated effects of tariff cuts only if regional tariff cut is systematically correlated with the extent of privatization. We find no evidence of this in the data. In Table 6, we include into the regression the employment share of the SOE in each prefecture to control for the effects of privatization.

Other unobservable local shocks. As a final check of the confounding variables, we include the interaction terms between province dummies and a post-WTO dummy. These interaction terms

absorb all time-varying shocks at the provincial level; thus, the identification of the tariff effects is based on the cross-city variation in tariff exposure within a province.

In Pane A of Table 6, we conduct the robustness checks with all these potentially confounding policy variables. We report the OLS estimation result of the tariff variable when a policy variable is included in the regression. Column (1), for example, shows the estimated impact of the tariff on log wage with the import license as an additional control variable in the regression. We can see that the estimated coefficient is still statistically significant at the 5 percent level. Other results reported in Panel A are qualitatively similar to the baseline results in the previous tables, although the magnitude of the coefficients may be different. These exercises indicate that our results are not sensitive to the inclusion of policy control variables.

5.3 Alternative measures of regional tariffs

We also experiment with several alternative regional tariff measures. First, to account for the effect of both output tariffs and input tariffs, we calculate regional-level effective rates of protection (ERP). The regional ERP is constructed as the employment-weighted average of the industry-level ERP.[13] Second, we use the theory-consistent measure of regional tariffs as in Kovak (2013), where the employment weights are adjusted for labor cost share. Third, we use the employment weights in 2001, i.e., the year just prior to China's WTO entry, instead of using the average employment weights over 1998-2001. Fourth, we recalculate the employment weights using China Industrial Census data in 1995, so that the employment includes all industrial firms instead of only large firms as in the ASIF data. Finally, in our baseline regression, we set the tariff level in 1998-2001 to be constant over time. We now allow the tariff level to vary during this period. As seen in Panel B of Table 6, all the baseline results still hold with these alternative regional tariff measures.

[13]The industry level ERP is constructed as follows: $ERP_i = \frac{outputtariff_i - MS_i \times inputtariff_i}{1 - MS_i}$, where $outputtariff_i$ is output tariff in industry i, and is input tariff. MS_i is the share of intermediate input costs over total output.

5.4 Alternative samples

We now conduct more robustness checks with alternative samples. First, in our sample, not all cities exist in the sample throughout the entire period between 1999 and 2008. To address the potential selection issue, we re-estimate everything using a balanced sample of cities that exist in our sample every year during 1999-2008. Second, we drop the workers in the agriculture industry, since our tariff measure only includes mining and manufacturing industries.

The estimation results are shown in Panel C of Table 6. The estimated effect of tariffs on wages, labor supply, household size, co-residence, household income per capita, and household consumption survived almost all these tests.

5.5 Migration issues

A challenge to the regional approach in this paper is that labor may migrate across regions in response to trade shocks, thus arbitraging away any cross-regional wage differences. We address the migration issue in several ways. First, we only include those individuals who lived in their current city before 2002, and we conduct our baseline regressions on various outcome variables with this new sample. The last row of Table6 shows that restricting the sample to people who lived in their current city before 2002 does not affect our conclusion about the effects of tariff cuts on the various outcomes.

Second, the UHS provides information on when the individual began living in their current location, which enables us to directly examine how the tariff affects the migration decision. Column (1) of Table A8 in the Appendix shows that whether an individual moved to their current city after 2002 is not significantly affected by the regional tariff. Similarly, column (2) shows that the regional tariff is not signification associated with whether an individual had the *hukou* (registration place) other than their current city, either. Third, using Chinese population census data in 2000 and 2005, we calculate the log change in the working age population in each city and regress it on the regional tariff change between 1999 and 2004. Column (3) of Table A8 shows that the change in the working age population in the city is not significantly associated with a regional tar-

iff change. Taken together, these results suggest that migration decisions are not affected by trade liberalization shocks, and excluding migrants does not introduce material changes to our previous results.

6 Discussion

The previous analysis shows that households would increase their labor supply, enlarge their household size, and reduce their saving rate in response to a lowered regional tariff. This section attempts to answer a natural question: how much do these responses matter? We gauge the impacts of these behavioral responses through some simple back-of-envelope calculations.

Increased labor supply. Tables 2 suggests that a one-percentage-point increase in the regional tariff leads to a 0.42 percentage point increase in the labor supply and a 1.8 percent decrease in wages. Because 71 percent of individuals are working on average, and the mean level of the tariff cut is 7 percentage points, the local wage income reduction caused by the tariff cut is $-0.0615w_0$, where w_0 is the initial wage. By contrast, if we hold the labor supply constant and keep the other parameters the same, the local wage income reduction caused by the tariff cut would be$-0.0861w_0$. Therefore, the increased labor supply would offset the negative income shock by 30 percent. However, this is an up-bound estimation because we assume that the wage decline remains the same when the labor supply is not increased. However, we can further relax this assumption by setting the wage elasticity with respect to the labor supply to -0.5, which is larger than most estimates in the labor literature (Card, 2005; Borjas, 2009) and thus yields a lower bound estimation. According to this approach, the increased labor supply would offset the effects on consumption by 15 percent.

More Parental Co-residence. Young adults will move to co-reside with their parents when the regional tariff is lowered, which allows them to reduce living costs and share public goods within the parental home. Part of the effects of tariffs on consumption should be explained by

the changed larger household size and more cases of parental co-residence. Columns 3 and 4 in Table5 show that the coefficients on household consumption become 13-16 percent smaller after controlling for household structure. We argue that this could be a meaningful index: the larger the proportion of the effects on consumption explained by co-residence, the more consumption reduction is absorbed by sharing household public goods, leaving the consumption of individual private goods less affected. However, because consumption is collected based on household level rather than individual level and the costs of co-residence – such as reduced privacy – are hard to measure, it is difficult to quantitatively determine – in a reduced form framework – the extent to which parental co-residence offsets the utility loss caused by income shocks.

Less saving. This may be self-evident: as shown in Table 5, the coefficients of consumption are smaller than those of income. The estimates suggest that 13-35 percent of the impact of income shocks on consumption could be offset by saving behavior.

