Trade Liberalization and Labor Shares in China

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Abstract

We estimate the extent to which firms responded to tariff reductions associated with China's WTO entry by altering labor's share of value. Firm-level regressions indicate that firms in industries subject to tariff cuts raised labor's share relative to economy-wide trends, both through input choices and rent sharing. Our estimates suggest that, on average, an industry that experienced no reductions in output or input tariffs would have a 15.7% lower labor share of value in 2007 than it actually did, assuming the same economy-wide trends. There is significant variation across firms: the impact is significantly smaller for geographically remote firms and it is influenced by union presence and state ownership.

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HIGHLIGHTS

- We estimate the relationship of Chinese manufacturing labor shares to tariff reductions.
- Input and output tariff cuts are shown to have a positive and significant effect on labor shares.
- Our findings suggest that workers share part of the gains from China's WTO accession.
- The effect of tariff reform varies by location, union presence and ownership type.

1. Introduction

China's economic reforms and rapid development have produced spectacular growth in both real incomes and income inequality. While real incomes grew by more than 10 percent per annum between 1998 and 2007, one measure of the distribution of income, labor's share of national income, fell from 50% to only 40%.[1] Given the increasing importance of international trade and investment to China's development, it is natural to put the blame for the declining labor share on the liberalization of commercial policy. The most prominent change during this time period is China's accession to the WTO in 2001, and in this paper we investigate the relationship between the associated tariff cuts and changes in labor shares at the firm level.

Using a ten-year panel of Chinese manufacturing firms, we ask whether firms in industries with relatively deep tariff cuts experienced smaller or larger declines in labor shares relative to firms in other industries. We allow the effect of tariff cuts in a firm's own industry to differ from that of tariff cuts in industries that provide intermediate inputs. Given China's enormous size, we also ask whether or not our estimated tariff effects attenuate with distance from China's eastern international ports. Additionally, we explore the heterogeneous effects of tariff cuts on firms that host a union and for private and foreign firms versus state firms.

We are interested not only in measuring the effect of output and input tariff on labor shares but also in the channels by which such impacts occur. After discussing theoretically the channels of influence, we empirically measure the extent to which tariff cuts work through changes in industry rents as opposed to factor input choices. To do this exploration, we adopt the method pioneered in De Loecker, Goldberg, Khandelwal and Pavcnik (2012) to estimate firm level

[1] Income growth rate from World Bank, Economic Indicators; labor shares from Qian and Zhu (2012). Knight and Ding (2012) discuss Chinese GDP statistics and revisions by Western scholars. Bai and Qian (2010) calculate a drop of 12.5 points in China's labor share of national income using official data for 1995 to 2007, but after adjusting for changes in accounting methods, they estimate a drop of 7.2 points.

markups for Indian enterprises. In addition to estimating markups for firms in another large country, China, we demonstrate that this methodology is useful in understanding the behavior of labor shares and the extent to which they are influenced by movements in firm-level markups.

Reforms surrounding China's 2001 WTO accession produced significant liberalization despite the fact that China was already integrated into global production networks.[2] Protection remained strong in industries for which domestic supply was deemed "sufficient," state enterprises were dominant, or industrial policy or national security supported domestic expansion. Through its accession agreements, China committed to the reduction of both tariff and non-tariff barriers to imports of industrial goods, including those in many of the most protected industries. Tariff reductions were phased over a period of ten years but the bulk took place immediately on January 1, 2002. The average import-weighted output tariff rate on manufactured goods was lowered from about 20% in 1998 to about 9% by 2007, while the import-weighted average input tariff went down from about 15% to about 7%.[3]

Using China's Annual Survey of Industrial Production, we find a positive and statistically significant effect of these output and input tariff cuts on labor shares of output value. Using alternative measures, we find a positive and significant effect of reductions in the effective rates of protection on labor shares of value added. Our estimates suggest that, on average, an industry that experienced no reductions in output or input tariffs would have a 15.7% lower labor share of value in 2007 than it actually did, assuming the same economy-wide trends. Thus, our findings are consistent with the view that workers share part of the productivity gains from China's WTO accession identified by Brandt *et al.* (2012).

[2] As Branstetter and Lardy (2008, p. 633) stress, China's drive to liberalize dramatically accelerated in the late 1990s. China unilaterally reduced tariffs on imports, dramatically cut quantitative restrictions on imports, eliminated many restrictions on foreign investment, and expanded public investment in roads, ports, airports and communications.

[3] Average effective applied tariff rate calculated by authors from data source shown in Table 1 below.

To enhance identification, we allow the effect of both input and output tariff reductions to vary by firm location and we find that the positive impact of tariff reductions on labor share is stronger where access to global markets is better. Regression results indicate that while lower output and input tariffs lead to a higher labor share, the magnitude of the input tariff effect is smaller when a union is present in the enterprise. Interestingly, we find a significant and positive relationship between firm markups and labor shares in only those domestic private firms in which a union is present, suggesting that a collective voice for workers does influence the degree of rent sharing within the firm. In contrast, foreign-invested enterprises with a union present exhibit no significantly different rent sharing behavior than do those without a union present, with rent sharing taking place in both cases. Lastly, we test the hypothesis that changes in labor share are stronger for non-state firms than for state firms, and find no statistically significant difference between state firms and domestic private firms in the degree to which trade liberalization raises labor shares, but we do find a significantly larger response among foreign-invested enterprises in response to both input and output tariff cuts.