7 Conclusion

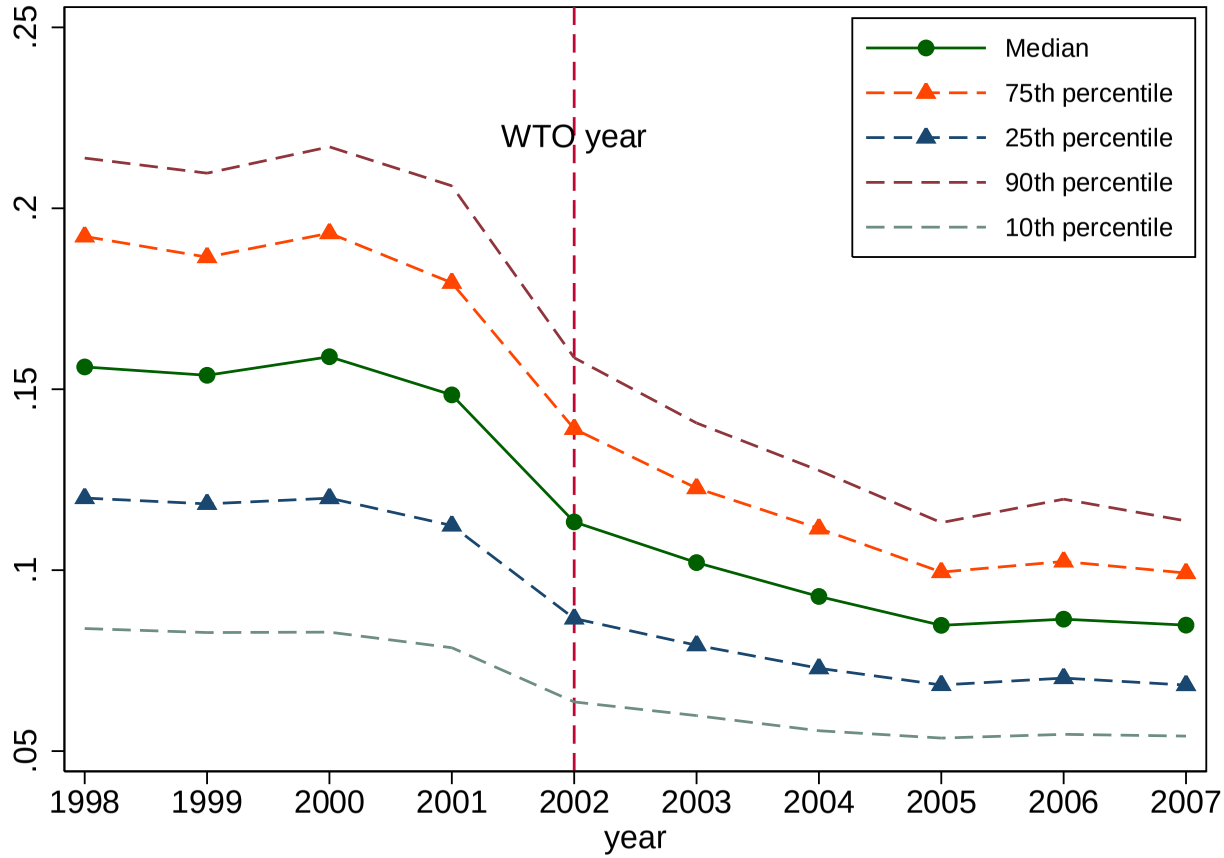
The extant literature finds that the labor market makes substantial adjustments in response to trade liberalization. However, insufficient attention has been paid to how households adjust to such trade-induced labor market shocks. Using a comprehensive household survey in urban China, we systematically examine how trade liberalization affects household behaviors and outcomes, including labor, living arrangements, income and consumption. We explore the regional variation in the exposure to tariff reduction caused by China's WTO accession.

Our results suggest that regional tariff cuts caused relative declines in local wages. However, households adopt a set of behaviors to buffer such income shocks. First, household members work more, especially in the non-tradable sector. The increase in labor supply is larger for females and the elderly, consistent with the "added worker effect" discussed in the labor literature. Second, more young adults move to live with their parents for the purpose of expenditure sharing. Finally, households also lower their saving rate in order to smooth consumption. We conclude that house-

holds play an important role in insuring individuals against the labor market shocks induced by trade liberalization.

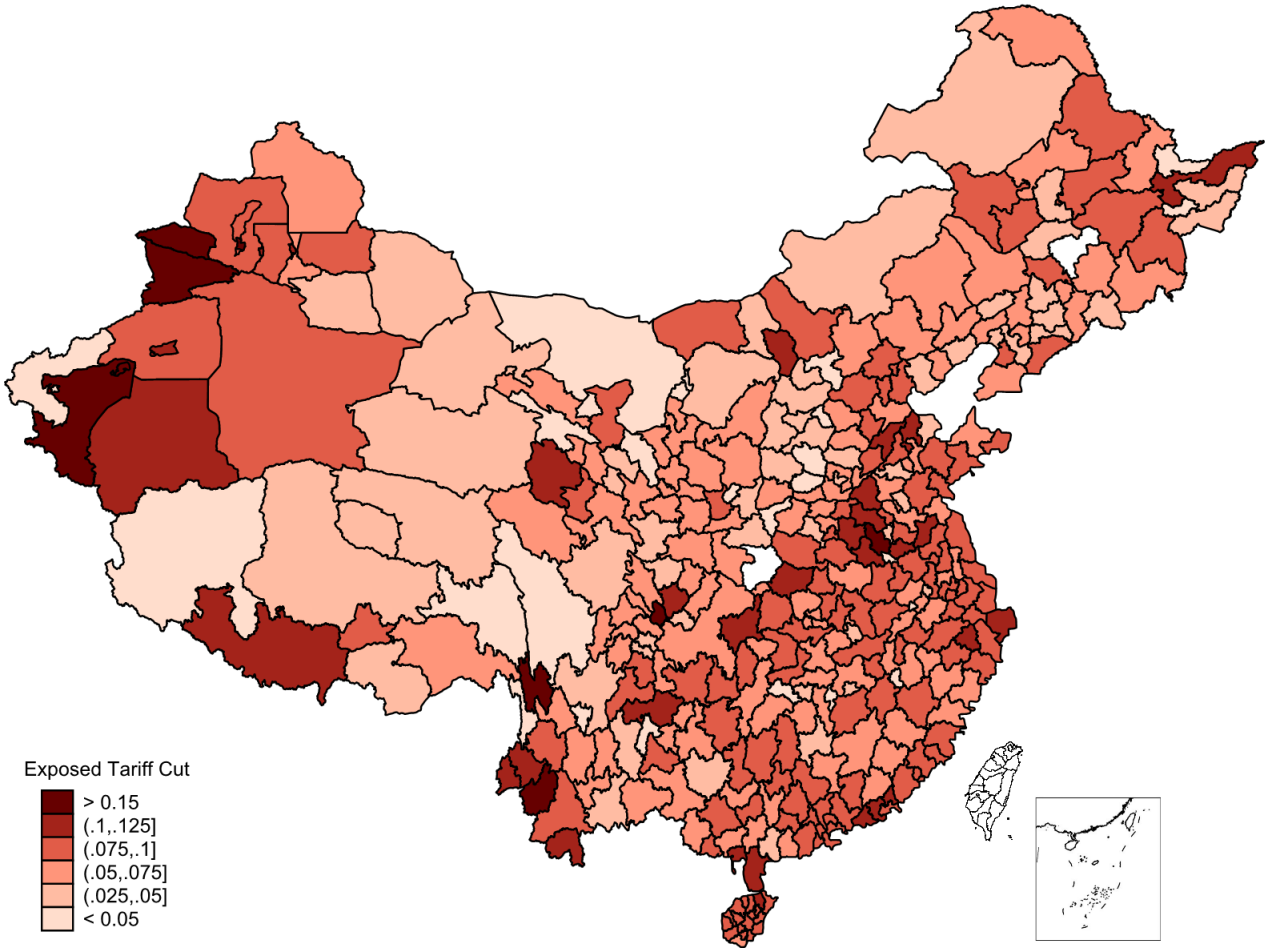
Our findings contribute to several on-going literatures and provide important policy implications. First of all, our results contribute to the current literature on the regional impact of trade liberalization by investigating various margins of household responses. Investigating household behaviors enriches our understanding of how the economy adjusts to trade liberalization and of the welfare implications of trade liberalization. Second, the impact of trade liberalization on household structures can have important implications for the earning trajectories of young people, the living arrangements of seniors, and the design of social insurance. Increased household sizes or more parental co-residence may lead to lower demand for and consumption of household goods per capita. Finally, by investigating the exogenous shocks to the labor market caused by trade liberalization, we provide new evidence regarding how people respond to those shocks in order to smooth consumption, and this evidence has important welfare implications.

Figure 1: Regional Tariff over 1998-2007, by Various Percentiles



Note: The figure shows the median and various percentiles of the regional tariffs during 1998-2007.
Data source: author's own calculation based on Annual Survey of Industrial Firms (ASIF) and tariff data.

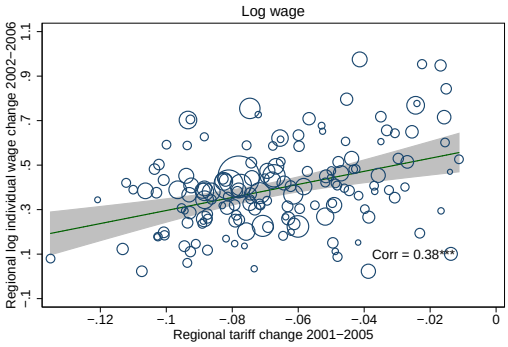
Figure 2: Geographical distribution of Regional Tariff Cut between 1998-2007 in Mainland China



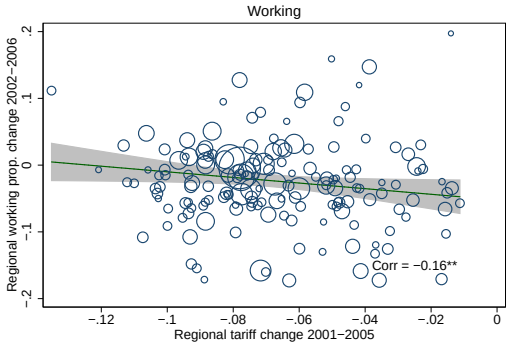
Note: The figure shows the geographical distribution the changes in regional tariffs during 1998-2007.
Data source: Author's own calculation based on Annual Survey of Industrial Firms (ASIF) and tariff data.

Figure 3: Correlations of Outcome Changes in 2002-2006 with Regional Tariff Changes in 2001-2005

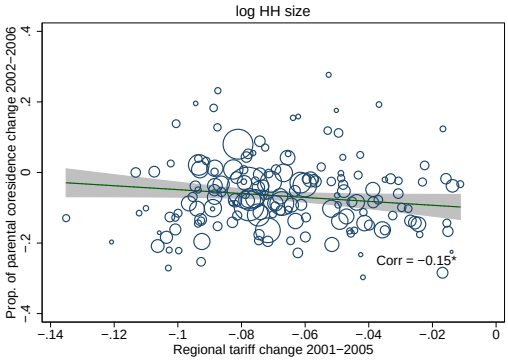
(a) Wage



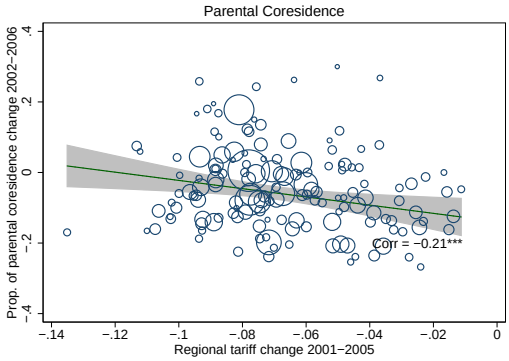
(b) Working



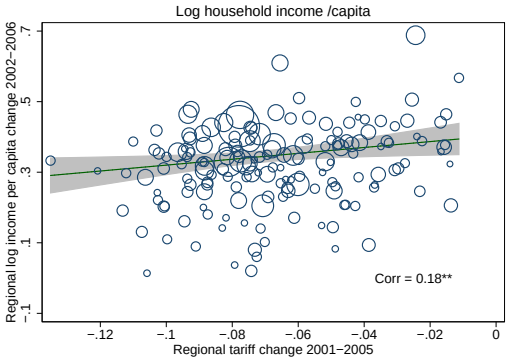
(c) Household size



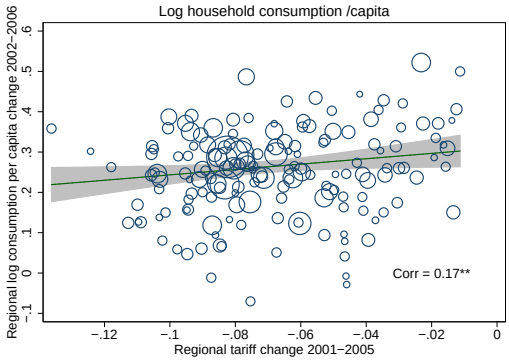
(d) Parental co-residence



(e) Household income



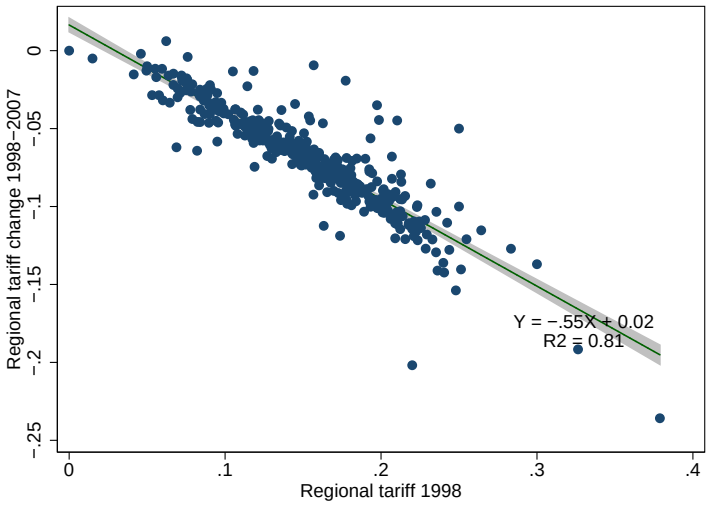
(f) Household consumption



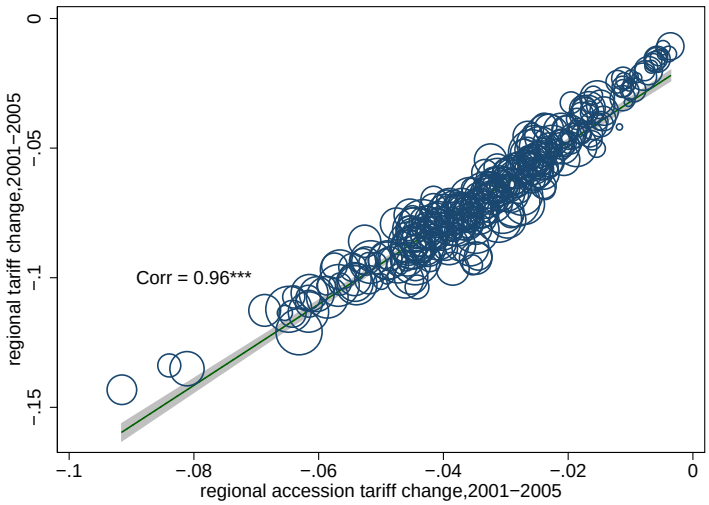
Note: Each circle represents a city. Circle size represents sampling size of the city in the UHS sample. X-axis: regional tariff change between 2001-2005. Y-axis: the change between 2002-2006 for (a) log real wage (b) proportion of working population (c) log household size (d) proportion of households with parental co-residence (e) log real household income per capita (f) log real household consumption per capita.
Data source: Author's own calculation based on UHS and tariff data.

Figure 4: Relationship between regional WTO accession tariff and actual tariff

(a) Tariff cuts over initial tariff level



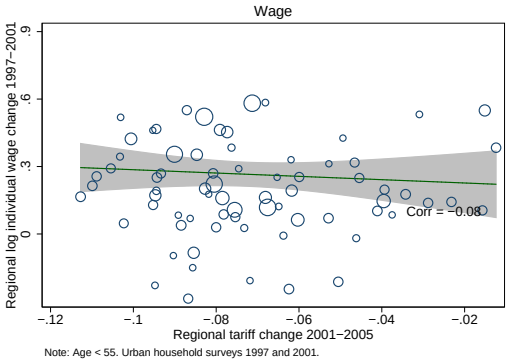
(b) Changes in Actual tariff v.s. Changes in Accession tariff



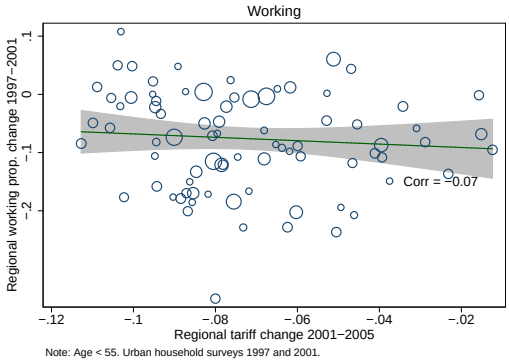
Data source: author's own calculation based on Annual Survey of Industrial Firms (ASIF) and tariff data.