Our analysis focuses on changes in labor shares rather than changes in absolute real wages. Since the 1980s many countries have experienced declines in labor shares, but not all have experienced declines in real wages. [4] Indeed, over the period 1998 to 2007, real annual urban wages in China grew by 13.2% (Yang, Chen, and Monarch; 2010). Bentolila and Saint-Paul (2003) describe a similar outcome for France during the period 1970-1990, when France experienced a sharp decline in the labor share yet a large increase in the average real wage. Labor's share of income is of interest in its own right because a decline in labor share is associated with an

[4] A recent International Labor Organization report (ILO, 2013) confirms that since the 1980s a majority of countries have experienced falling labor shares and finds that this has happened most frequently where wages have stagnated but also in some countries, such as China, where real wages have grown strongly.

increase in overall inequality even in the context of real wage growth. Further, changes in labor's share of income provide information on the extent to which workers benefit from higher productivity and is, thus, associated with social justice and fairness.

The results of this paper are related to a small cross-country literature examining the relationship between trade and labor's share of national income. A key contribution to this literature is Harrison (2005), who uses a panel of over a hundred countries for the period 1960-2000 to examine the impact of trade on labor share. She finds that an increase in globalization, as reflected in an increase in the share of trade in national income and a loosening of capital controls, is associated with a decline in labor's share in national income. A similar conclusion is reached by Guscina (2006), whose study focuses on OECD countries over the same period 1960-2000.

Ahsan and Mitra (2014) use firm-level data to find that India's trade liberalization initiated in 1991 led to an increase in labor's share of revenue for small, labor-intensive firms but a reduction in this share for larger, less labor-intensive firms. An important advance of our paper over Ahsan and Mitra (2014) is that we are able to identify in greater detail the channels through which trade liberalization affects labor shares. In particular, we are able to identify the separate effects of input and output tariffs. We do so both controlling and not controlling for markups. Thus our work is able to shed light on the possibility that the effects of trade on labor shares might be working through input complementarity, productivity gains and rent sharing. As mentioned above, as a by-product of our investigation of labor shares, we contribute to the new literature on the impact of input and output tariffs on firm-level markups, by extending the work of De Loecker *et al.* to the important case of China.

Our analysis also relates to a growing literature focused on the role of input prices as a determinant of labor shares. Bentolila and Saint-Paul (2003) show theoretically that changes in

imported materials prices can influence labor shares, with the direction of influence theoretically indeterminate. Changes in imported input prices are potentially of importance for China given the large share of output value, particularly in traded goods sectors, accounted for by imported inputs. Koopman, Wang, and Wei (2012) estimate that the share of domestic content in Chinese exports was only about 50% before its accession to the WTO.

Previous empirical studies also try to separate the effects of input and final-good trade costs on firm-level outcomes other than factor shares. The main outcome variables studied in this developing literature are plant-level productivity (Amiti and Konings, 2007 and Topolova and Khandelwal, 2011) and the range of goods produced at the firm-level (Goldberg, Khandelwal, Pavcnik and Topalova, 2010). These outcomes are influenced by some of the same forces through which, we believe, trade reforms affect labor shares.

We turn next to a brief overview of labor market reform in China. We argue that existing evidence supports both the view that wages are market driven and that wages may reflect some element of rent sharing. The third section outlines a simple theoretical model with these elements and explains how we use this model to develop estimating equations. The fourth section describes the tariff and manufacturing census data we use to estimate labor share equations, with our results presented and discussed in the fifth section. We conclude with a consideration of the implications of our findings for understanding the distributional effects of trade reform in China.

2. Labor Market Reforms in China

Extensive labor market reforms were undertaken by China during the 1990s, both to increase mobility of workers across jobs and to reduce the role of state enterprises as employers and as a source of social insurance. In 1994, China passed the Labor Law, which established the legal framework for market-based worker-employer relations in the context of expanded

employment flexibility. [5] In addition to providing a framework for safeguarding workers' rights, the Law calls for equal treatment of workers across ownership sectors and permits no-fault dismissal of workers. Toward the end of the decade and in recognition of the employment mobility unleashed by the Labor Law, the Chinese government began strengthening social insurance programs and improving conditions for the increasingly large number of migrant workers. Although far from fully realized, these regulatory and policy changes represent significant steps toward market-mediated labor relations.

As noted by Cai, Park, and Zhao (2008), the 1994 Labor Law facilitated a massive restructuring of state-owned enterprises, which led to layoffs of at least 10 million workers by 1997 and 27 million more from 1998 to 2004. Giles, Park, and Zhang (2005) estimate that the unemployment rate for all urban residents rose from 6.8 percent in 1996 to 11.1 percent in 2002. Workers remaining in the state sector were subject to removal of most administrative controls on the determination of wages and benefits. Thus, over the period, wages for all enterprise type were freed to adjust to market-determined levels.[6]

In our theoretical framework, we treat the alternative or outside wage as market determined, while also allowing for the possibility of rent sharing with workers in a fair wage context.[7] The hypothesis that firms share surplus with workers is consistent with recent work by Nee and Opper (2012). Based on interviews and financial data from over 700 manufacturing firms in the Yangzi region, they find that: "Work compensation and firm success are closely linked.

[5] Gallagher and Jiang (2002) provide an overview of the Labor Law of the People's Republic of China.

[6] Workers also became increasingly mobile across labor markets, as controls were loosened on domestic migration, including migration without formal changes in household registration (non-*hukou* migration). Cai, Park, and Zhao (2008) use the 2000 census to calculate the stock of migrants, defined as the share of persons residing in a location for more than six months in the prior year whose *hukou* is from outside the city or county. They estimate that by 2000 migrants comprised 14.6 % of the population and 19.6 % of the employment in China's cities (p. 191).