Figure 5: Placebo test: Correlation of Outcome Changes in 1997-2001 with Regional Tariff Changes in 2001-2005

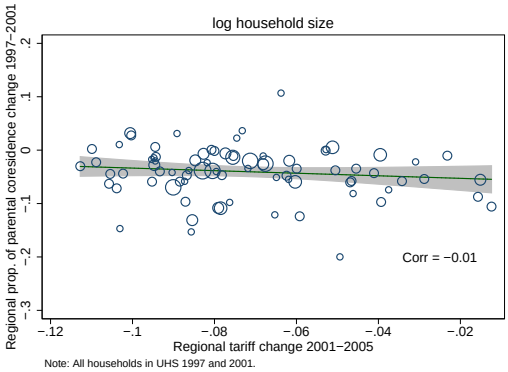
(a) Wage



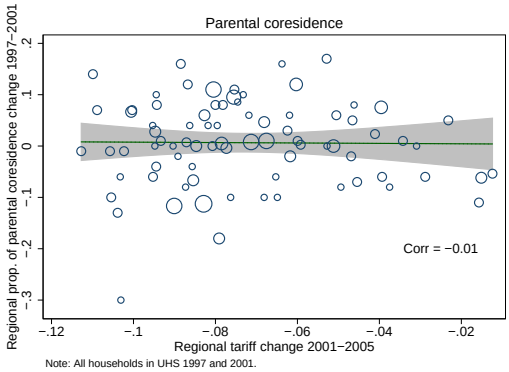
(b) Working



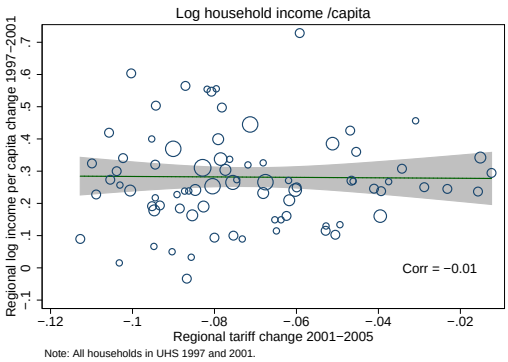
(c) Household size



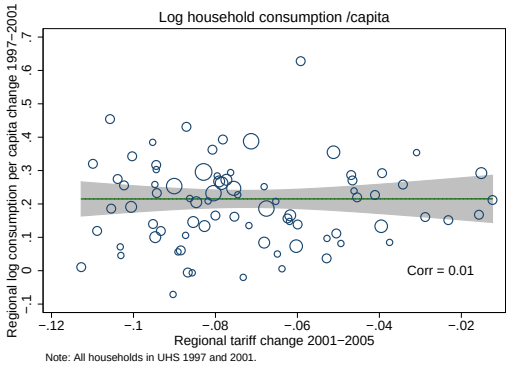
(d) Parental co-residence



(e) Household income



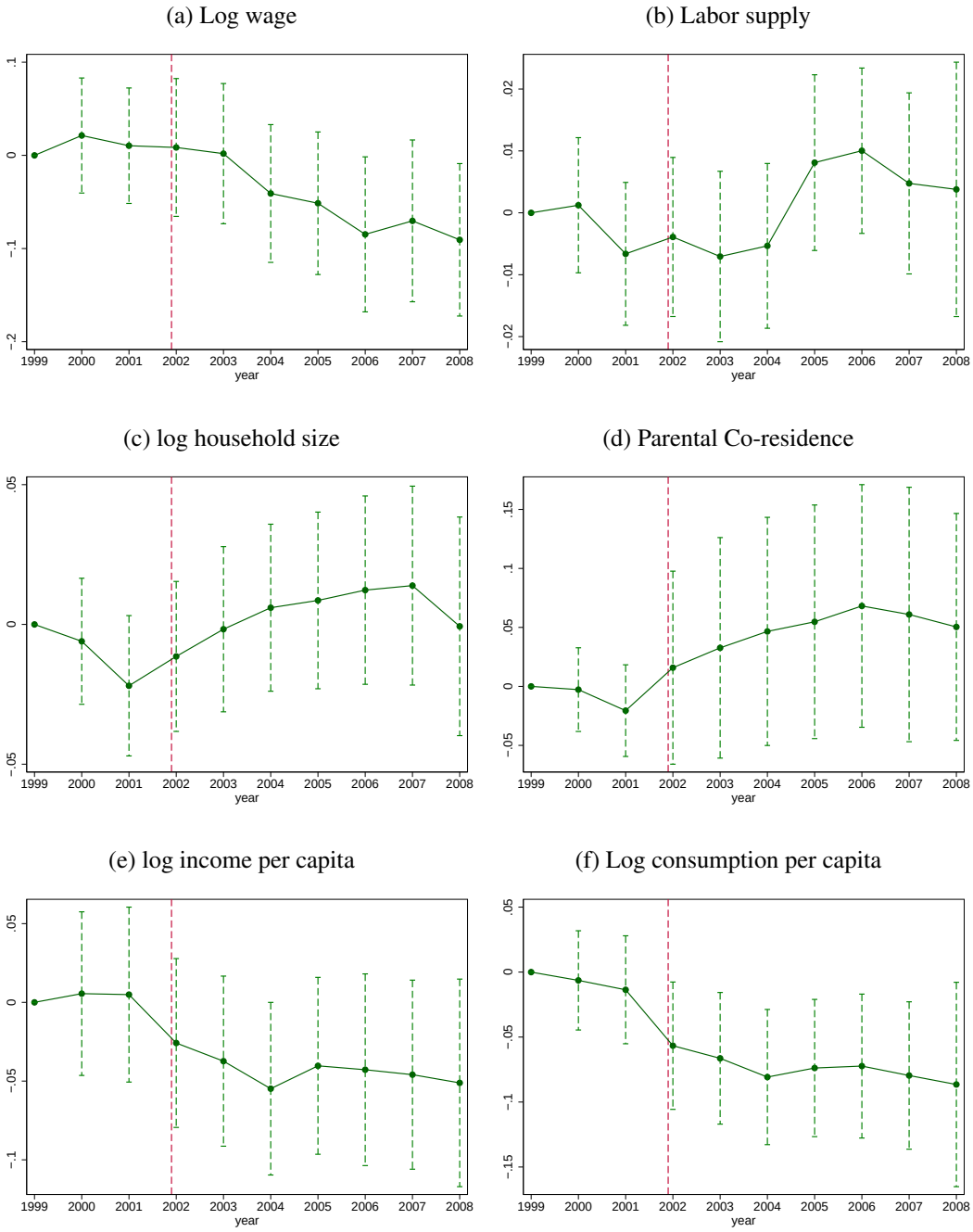
(f) Household consumption



Note: Each circle represents a city. Circle size represents sampling size of the city in UHS. X-axis: regional tariff change between 2001-2005. Y-axis: the change between 1997-2001 for (a) log real wage (b) proportion of working population (c) log household size (d) proportion of households with parental co-residence (e) log real household income per capita (f) log real household consumption per capita.

Data source: Author's own calculation based on UHS and tariff data.

Figure 6: Outcome Difference between Regions with Larger and Smaller Tariff Cuts, by Year



Note: We replace the tariff variable in equation (2) by a dummy variable for prefectures with larger tariff cuts and its interactions with year dummies and report the corresponding coefficients and confidence intervals here. The dependent variables are (a) log wage (b) working (c) log household size (d) parental co-residence (e) log real household income per capita (f) log real household consumption per capita.
Data source: Author's own calculation based on the UHS and tariff data.

Table 1: Summary statistics

	(1)	(2)	(3)
Panel A: Individual level variables			
Sample	Full sample	Age < Retire age	Age >= Retire age
Working (Yes = 1)	0.71	0.85	0.17
	(0.45)	(0.36)	(0.37)
Working at tradable sector	0.17	0.22	0.01
(Yes = 1)	(0.38)	(0.41)	(0.11)
Working at non-tradable sector	0.53	0.63	0.15
(Yes = 1)	(0.50)	(0.48)	(0.36)
Working hours (Monthly)	119.1	145.1	16.0
	(91.9)	(80.9)	(52.1)
Log(wage)	4.53	4.60	3.30
	(1.06)	(0.95)	(1.78)
Observations	591,063	470,623	120,440
Panel B: Household level variables			
Sample	Full sample	HH head age < 50	HH head age $\geqq$ 50
Household size	2.95	3.03	2.84
	(0.83)	(0.63)	(1.01)
Parental co-residence	0.31	0.17	0.49
(Yes = 1)	(0.46)	(0.37)	(0.50)
Household head living with adult	0.26	0.09	0.48
children (Yes = 1)	(0.44)	(0.28)	(0.50)
Household head living with	0.05	0.08	0.02
parent(s) (Yes = 1)	(0.22)	(0.27)	(0.13)
Household yearly income per capita	11.2	10.6	12.0
(1,000 yuan)	(8.6)	(8.5)	(8.7)
Consumption yearly per capita	7.4	7.1	7.7
(1,000 yuan)	(5.5)	(5.4)	(5.7)
Saving rate	0.28	0.27	0.30
	(0.25)	(0.25)	(0.26)
Observations	251,506	142,278	109,228

Note: Standard deviations in parentheses.

Table 2: Lower Tariff Leads to Lowered Wage and Increased Labor Supply

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var:	Log (Wage)			Working (Yes = 1)	Tradable sector (Yes = 1)	Non-tradable sector (Yes = 1)	Log(Working hours)
Sample	Full sample	Tradable	Non-tradable	Full sample			Working people
Panel A: OLS							
$Tariff_{c,t-1}$	1.76***	2.22***	1.45***	-0.42***	0.43**	-0.85***	-1.42**
	(0.47)	(0.77)	(0.42)	(0.14)	(0.18)	(0.21)	(0.67)
Observations	379,389	95,205	282,225	591,063	591,063	591,063	229,160
R^2	0.35	0.36	0.36	0.53	0.12	0.28	0.15
Panel B: 2SLS							
$Tariff_{c,t-1}$	2.67***	3.05***	2.47***	-0.59***	0.29	-0.88***	-1.05
	(0.74)	(0.90)	(0.72)	(0.18)	(0.21)	(0.24)	(0.72)
Observations	379,389	95,205	282,225	591,063	591,063	591,063	229,160
R^2	0.35	0.36	0.36	0.53	0.12	0.28	0.15
Controls in both panels							
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	179	179	179	179	179	179	166

Note: Dependent variable is log yearly wage at individual level. Panel B uses regional WTO accession tariff as instrument for regional tariff. Column (2) only includes workers in the tradable sector (manufacturing and mining). column (3) only include workers in the non-tradable sector. Column (7) include only working people. All regressions include dummies of city, survey year, gender (male/female), education (junior high or below, senior high, and college or above), and interactions between city and gender, interactions between gender, year, and age, and interactions between gender and education.
Standard errors in parentheses are clustered at the city level.
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Labor supply adjustment: Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.:	Working or not		Working at tradable sector		Working at non-tradable sector		Log wage	
Sample	Male	Female	Male	Female	Male	Female	Male	Female
Panel A: OLS								
20-29	-0.42	-1.23***	0.15	-0.13	-0.57	-1.10**	1.2	0.5
30-39	-0.10	-0.59**	0.30	0.11	-0.40	-0.69	1.7***	0.8
40-49	-0.13	-0.76**	0.60	0.64	-0.73**	-1.40***	1.9***	1.7***
50-59	-0.03	-0.45	0.48	-0.02	-0.51	-0.43	2.6***	2.7*
60+	-2.39***	-1.08***	-0.06	0.02	-2.33***	-1.10***	-	-
Panel B: 2SLS								
20-29	-0.31	-0.98***	0.19	-0.03	-0.50	-0.95***	2.4**	1.5
30-39	-0.11	-0.49***	0.57*	0.32	-0.68**	-0.81*	2.4***	1.7*
40-49	-0.03	-0.55**	0.89***	0.67	-0.92***	-1.22***	1.9**	2.0**
50-59	-0.21	-0.26	0.76**	0.05	-0.97***	-0.30	4.3***	5.7***
60+	-1.48***	-0.61**	-0.07	0.04	-1.41***	-0.65**	-	-

Note: This table reports estimation of equation 2 by gender and age group. Dependent variables are all at individual level. Column (1) - (2): working or not (yes=1); Column (3) - (4): working for tradable sector (yes=1); Column (5) - (6): working for non-tradable sector (yes=1). Column (7) - (8): log yearly wage. Panel B use regional WTO accession tariff as instrument for regional tariff. All regressions include dummies of city, survey year, gender (male/female), education (junior high or below, senior high, and college or above), and interactions between city and gender, interactions between gender, year, and age, and interactions between gender and education.
Standard errors in parentheses are clustered at the city level.
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Lower Tariff Leads to Larger Household Size and More Parental Co-residence

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log (Household size)			Parental co-residence (Yes = 1)			Head with children	Head with parents
Sample	Full sample	HH head age < 50	HH head age $\geqq$ 50	Full sample	HH head age < 50	HH head age $\geqq$ 50	HH head age $\geqq$ 50	
Panel A: OLS								
$Tariff_{c,t-1}$	-0.27**	-0.12	-0.54**	-0.50**	-0.19	-1.09**	-1.13**	0.03
	(0.13)	(0.11)	(0.25)	(0.24)	(0.18)	(0.50)	(0.50)	(0.05)
Observations	251,492	142,264	109,228	251,492	142,264	109,228	109,228	109,228
R-squared	0.11	0.10	0.08	0.21	0.14	0.09	0.09	0.03
Panel B: 2SLS								
$Tariff_{c,t-1}$	-0.35**	-0.24*	-0.50*	-0.35	-0.16	-0.79*	-0.86*	0.08
	(0.15)	(0.13)	(0.29)	(0.26)	(0.20)	(0.48)	(0.48)	(0.08)
Observations	251,492	142,264	109,228	251,492	142,264	109,228	109,228	109,228
R-squared	0.11	0.10	0.08	0.21	0.14	0.09	0.09	0.03
Controls in both panels								
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	179	179	179	179	179	179	179	179

Note: Dependent variables are at household level. Columns (1) - (3): log household size; Columns (4) - (6): dummy of co-residence between two adult generations (yes=1); Columns (2) and (5) include households whose household head are aged below 50, Columns (3) and (6) include households whose household head are aged 50 or above. Panel B use regional WTO accession tariff as instrument for regional tariff. All regressions include dummies of city, survey year, household head characteristics including gender (male/female), education (junior high or below, senior high, and college or above), and interactions between city and gender, interactions between gender, year, and age, as well as interactions between gender and education. Standard errors in parentheses are clustered at the city level.