[7] In our empirical work, we account for general labor market reforms by identifying the effect of tariff cuts on labor shares using firm-level deviations from economy-wide time trends in manufacturing.

Controlling for other factors (firm size, firm age, employment structure, location, and industry), there is a substantive and significant positive association between the average wage rate and a firm's return on assets (p.181)." Nee and Opper conclude, "In other words, the more profitable the firm, the higher the labor compensation and thus the better a firm's chances to recruit and retain skilled workers (p. 181)."

Our fair wage model is distinct from models based on union-management bargaining. The All-China Federation of Trade Unions (ACFTU) is the only national trade union federation recognized by law. It is the largest trade union federation in the world, claiming representation of more than 258 million workers in 5.2 million local chapters.[8] According to Trade Union Law, a union may be established in an enterprise as a result of a request from an "above-level" union or by a request from employees, although only the former requests are thought to be effective (Ge, 2014). About the ACFTU, one knowledgeable observer writes, "Contemporary union organizing in China is different from its counterparts in Western countries and other authoritarian states around the world. As a formal part of the communist political structure, the ACFTU bases its power on its quasigovernment status rather than on organized labor and does not operate by mobilizing the support of grassroots labor" (Liu, 2010). Chen (2009) also notes the lack of effective union bargaining power in China, "…even though unions have come to support workers' economic demands in certain selective ways, this by no means suggests that they are capable of making claims directed at the state on behalf of workers."

Given this understanding of labor unions in China, in our empirical work we allow for the possibility that the presence of a labor union to alter a firm's response to trade liberalization. Ge (2014) agrees that Chinese unions lack a "monopoly" function, in that they have weak power in

[8] *Trade Unions of the World, 6th Ed*. (2005), John Harper Publishing.

bargaining with management, but he highlights their roles as a "collective voice" for workers. This collective voice function includes mediating labor disputes, monitoring implementation of the Labor Law, providing various services and welfare benefits to employees, promoting technology innovation and employee training, and participating in corporate governance.[9] These roles allow for the possibility that a union can facilitate or resist changes to production processes, such as the introduction of imported inputs when they are made more accessible with trade liberalization. We discuss the possible influence of a labor union in the rent sharing model below and in our empirical work we test for different firm-level responses to trade liberalization by union status.

3. Theory and Estimating Strategy

A Model of Input Choice with Rent Sharing

Consider a firm with the following production function:

$$Q = F(N, K, v), \tag{1}$$

where Q is quantity produced, N is firm's employment of labor, K is capital and v is the vector of all other inputs. This production function is assumed to exhibit constant returns to scale and, thus, diminishing marginal product of labor. The profits of a firm can be written as:

$$\pi = P(Q;\tau)Q - wN - rK - vp_v\,, \tag{2}$$

where w is the wage paid by the firm, r is the rental rate, p_v is the vector of prices of other factor inputs and P is the output price. P depends on quantity, as the firm is assumed to have some market power. That power depends on how protected its market is, which is captured by the ad valorem

[9] Empirical evidence on the effectiveness of Chinese labor unions is mixed. Using a cross-section of firms from the 2004 National Economic Census, Ge (2014) finds that union presence is positively associated with average wage and benefits levels and output per worker, but negatively associated with profitability. Using a different data source, the 2006 Private Enterprise Survey, Lu, Tao, and Wang (2010) find no relationship between the average wage paid by the firm and union status, but they confirm a positive relationship between union presence and labor productivity.

tariff, τ: $P(Q;\tau)$ is the inverse demand function. In addition, let τ_v be the tariff on the imports of inputs. Then $p_v = p_v^*(1+\tau_v)$ where p_v^* is the world price vector of intermediate inputs.

We assume that the firm takes the prices of all factors other than labor as given.[10] In the case of labor, let w_a be the alternative or outside wage, which the firm also takes as given. This is the expected wage a worker would receive if he or she looked outside.[11] We assume that the firm pays a fair wage to its workers because it promotes goodwill among workers and minimizes worker turnover. We assume that workers consider the wage fair if the firm shares a fraction of its profits, $0 \leq \gamma \leq 1$, with its employees.[12, 13] The fraction of profits a firm divides among employees will depend on norms. However, this fraction could also depend on firm-specific skills and experience of the workforce and the scarcity of these skills in the labor market. The fair wage, therefore, is written as:

$$w = w_a + \gamma \frac{\pi}{N}, \tag{3}$$

which, in turn, can be written as

$$w = w_a + \gamma \left[\frac{P(Q)Q - wN - rK - vp_v}{N}\right]. \tag{4}$$

[10] Note that the firm could either be renting capital at the market rental rate or it could own all or some of its capital in which case it is earning this competitive rental on the capital it owns and also its share in profits.

[11] Implicitly, we are assuming that there is a large competitive labor market (which, for instance, could be the informal sector) and that finding a job in another profit-sharing firm in the economy is not possible. This is a reasonable assumption as job search in the formal sector takes time.

[12] There might be a social norm about what this fair share, γ, is. Workers might work at levels much lower than their full efficiency if they feel they are being denied their fair share in profits. As a result, under standard conditions, it would always be optimal for firms to pay their workers this fair share.