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Lower Tariff Leads to Lower Household Income, Less Consumption, and Higher Saving Rate

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	Log (Household income /capita)		Log (Household consumption /capita)		Saving rate	
Panel A: OLS						
$Tariff_{c,t-1}$	1.17***	1.05***	1.03***	0.90***	0.07	0.08
	(0.36)	(0.36)	(0.33)	(0.32)	(0.12)	(0.12)
Observations	251,492	251,492	251,492	251,492	251,492	251,492
R-squared	0.42	0.47	0.36	0.42	0.07	0.07
Panel B: 2SLS						
$Tariff_{c,t-1}$	1.58***	1.42***	1.08**	0.91*	0.31**	0.32**
	(0.55)	(0.54)	(0.51)	(0.50)	(0.15)	(0.15)
Observations	251,492	251,492	251,492	251,492	251,492	251,492
R-squared	0.42	0.47	0.36	0.42	0.07	0.07
Controls in both panels						
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Household structure	No	Yes	No	Yes	No	Yes
Clusters	179	179	179	179	179	179

Note: Dependent variables: Column (1) log household income per capita; Column (2): log household real consumption per capita; Column (3) household saving rate. Panel B use regional WTO accession tariff as instrument for regional tariff. All regressions include dummies of city, survey year, household head characteristics including gender (male/female), education (junior high or below, senior high, and college or above), and interactions between city and gender, interactions between gender, year, and age, as well as interactions between gender and education.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Robustness Checks

Dep. var.	(1) Log wage	(2) Working	(3) Log HH size	(4) Parental co-residence	(5) log(HH income /capita)	(6) log(HH consump /capita)
Panel A: Control for confounding factors						
Import license	1.26**	-0.38***	-0.51*	-1.22*	0.92**	0.74**
FDI restrictions	1.77***	-0.42***	-0.53**	-1.06**	1.18***	1.04***
Tariff uncertainty	2.00***	-0.42***	-0.45*	-0.81**	1.27***	1.05***
Regional exports	1.77***	-0.42***	-0.51**	-0.98**	1.18***	1.03***
Regional consumption tariff	1.63***	-0.40***	-0.46**	-0.89**	1.07***	0.91***
Minimum wage	1.78***	-0.43***	-0.48**	-0.92**	1.21***	1.02***
Housing price	1.74***	-0.43***	-0.54**	-1.04**	1.19***	0.99***
SOE share	1.76***	-0.42***	-0.54**	-1.11**	1.19***	1.09***
Province*Post WTO	1.63***	-0.48***	-0.43*	-0.66**	0.91***	0.57*
Panel B: Alternative regional tariff measures						
Effective rate of protection	0.46***	-0.11***	-0.13*	-0.27*	0.30***	0.28***
Labor-share adjustment	1.38***	-0.32***	-0.40*	-0.41*	0.95***	0.82***
2001 weights	1.68***	-0.43***	-0.55**	-0.85*	1.05***	0.92***
Industrial census weights	1.93***	-0.39**	-0.46*	-0.79*	1.34***	1.03***
Using 1999-2001 actual tariff	1.57***	-0.39***	-0.48**	-0.99*	1.00***	0.79**
Panel C: Results in alternative samples						
Consistent cities (1999-2008)	2.94***	-0.66***	-0.60*	-1.38**	1.25**	1.24**
Drop agriculture industry	1.80***	-0.42***	-0.55**	-1.10**	1.18***	1.02***
Living here since 2001	1.77***	-0.42***	-0.53**	-1.09**	1.19***	1.04***

Note: This table reports the OLS coefficients of regional tariff measures under specific setting. Panel A: "Import license" controls for regional measure of import license restrictions. "FDI" controls for regional measure of FDI restrictions. "Tariff uncertainty" controls for the interaction between the post-WTO dummy and the regional tariff gap measure. "Regional exports" controls for a regional export measure constructed following Autor et al. (2013). "Regional consumption tariff" controls for regional consumption-weighted tariff measure. "Minimum wage", "Housing prices", and "SOE share" controls for prefecture minimum wage standards, housing price index, and the employment share of state-owned-enterprises. "Province*Post-WTO" controls for dummies for province interacting with post-WTO. Panel B: "effective rate of protection" uses regional effective rate of protection. "2001 weight" uses employment weight in 2001 to construct regional tariff measure. "Industrial census weights" uses employment weights from the 1995 Industrial Census which covered all industrial firms in China. "1999-2001 actual tariff" uses the actual tariff in 1998-2001 and thus allows tariff to vary in pre-WTO period. Panel C: "Consistent cities" uses 96 cities that exist every year during 1999-2008. "Drop agriculture industry" drops workers in the agriculture industry. "Living here since 2001" only keep those households who have been living in local regions since 2001.
*** p<0.01, ** p<0.05, * p<0.1

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Online Appendix

A1 The impact of tariff reduction on firm-level outcomes

In this appendix section we investigate how tariff reduction affect firm performance, using Chinese firm-level data. The purpose of doing this is two folded. First, we can check whether the wage effects we found using household data are also present in the firm-level data. If so, they provide cross-validation for the wage results presented in the main text. Second, we can explore how other firm performance, such as investment, sales, and profit, are affected by tariff change, and whether such changes are consistent with the wage effects. In other words, examining the response of these firm performance variables are useful in revealing the mechanism underlying the impact of tariff on wages.

The main data set we use are the Annual Survey of Industrial Firms for 1998-2007. We estimate the following equation.

$$Y_{fct} = \alpha + \beta Tariff_{c,t-1} + v_f + \lambda_t + \varepsilon_{ft}$$

Where f, c, t refers to firm, city, and year, respectively. is the outcome variable. Y_{fct} is the constructed regional tariff in the main text. We include firm fixed effects (v_f) to capture the effect of time-invariant firm heterogeneity, and year fixed effects (λ_t) to capture the effect of economy-wide shocks. We estimate the equation by OLS and cluster the standard error at city-year level.

Equation (A1) exploits the variation of tariff changes across cities. We also estimate another equation, exploiting the variation of tariff changes across industries, as follows:

$$Y_{fjt} = \alpha + \beta Tariff_{j,t-1} + v_f + \lambda_t + \varepsilon_{ft}$$

The only difference between Equation (A2) with (A1) is that here the independent variable is the 4-digit CIC industry-level tariff ($Tariff_{j,t-1}$) instead of the regional tariff. We can estimate this equation because the ASIF data reports firm's detailed industry affiliation. We estimate the equation by OLS and cluster the standard error at industry-year level.

For each of these two specifications, we report the results for four outcome variables: log

wage, log investment, log domestic sales, and log profit. The first variable directly checks the wage effects of trade liberalization, while the other three variables help revealing the mechanism of the wage effects. That is, whether firms lower their wages because tariff reduction reduced investment, profit, sales, etc.

The results are reported in Table A4. In Column (1), tariff reduction is associated with lower wages. This holds regardless of whether the tariff measure is at the regional or industry level. The results corroborates our findings using household data that regional tariff reduction reduced local wages. In Columns (2) - (4), tariff reduction is associated with lower investment, lower domestic sales, and lower profit. This suggests that the reason why firms lower wages is that the import competition resulting from tariff reduction reduced firms' profitability in the short-run and firms transmit such shocks to workers through lowering wages.

A2 Construction of measures in the robustness section

Import License Control We assembled information on the licensing of imports at HS 8-digit level, drawing on annual circulars of the Ministry of Foreign Trade and Economic Cooperation and the Ministry of Commerce. We construct city-level import license measure as follows. First, we measure the extent of import license control for each 4-digit CIC industry as the share of HS8 products under import license control within this industry. Second, we construct city level import license measure as employment weighted average of the share across all industries.

FDI restrictions Our data on FDI restrictions is from the Catalogue for the Guidance of Foreign Investment Industries issued by the Ministry of Commerce of China. Based on the industry descriptions listed in the Catalogue, we first map city-level FDI restriction measures to CIC 4-digit, and categorize a CIC industry as subject to an FDI restrictions if it is either restricted or prohibited. We then further map 4-digit CIC to the 1-digit industry classification in the UHS data and calculate the share of 4-digit CIC industries that are restricted within each 1-digit industry. Finally, we construct city-level FDI restriction as the employment weighted average of the share across all 1-digit industries, where the 1-digit employment data is obtained from the UHS.

Regional tariff uncertainty The recent literature finds that tariff uncertainty reduction resulting from the US granting permanent normal trade relations (PNTR) to China after China's WTO entry has substantially increased Chinese exports (Handely and Limao, 2017; Pierce and Schott, 2016). Therefore, we construct regional level tariff uncertainty measures to capture the export effects.

We construct regional tariff uncertainty measures as follows. First, following Handely and Limao (2017) and Pierce and Schott (2016), we define tariff uncertainty for each HS 8-digit product as the difference between the MFN tariff and the US "Column 2" tariff in year 2000. We call this tariff uncertainty measure "GAP":

$$GAP_g = Tariff_{column2,g} - Tariff_{MFN,g}$$

Second, we map HS 8-digit goods to 4-digit CIC industry, and calculate the CIC industry level GAP as the simple average of the GAP for all HS products within this industry. Third, we calculate the GAP for each city as the weighted average of GAP across all industries in the city, where we use the share of an industry's export value in the city's total export value in 2000 as weights.[14]

$$GAP_c = \sum_g s_{cg,2000} GAP_g$$

This regional GAP variable captures the degree of tariff uncertainty of each city in the Pre-WTO year. We interact this variable with a post-WTO dummy ($Post - WTO$) which equals 1 for years later than (including) 2002. Theoretically, cities facing larger tariff uncertainty pre-WTO will experience larger reductions in tariff uncertainty after China's WTO entry. Therefore, we expect exports to growth faster in these regions in the Post-WTO years.

Regional exports We construct a regional export measure for each city and year, following Autor et al. (2013). Specifically, the regional export measure ($RegExp_{ct}$) is a employment-weighted averages of exports per worker in each industry. In equations:

$$RegExp_{ct} = \sum_i \frac{L_{ic0}}{L_{c0}} * \frac{Exp_{it}}{L_{it}}$$

[14]This strategy has been used in Facchini et al. (2017). Alternatively, Erten and Leight (2017) used regional employment weights instead of export weights. We experiment with both and find similar results.

Where i, c, t indicates industry, city, and year, respectively. $\frac{Exp_{it}}{L_{it}}$ measures exports per worker in each industry. We weigh these industry-level export shocks by the share of this industry in the regional employment in the initial period ($\frac{L_{ic0}}{L_{c0}}$), and then aggregate up to the prefecture-year level. In table 6, we choose the average of 1998-2001 as the initial period, while we also experimented with using 1998 or 2001 in unreported regressions.

Regional consumption-weighted tariff We capture the expenditure channel of tariff cuts by the regional consumption-weighted tariff. We construct the consumption-weighted tariff in each prefecture and year as follows:

$$ConsumTariff_{ct} = \sum_{g} s_{gc,2002} \tau_{gt}$$

Where g is a good in the UHS data, c is city, t is year. $s_{gc,2002}$ is the expenditure share of good g is prefecture c's good consumption in year 2002.[15] The UHS reports the consumption of 74 tradable goods, including food, clothing, furniture, home appliances, telecommunication equipment, etc. We manually map these goods to HS 8-digit codes. Then we calculate the tariff of each good as the simple average of the tariff of all HS codes within this good. We have also experimented with including services into total consumption, and set the tariff changes of the service sector to 0. The results are qualitatively similar for the alternative consumption tariff measures.

[15] We use the expenditure share in 2002 because the categorization of consumption goods in the UHS changed in 2002 due to questionnaire design change. In addition, consumption data are missing for many of the goods before 2002.

Appendix Table A1: Tariff and changes in different industries

(1) CIC code	(2) Industry name	(3) Tariff 1998	(4) Tariff 2007	(5) Change
15	Manufacture of Beverages	0.465	0.231	-0.235
16	Manufacture of Tobacco	0.537	0.315	-0.221
21	Manufacture of Furniture	0.220	0.019	-0.201
17	Manufacture of Textile	0.261	0.112	-0.149
28	Manufacture of Chemical Fibers	0.164	0.043	-0.121
13	Processing of Food from Agricultural Products	0.263	0.150	-0.113
14	Manufacture of Foods	0.276	0.166	-0.111
18	Manufacture of Textile Wearing Apparel, Footwear and Caps	0.279	0.173	-0.106
37	Manufacture of Transport Equipment	0.211	0.108	-0.103
11	Support Activities for Mining	0.233	0.133	-0.100
40	Manufacture of Communication Equipment, Computers and Other Electronic Equipment	0.156	0.060	-0.096
42	Manufacture of Artwork and Other Manufacturing	0.231	0.135	-0.096
19	Manufacture of Leather, Fur, Feather and Related Products	0.232	0.148	-0.084
30	Manufacture of Plastics	0.186	0.102	-0.084
36	Manufacture of Special Purpose Machinery	0.137	0.053	-0.083
20	Processing of Timber, Manufacture of Wood, Bamboo, Rattan, Palm and Straw Products	0.120	0.042	-0.078
22	Manufacture of Paper and Paper Products	0.132	0.057	-0.076
24	Manufacture of Articles For Culture, Education and Sport Activities	0.205	0.130	-0.075
23	Printing, Reproduction of Recording Media	0.116	0.044	-0.072
41	Manufacture of Measuring Instruments and Machinery for Cultural Activity and Office Work	0.138	0.070	-0.069
39	Manufacture of Electrical Machinery and Equipment	0.179	0.117	-0.062
35	Manufacture of General Purpose Machinery	0.141	0.085	-0.056
27	Manufacture of Medicines	0.104	0.052	-0.052
26	Manufacture of Raw Chemical Materials and Chemical Products	0.127	0.080	-0.047
29	Manufacture of Rubber	0.182	0.137	-0.045
31	Manufacture of Non-metallic Mineral Products	0.157	0.116	-0.041
34	Manufacture of Metal Products	0.146	0.108	-0.038
7	Extraction of Petroleum and Natural Gas	0.050	0.020	-0.030
32	Smelting and Pressing of Ferrous Metals	0.056	0.035	-0.021
33	Smelting and Pressing of Non-ferrous Metals	0.052	0.032	-0.020
25	Processing of Petroleum, Coking, and Processing of Nuclear Fuel	0.056	0.043	-0.013
10	Mining and Processing of Non-metal Ores	0.045	0.036	-0.009
9	Mining and Processing of Non-Ferrous Metal Ores	0.012	0.004	-0.007
6	Mining and Washing of Coal	0.046	0.044	-0.002
8	Mining and Processing of Ferrous Metal Ores	0.000	0.000	0.000

Appendix Table A2: Regional tariff change in different cities

(1) City name	(2) Tariff 1998	(3) Tariff 2007	(4) Tariff change	(5) Major industry in 1998-2001
Panel a: Five cities with largest cut				
Shi yan	0.379	0.143	-0.236	Manufacture of Transport Equipment
Hao zhou	0.240	0.098	-0.142	Manufacture of Beverages
Zhou kou	0.244	0.116	-0.128	Manufacture of Textile
Fu yang	0.223	0.102	-0.122	Manufacture of Beverages
Pu ning	0.255	0.134	-0.121	Manufacture of Textile
Panel b: Five cities with smallest cut				
Chang zhi	0.072	0.056	-0.016	Mining and Washing of Coal
He gang	0.067	0.052	-0.015	Mining and Washing of Coal
Pan zhi hua	0.050	0.037	-0.013	Smelting and Pressing of Ferrous Metals
Qi tai he	0.060	0.048	-0.012	Mining and Washing of Coal