[13] Two recent papers introduce a fair wage that is internal to the firm. Egger and Kreickemeier (2009) offer a one-factor model where the constant marginal cost is inversely related to a productivity parameter. Wages are assumed to be increasing in this productivity parameter. Since profits are increasing in productivity, the wage rate is increasing in profits. Note that since productivity at the firm level is represented by a parameter, the firm ends up taking the wage as given. Amiti and Davis (2011) directly take the fair wage as an increasing function of the firm's profits. They show that internalizing the dependence of the wage on profits in the firm's optimization problem does not yield an outcome that is different from the one where the wage is taken as given by the firm in its optimization problem. Our assumption that the fair wage incorporates profit sharing makes the fair wage an increasing linear function of the profits per worker (rather than the total profits of a firm). This fair-wage specification has the flavor of both profitability and productivity at the same time.

Equation (4) can be rewritten as

$$w = w_a + \frac{\gamma}{1+\gamma}\frac{R}{N}, \tag{5}$$

where *R* is the rent earned by the firm over the outside value of the factors of production employed in the firm, defined as[14]

$$R = P(Q)Q - w_a N - rK - vp_v. \tag{6}$$

Using equations (5) and (6) to restate the expression for profits in (2) we have

$$\pi = \frac{1}{1+\gamma}R. \tag{7}$$

Equation (7) shows that profit maximization and rent maximization are equivalent optimization problems in our model. The first-order condition with respect to N gives us:

$$w_a = MR.F_N, \tag{8}$$

where MR is marginal revenue and F_N is the marginal product of labor. Using (5) and (8) and the first-order conditions for all other factors of production, the share of wages in total revenue is:

$$S^N = \frac{\varepsilon_{Q,N}}{\mu} + \frac{\gamma}{1+\gamma}\left(1 - \frac{1}{\mu}\right) \tag{9}$$

where $\varepsilon_{Q,N}$ is the elasticity of output with respect to employment and μ is the price-marginal cost ratio, also called the markup.[15] In equation (9), $\frac{\varepsilon_{Q,N}}{\mu}$ is the share of wages in output when workers are just paid their marginal revenue product (*MRP*). The existence of rent shared by workers leads to an additional portion for workers, given by $\frac{\gamma}{1+\gamma}\left(1 - \frac{1}{\mu}\right)$. The fraction $\frac{\gamma}{1+\gamma}$ reflects the degree of rent sharing and it is increasing in the parameter, γ. Equation (9) leads to the following insight: while a reduction in markups increases the *MRP* (brings it closer to the value of the marginal

[14] An alternative interpretation of equation (5) is based on union-firm bargaining, which leads to a sharing of rents between the firm and the members of the union. With that interpretation, γ is a function of bargaining power.

[15] Note that the markup, μ, is not a parameter. It is the ratio of price to marginal cost. Expression (9) is completely derived from the maximization of the objective function in (6).

product), this reduction in markup also reduces profits available for sharing with workers. Thus, a change in markup leads to two mutually opposing effects on labor's share. As will be seen later in this paper, our empirical evidence shows that the second of these two markup channels is dominant in that we find empirically that the labor share is positively associated with the markup. While derived in a fair-wage context, we note that such results would be observationally equivalent to the case with firm-union bargaining even in the absence of fairness concerns.

Tariff Cuts and the Labor Share of Output

Given the degree of rent sharing, equation (9) indicates that labor's share of output depends on the elasticity of output with respect to labor input and the markup. We will now consider, in turn, the impact on labor's share of an input tariff cut and then an output tariff cut. We will first consider how trade liberalization affects the elasticity of output with respect to labor, conditional on a given markup, and then how liberalization affects the markup, conditional on a given elasticity of output with respect to labor.

To be concrete, consider a constant-elasticity-of-substitution production function,

$$Q = \left[\alpha_N N^{\frac{\sigma-1}{\sigma}} + \alpha_K K^{\frac{\sigma-1}{\sigma}} + \sum_{i=1}^{n} \alpha_i v_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \tag{10}$$

where σ is the elasticity of substitution between different factors of production. With this production function, the elasticity of output with respect to labor takes the form:

$$\varepsilon_{Q,N} = \alpha_N \left[\frac{Q}{N}\right]^{\frac{1-\sigma}{\sigma}}, \tag{11}$$

which depends on average labor productivity and the elasticity of factor substitution.

Impact of an input tariff cut

Let us first consider the impact of a reduction in the input tariff, τ_v. The tariff cut makes imported inputs cheaper, and, as a result, more of these inputs will be combined with each unit of

labor. In turn, average labor productivity, $\frac{Q}{N}$ will rise. Assuming these inputs are complementary to labor, i.e., $\sigma <$, then, using equation (11), the elasticity of output with respect to labor, $\varepsilon_{Q,N}$, will rise with trade liberalization. Through this channel, we expect that, conditional on the markup, input tariff liberalization will increase labor's share of output.

Input tariff reductions can also lead to an increase in the markup, consistent with evidence on India from DeLoecker *et al*. (2012). When a firm has some monopoly power, a fall in input prices will not generally be fully passed to consumers in the form of lower output prices. This is clearly seen in the case of a monopolist facing a linear demand curve, where the markup increases with a fall in the input tariff. However, an increase in the markup alone is not enough to guarantee an increase in labor's share. The rent sharing channel of the markup must dominate the *MRP* channel, $\left(\frac{\gamma}{1+\gamma} - \varepsilon_{Q,N}\right) > 0$. If this condition holds, a higher markup leads to more rents shared between employers and employees.

We can summarize this result as follows:

$$\frac{\partial S^N}{\partial \tau_v} = \frac{1}{\mu}\underbrace{\frac{\partial \varepsilon_{Q,N}}{\partial \tau_v}}_{(-)} + \underbrace{\left(\frac{\gamma}{1+\gamma} - \varepsilon_{Q,N}\right)}_{(+)}\frac{1}{\mu^2}\underbrace{\frac{\partial \mu}{\partial \tau_v}}_{(-)} < 0 \qquad (12)$$

where $\left(\frac{\gamma}{1+\gamma} - \varepsilon_{Q,N}\right) > 0$ reflects our assumption that the rent sharing channel dominates the *MRP* channel. Thus, input tariff reductions are expected to increase labor's share of value.

Impact of an output tariff cut

We next look at the impact of the output tariff, τ. When τ falls, there is a downward shift in the inverse demand function. Using (11), we can see that a tariff cut affects $\varepsilon_{Q,N}$ depending on how it affects the average product of labor. If there are constant returns to scale and if all inputs are variable, then holding input prices fixed, there will be no change in the average product of

labor (as labor and all other inputs will be adjusted in the same proportion). Even if a subset of inputs is fixed, diminishing product of labor will kick in and $\frac{Q}{N}$ will increase as a result when output shrinks as demand shrinks. Continuing to assume that all inputs are complementary to labor, $\sigma < 1$, we will see an increase in $\varepsilon_{Q,N}$ which will push the labor share up.

Holding $\varepsilon_{Q,N}$ fixed, increased import competition will normally lead to a decrease in the markup. This decrease moves the marginal revenue product closer to the value of the marginal product, exerting upward pressure on labor's share, through an increase in $\frac{\varepsilon_{Q,N}}{\mu}$. On the other hand, the rent sharing channel, as captured by the term $\frac{\gamma}{1+\gamma}\left(1-\frac{1}{\mu}\right)$, will push the labor share down.

Overall, there are some channels through which an output tariff reduction pushes up the labor share and others through which it pushes the labor share down. This theoretically ambiguous impact of the output tariff on the labor share can be represented by

$$\frac{\partial S^N}{\partial \tau} = \frac{1}{\mu}\underbrace{\frac{\partial \varepsilon_{Q,N}}{\partial \tau}}_{(-)} + \underbrace{\left(\frac{\gamma}{1+\gamma} - \varepsilon_{Q,N}\right)}_{(+)}\frac{1}{\mu^2}\underbrace{\frac{\partial \mu}{\partial \tau}}_{(+)} < or > 0 \; as \; -\frac{1}{\mu}\frac{\partial \varepsilon_{Q,N}}{\partial \tau} > or < \left(\frac{\gamma}{1+\gamma} - \varepsilon_{Q,N}\right)\frac{1}{\mu^2}\frac{\partial \mu}{\partial \tau} \quad (13)$$

Heterogeneous Firm-Level Effects

Because market forces vary spatially, we seek additional identification of the impact of trade liberalization on labor shares by allowing the effects of both input and output tariffs to vary with access to international ports, conditional on the markup. If tariff cuts affect the *MRP* of labor through the prices and variety of imports, it is likely that these pressures are strongest where access to foreign markets is easiest. To allow for this possibility, we posit that the impact of tariff cuts on labor shares moderates as the distance of the firm from international markets increases.

We next raise the possibility that the firm's response to trade liberalization depends on the presence or absence of a union within the enterprise. Previous authors have emphasized the role

of unions in bargaining over disposition of firm rents. Using this lens, the pass-through of changes in market rents to workers may be stronger in unionized firms. Another view of unions is that they play a role on the shop floor as the workers' "collective voice." In this view, a union may deter a firm from importing inputs that replace in-house production. While in-house production of these inputs may directly create or protect jobs within the firm, it may cost the firm more to do so than to import from abroad. For this reason, in-house production of inputs will adversely affect downstream output. The union might be boundedly rational in that it is able to see the upstream jobs saved within a firm from the in-house production of inputs but does not see how these retained activities could adversely affect the downstream jobs within the same firm. If the indirect effect on downstream jobs dominates the direct effect on upstream jobs, the presence of a union can weaken the positive effect of trade liberalization on the labor share, conditional on the markup.

Lastly, we allow the impact of tariff cuts on labor shares to vary by firm ownership type. While wage setting in Chinese state firms has been largely deregulated, there remain important aspects of labor relations in state firms that do not conform to profit maximizing behavior. Kamal and Lovely (2013) find that labor productivity varies systematically within industries by ownership type, with state owned firms exhibiting significantly lower marginal revenue products of labor. Even though ownership differentials have diminished over time, Kamal and Lovely find that on average the marginal labor productivity of private firms is 60% higher than for state firms during the 2004-2007 period, controlling for both industry and location. This evidence suggests that state firms pursue employment as well as profit objectives and that their response to competitive changes due to trade reform may be muted.

Tariff Cuts and the Labor Share of Value Added

While we have discussed the share of the wage bill in total sales, many of its channels of influence also apply to the share of the wage bill in value added. Instead of the output production function, (1), we can posit a value added production function that depends only on direct factor inputs. In this case, arguments in favor of higher labor shares in response to input tariff cuts are stronger because there is no opportunity for an expanded share of imported and domestic non-factor inputs to crowd out the share of labor. We argued above that with other inputs complementary to labor, the output elasticity with respect to labor will rise with an increase in labor productivity measured by real sales or output per worker. Similarly, the elasticity of value added with respect to labor will also increase as long as cheaper imported inputs bring about an increase in labor productivity measured by value added per worker as well.