Appendix Table A3: Tariff and Firm-level Outcomes

	(1)	(2)	(3)	(4)
Dep. Var.	log wage	log investment	log dom. sales	log profit
Period	98-07	98-07	98-07	98-07
Panel A: Regional tariff				
Regional tariff	1.08***	1.08*	0.52	4.11***
	(0.25)	(0.59)	(0.35)	(0.83)
Observations	1,434,873	964,156	1,318,575	1,132,034
R-squared	0.724	0.666	0.868	0.811
Panel B: Industry tariff				
Industry tariff	0.14***	0.46***	0.16*	0.63***
	(0.05)	(0.17)	(0.10)	(0.15)
Observations	1,436,855	686,396	1,310,617	1,105,894
R-squared	0.688	0.684	0.840	0.793
Controls in both panels				
Firm FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes

Note: Dependent variable in each column: column (1): log wage; Column (2) log investment; Column (3) log domestic sales; Column (4) log profit. Panel A uses regional tariff, Panel B uses 4-digit industry tariff. All regressions include firm fixed effects and year fixed effects. Standard errors are clustered at city-year level in Panel A, and industry-year level in Panel B.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A4: How tariff affects labor supply arrangement within couples

	(1)	(2)	(3)	(4)
Dep. Var.	Both working	Only husband working	Only wife working	Neither working
Sample	Households with head's age < 60			
Mean of dep. var.	0.748	0.182	0.027	0.043
Panel A: OLS				
$Tariff_{c,t-1}$	-0.55***	0.45***	0.03	0.06
	(0.20)	(0.16)	(0.06)	(0.06)
Observations	192,247	192,247	192,247	192,247
R-squared	0.29	0.14	0.04	0.21
Panel B: 2SLS				
$Tariff_{c,t-1}$	-0.72***	0.71***	-0.05	0.06
	(0.26)	(0.22)	(0.06)	(0.09)
Observations	192,247	192,247	192,247	192,247
R-squared	0.29	0.14	0.04	0.21
Controls in both panels				
Basic controls	Yes	Yes	Yes	Yes
Clusters	179	179	179	179

Note: Dependent variables are at household level. Dependent variables in each column: column (1) both husband and wife are working (yes=1), column (2) only the husband is working (yes=1), column (3) only the wife is working (yes=1), column (4) neither husband nor wife is working (yes=1). All regressions include dummies of city, survey year, household head characteristics including gender (male/female), education (junior high or below, senior high, and college or above), and interactions between city and gender, interactions between gender, year, and age, as well as interactions between gender and education.

Standard errors in parentheses are clustered at the prefecture level.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A5: How tariff affects household age structure

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	Prop. of people aged below 16 in the HH			Prop. of people aged over 60 in the HH		
Sample	Full sample	HH head age < 50	HH head age ≧ 50	Full sample	HH head age < 50	HH head age ≧ 50
Panel A: OLS						
$Tariff_{c,t-1}$	0.01	0.03	0.01	0.13**	0.00	0.33***
	(0.04)	(0.06)	(0.06)	(0.05)	(0.04)	(0.11)
Observations	251,492	142,264	109,228	251,492	142,264	109,228
R-squared	0.49	0.45	0.07	0.76	0.03	0.75
Panel B: 2SLS						
$Tariff_{c,t-1}$	0.02	0.04	0.03	0.18**	0.02	0.37**
	(0.05)	(0.08)	(0.08)	(0.07)	(0.05)	(0.15)
Observations	251,492	142,264	109,228	251,492	142,264	109,228
R-squared	0.49	0.45	0.07	0.76	0.03	0.75
Controls in both panels						
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	179	179	179	179	179	179

Note: Dependent variables are at household level. Dependent variable in each column: column (1)-(3): the proportion of people aged below 16 in the household; column (4)-(6): the proportion of people aged above 60 in the household. All regressions include dummies of city, survey year, household head characteristics including gender (male/female), education (junior high or below, senior high, and college or above), and interactions between city and gender, interactions between gender, year, and age, as well as interactions between gender and education.
Standard errors in parentheses are clustered at the prefecture level.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A6: Household Transfers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Var.	Received public transfer (Yes = 1)		Log(Public transfer income)		Received private transfer (Yes = 1)		Log(Private transfer income)		Have any out-transfer (Yes = 1)		Log(transfer out)	
Mean	0.445		3.561		0.359		1.328		0.934		1.769	
$Tariff_{c,t-1}$	0.42**	0.39**	1.57**	1.22*	0.28	0.25	1.24	1.13	-0.03	-0.03	1.09	0.97
	(0.17)	(0.16)	(0.67)	(0.64)	(0.31)	(0.30)	(0.84)	(0.85)	(0.11)	(0.10)	(0.92)	(0.90)
Observations	218,819	218,819	97,367	97,367	218,819	218,819	78,493	78,493	251,492	251,492	234,773	234,773
R-squared	0.50	0.89	0.44	0.99	0.08	0.72	0.12	0.82	0.05	0.98	0.13	0.88
Controls in both panels												
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH structure	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	166	166	166	166	166	166	166	166	179	179	179	179

Note: Dependent variable in each column: columns 1-2 received public transfer (yes=1); columns 3-4 log (public transfer income); columns 5-6 received private transfer (yes=1); columns 7-8 log (private transfer income); columns 9-10 conduct any out-transfer (yes=1); columns 11-12 log (out-transfer). All the covarietes are the same as those in Table 5. Standard errors in parentheses are clustered at the prefecture level. The number of clusters in columns 1-8 is smaller because the information is available only in 2002-2008 UHS data.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A7: Household Borrowing and Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.	Borrow (Yes = 1)		Log(Money borrowed from others)		Lend (Yes = 1)		Log (Money lent to others)	
$Tariff_{c,t-1}$	0.35	0.36	0.01	-0.15	0.13	0.15	1.17	1.08
	(0.41)	(0.41)	(1.40)	(1.40)	(0.35)	(0.35)	(1.18)	(1.17)
Observations	251,492	251,492	155,130	155,130	251,492	251,492	189,648	189,648
R-squared	0.10	0.88	0.25	0.93	0.11	0.93	0.35	0.95
Controls in both panels								
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH structure	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	179	179	179	179	179	179	179	179

Note: Dependent variable in each column: columns 1-2 borrowed any money (yes=1); columns 3-4 log (money borrowed from others); columns 5-6 lent any money to others (yes=1); columns 7-8 log (money lent to others); All the covariants are the same as those in Table 5. Standard errors in parentheses are clustered at the prefecture level.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A8: Migration

Dep. Var.	(1) Moving here in 2002 or afterwards (Yes = 1)	(2) Local hukou (Yes = 1)	(3) Change in log (working age population, 2000-2005)
Mean of dep. var.	0.018	0.984	
Panel A: OLS			
Tariff	0.07	0.04	0.422
	(0.05)	(0.04)	(0.424)
Observations	515,259	515,259	176
R-squared	0.05	0.05	0.328
Panel B: 2SLS			
Tariff	0.16	0.04	0.645
	(0.10)	(0.06)	(0.482)
Observations	515,259	515,259	176
R-squared	0.05		0.327
Controls in both panels			
Basic controls	Yes	Yes	Yes
Clusters	179	179	18

Note: Columns 1 includes basic controls the same as those in Table 2. Standard errors in parentheses are clustered at the city level. In column 2, dependent variable is the log change of city's working age population between 2000 and 2005, constructed using 2005 China Population Census. RTC is calculated as the regional output tariff change between 1999 and 2004. The instrument in panel b is regional tariff level in initial year (1998). Basic controls include province fixed effects. Standard errors (in brackets) are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1