The markup channels and the rent sharing channels would work very similarly for both the wage share in output and in value added. In fact, the rents (and profits) defined in terms of output or, alternatively, in terms of the value added are exactly the same. So the rent-sharing based arguments above hold also for the share in value added as long as both output markups and value added markups move together. Markups of both kinds are measures of a firm's market power and in most cases, therefore, are expected to be positively correlated. In our empirical work, we will estimate the response of both the output share of wages and the value added share and, thus, we test whether they behave in the same way with respect to our variables of interest.

Estimation Strategy

Our empirical strategy uses variation in output and input tariff rates across industries and over time to identify the effect of trade reform on labor shares. While most of our regressions rely on the assumption that the evolution of industry-level tariffs is exogenous to that of firm labor

shares, we also estimate instrumental variables regressions to address potential endogeneity problems. While Shea's partial R^2s from our first stage regressions show that our instruments are strong, the Durbin-Wu-Hausman test points to the consistency of our OLS estimates.

Brandt *et al.* (2012) provide extensive documentation of the evolution of Chinese tariffs over 1995 to 2007. They highlight several patterns in the data. First, there is important variation across industries. Differences in effective rates of protection across industries narrowed dramatically over time, with the 25/75 quartile range dropping from approximately 20-120% in 1995 to 5-30% in 2007.[16] Secondly, Brandt *et al.* conclude that tariff reform over the period can be well described as tariff compression, with initially highly protected industries receiving the largest cuts. Moreover, they show that the relationship between tariff reductions and initial protection is almost one-for-one, implying that the decline in tariffs was mostly proportional to initial tariff and subject to little policy discretion. Additionally, tariff cuts after 2001 were fixed by China's WTO accession agreement. In light of these findings, we control for the initial level of protection using firm fixed effects, and otherwise treat tariff cuts as exogenous to the evolution of labor shares through most of the paper.

However, because Brandt *et al.* (2012) find a positive relationship between initial tariffs and the size of subsequent cuts, we also estimate instrumental variables regressions. We estimate long difference specifications using five-year differences of tariffs and their interactions with firm characteristics instrumented by the nine-year lag in levels of tariffs and those same interactions. This approach is a variant of the instrumental variable (IV) strategy used by Goldberg and Pavcnik (2005). For this IV strategy to be valid, two assumptions must hold. First, five-year *differenced* output and input tariffs must be correlated with 9-year lagged output and input tariffs. This

[16] Brandt *et* al. also show that output tariffs are higher than input tariffs, implying that effective rates of protection are higher than stated tariff rates.

correlation is suggested by the tariff-compression nature of Chinese reforms. As a result, current tariff levels in an industry are correlated with future *changes* in the industry's tariffs. Second, five-year *differences* in the error term must be uncorrelated with 9-year lagged output and input tariffs. This should be true in our case, given the significant time difference between the *differenced* error term and the instruments.

To examine the effect of trade liberalization on the share of total wage bill in output, *wage bill/sales*, we start with the following simple specification,

$$\left(\frac{wage\ bill}{sales}\right)_{it} = \alpha + \beta_1 Output\ Tariff_{j,t-1} + \theta_i + \theta_t + \varepsilon_{it}, \qquad (14)$$

where i indexes firms, j industry, and t time. $Output\ Tariff_{j,t-1}$ captures the level of protection placed on the final good in the industry in which firm i operates. This measure of protection is lagged one period. We include firm fixed effects, θ_i, to control for time-invariant firm characteristics, such as skill intensity, and year effects, θ_t, to capture economy-wide changes in factor markets, especially the outside wage. These time dummies also control for general-equilibrium effects of the economy-wide trade reforms. We also estimate (14) by substituting the year effects with region-by-year effects, θ_{rt} (where the subscript r denotes region), thereby controlling for regional time variation in outside wage trends.[17] Finally, ε_{it} represents an idiosyncratic error term. Because our key variable of interest, output tariff, is constructed at the four-digit ISIC Rev. 3 industry level, we cluster standard errors at the same level of aggregation.

The coefficient β_1, obtained through fixed effects estimation of (14) provides a measure of the overall average effect of the industry-specific tariff reform on firm-level labor shares, relative to a non-linear time trend. As discussed in section 3 above, tariff cuts influence the labor

[17] Regional assignments follow those used by Démurger, Sachs, Woo, Bao, and Chang. (2002), in a contribution on the role of location in China's development.

share by their impact on firm input choices, markups and labor's bargaining power. Thus, our estimate of β_1 is an estimate of the net effect through all of these channels, as it captures the impact of cuts in both tariffs on imports competing with the final output of an industry as well as on imports that are inputs into it.

We separate the effects of own-industry tariff cuts from those in other industries that are used for intermediates. Our next estimating equation is therefore:

$$\left(\frac{wage\ bill}{sales}\right)_{it} = \alpha + \beta_1 Output\ Tariff_{j,t-1} + \beta_2 Input\ Tariff_{j,t-1} + \theta_i + \theta_t + \varepsilon_{it}. \qquad (15)$$

The introduction of a separate input tariff measure is useful and important since it measures the influence of a possibly complementary input channel through which trade liberalization may affect labor shares. The impact of cuts in tariffs on intermediates belonging to the same industry continues to be captured by the output tariff variable. On the assumption that imported inputs are complementary to domestic labor input, we expect the sign of the estimate of β_2 to be negative.

An important feature of China's industrial development over the past decade is the entry of new firms (Brandt and Zhu, 2010). These new firms are significantly more productive than exiting firms and this suggests that they are different from incumbent firms. To ensure that our results are not being driven by entry, in addition to using the full sample, we also estimate (14) and (15) with a balanced panel containing only firms present in the last eight years of the sample.

Channels of influence: controlling for firm markups

Tariff cuts influence both labor shares and firm markups. However, we are able to use longitudinal firm level data to estimate firm markups and then include the (lagged) markup as a control in the labor share regression. In this way, we are able to estimate the effect of changes in markups on labor shares, isolating them from other channels that operate on firm input choices. To do this, we estimate (15) including an estimated (and lagged) year-specific firm markup:

$$\left(\frac{wage\ bill}{sales}\right)_{it} = \alpha + \beta_1 Output\ Tariff_{j,t-1} + \beta_2 Input\ Tariff_{j,t-1} + \beta_3 Markup_{i,t-1} + \theta_i + \theta_t + \varepsilon_{it}. \qquad (16)$$

If firms share rents with workers, we expect the estimated coefficient on firm markup, β_3, to be positive and significantly different from zero. We interpret the tariff coefficients, β_1 and β_2, as the effect of the output and input tariffs on labor shares, holding the markup fixed.

Estimation of equation (16) requires a measure of the firm-level markup in each year. To create this measure, we follow the approach pioneered by De Loecker *et al.* (2012). This estimating strategy relies on cost-minimization by producers and the existence of at least one variable input. In our application, this variable input is taken to be material inputs and the markup, defined as the ratio of price to marginal cost, is calculated as the ratio of the (estimated) elasticity of output with respect to material inputs and the (reported) material expenditure share. The appendix provides further details on markup estimation.

In all labor share regression, we cluster standard errors at the four-digit ISIC level. In addition, in the case of regressions that include the markup on the right-hand side we bootstrap the standard errors, since the firm-level markup is an estimated regressor.[18] The markup is a function of tariff levels and we respond to this relationship in three ways. First, in estimating (15), we use a lagged value for the estimated markup to reduce concerns about contemporaneous shocks to both markups and labor shares. Secondly, we estimate (16) using five-year differences.[19]

[18] In the case of labor adjustment costs (which raise the same issues in markup estimation as does our fair wage framework), De Loecker and Warzynski (2012) suggest reliance on a gross output production function and the use of information on the expenditure share of materials to estimate markups. In our regressions, the variable *markup* is the firm level markup constructed by estimating production function coefficients for every two-digit CIC industry and using the firm's material share of revenue. Effectively, the marginal cost in the denominator of our markup estimate uses the marginal revenue product (which is the wage exclusive of shared rents) to evaluate labor costs. This way movements in markup will give us a very good sense of the movements in firm rents. Because markup is estimated, we bootstrapped errors using 400 repetitions. See Cameron and Trivedi (2005), Chapter 11, for a discussion on selecting number of bootstrap replications.

[19] We also estimate very long differences spanning our full observation period, with qualitatively similar results leading to the same inferences. These long-difference regressions are available in an on-line appendix at http://faculty.maxwell.syr.edu/dmitra/klm_webappendix.pdf .

As discussed above, evidence from India suggests that output tariff cuts lead to lower markups while input tariff cuts lead to higher markups. With firm-level markups estimated, we are able to see if this relationship also holds for China:

$$(markup)_{it} = \alpha + \Upsilon_1 Output\ Tariff_{j,t-1} + \Upsilon_2 Input\ Tariff_{j,t-1} + \theta_i + \theta_t + \upsilon_{it}, \quad (17)$$

where *markup* is the estimated firm-level markup. The Indian evidence suggests sign predictions: $\Upsilon_1 > 0$ and $\Upsilon_2 < 0$. As in the labor share regressions, we include firm fixed effects, θ_i, to control for time-invariant firm characteristics and year effects, θ_t, to capture economy-wide changes in product and input markets. Finally, υ_{it} represents an idiosyncratic error term. We again cluster standard errors at the 4-digit ISIC industry level of aggregation.

Allowing for heterogeneous spatial effects

To test the hypothesis that the effect of tariffs attenuates as geographic remoteness from international markets increases, we estimate the following variation on equation (15):

$$\left(\frac{wage\ bill}{sales}\right)_{it} = \alpha + \beta_1 Output\ Tariff_{j,t-1} + \beta_2 Output\ Tariff_{j,t-1} * Remoteness_i +$$

$$\beta_3 Input\ Tariff_{j,t-1} + \beta_4 Input\ Tariff_{j,t-1} * Remoteness_i + \theta_i + \theta_t + \varepsilon_{it}. \quad (18)$$

$Remoteness_i$ is the distance to the nearest international port – either Shanghai, Tianjin, or Guangzhou -- from the city in which the firm *i* is located. We expect the estimated coefficients of these interaction terms to have the opposite signs from their respective tariff level terms. Greater distance from an international port should push the impact of the tariff toward zero.

Allowing heterogeneous effects by ownership type

To test the hypothesis that the effects of output and input tariffs vary with ownership type, we estimate the following variation on equation (15):

$$\left(\frac{wage\ bill}{sales}\right)_{it} = \alpha + \beta_1 Output\ Tariff_{j,t-1} + \beta_2 Output\ Tariff_{j,t-1} * Private_i + \beta_3 Output\ Tariff_{j,t-1} *$$

$$Foreign_i + \beta_4 Output\ Tariff_{j,t-1} * Remoteness_i + \beta_5 Input\ Tariff_{j,t-1} + \beta_6 Input\ Tariff_{j,t-1} * Private_i +$$

$$\beta_7 Input\ Tariff_{j,t-1} * Foreign_i + \beta_8 Input\ Tariff_{j,t-1} * Remoteness_i + \theta_i + \theta_t + \varepsilon_{it} \quad (19)$$

$Private_i$ is a dummy variable that takes the value unity if the firm is privately-owned and $Foreign_i$ is a dummy variable that takes the value unity if the firm is foreign-owned. State ownership is the left-out category and thus we are able to test whether the impact of tariffs differs between private and state firms and between foreign and state firms.

Allowing heterogeneous effects by union status

To test the hypothesis that the effect of tariffs varies by a firm's union status, we estimate an additional variation on equation (16):

$$\left(\frac{wage\ bill}{sales}\right)_{it} = \alpha + \beta_1 Output\ Tariff_{j,t-1} + \beta_2 Output\ Tariff_{j,t-1} * Union_i + \beta_3 Input\ Tariff_{j,t-1} +$$

$$\beta_4 Input\ Tariff_{j,t-1} * Union_i + \beta_5 Markup_{j,t-1} + \beta_6 Markup_{j,t-1} * Union_i + \theta_i + \theta_t + \varepsilon_{it}. \quad (20)$$

$Union_i$ is a dummy variable that takes the value unity if the firm hosts a registered union.[20] We expect that the presence of a union will use its "collective voice" function to mute the impact of tariff reform on input choices, so we expect β_4 to take the opposite sign from β_3. If a union also plays a role in negotiating the extent of rent sharing, either by way of setting a fair wage norm or by exerting monopoly bargaining power, the presence of a union in the enterprise will raise the degree of rent sharing, so we expect β_6 to be positive.[21]

[20] Information on union status is only available for 2004. Consequently, when we include union status, we estimate our regressions using all firm-years for those firms present in the survey in 2004. move stuff here

[21] Given that labor unions are subordinate to the state-party in China, we do not explore the hypothesis that trade reforms have reduced union power over time. Such hypotheses have focused on developed countries and are framed in terms of union bargaining over employment and wages. For example, Brock and Dobbelaere (2006) find no significant negative relationship between trade and bargaining power, and Arbache (2004), using data from Brazil, also finds no significant effect of trade on bargaining power. Conversely, Dumont, Rayp and Willemé (2006) use data from five EU countries and find that liberalization does reduce the bargaining power of workers.

Labor Share of Value Added

We test the robustness inferences drawn from estimation of (15) and (16) by replacing labor's share of sales with labor's share of value added. How protected value added is from foreign competition is measured by the industry's effective rate of protection (IERP). IERP is calculated as $\frac{Output\ Tariff_{jt}-\alpha_{jt}*Input\ Tariff_{jt}}{(1-\alpha_{jt})}$, where α_{jt} is the material share in industry j at time t.[22] Note that the negative protection on the output due to a positive input tariff is effectively netted out (on weighted basis) in the formula for IERP just as the value of input is netted out to arrive at the value added. Therefore, we estimate:

$$\left(\frac{wage\ bill}{VA}\right)_{it} = \alpha + \beta_1 IERP_{j,t-1} + \theta_i + \theta_t + \varepsilon_{it}, \quad (21)$$

where IERP is a calculated measure of the industry effective rate of protection and we include both firm and time fixed effects as before. We also test whether the effect of tariff cuts on the labor share of value added dissipates with distance from international ports.

4. Data

Firm-level data used in this study are drawn from the Annual Surveys of Industrial Production (ASIP) conducted by the Chinese government's National Bureau of Statistics (NBS) between 1998 and 2007. The Annual Surveys of Industrial Production include all state-owned enterprises and all non-state-owned firms whose annual sales exceed 5 million RMB (referred to as "above-scale" industrial firms).[23] We impose several restrictions on the raw data to generate our analysis dataset. We filter it to exclude observations with missing information and improbable values. We exclude those firms that employ eight or fewer workers since most improbable values

[22] IERP is constructed using the full input-output matrix.

[23] The NBS classifies non-state-owned enterprises to include collectively-owned enterprises, Chinese indigenous privately-owned enterprises, and foreign-owned enterprises operating in China. The annual sales cut-off for non-state firms is approximately $ US 600,000 over this period.

are associated with smaller firms.[24] We further restrict the sample to include firms that have non-negative values for value added, total wages, total sales, total intermediate input use, gross industrial output value and capital. The final sample is an unbalanced panel spanning 1998 to 2007. Additionally, we consider a balanced panel of firms for which we have continuous data from 2000 to 2007.

Our dependent variable is the wage bill divided by total sales or, alternatively, divided by value added. The labor share of sales, averaged over all firm-years, is 9.15 percent and the average labor share of value added is 28.17 percent. To understand the extent to which our measure of labor's income share is underestimated by excluding non-wage compensation we reconstruct the measure, following Ge (2007), to include pension and health insurance, housing subsidy, and labor and unemployment insurance. Since we use the Annual Surveys, we have limited information about these variables and not all variables are available in all years. Information on unemployment insurance, medical insurance, and housing provident funds are available for the years 2005-2007. Using these three variables, we construct labor's non-wage compensation, add it to wage compensation, and recalculate annual average labor shares. Pooling all three years, the average labor share of sales (value added) only rises to 9.10 (28.95) percent and is highly correlated with shares computed without adjustment. The small differences in these two methods of calculation lead us to conclude that our results are not sensitive to exclusion of non-wage compensation.

Output tariff data at the HS6 digit level are obtained from the World Integrated Trade Solution (WITS). We concord these data to four-digit ISIC Rev. 3 and then to four-digit CIC. [25] We use effectively applied tariffs, which are tariff rates aggregated using import shares as weights.

[24] Individual businesses (*getihu*) are owned by private individuals or households and legally not considered enterprises. These businesses are officially limited to members of a family and up to seven non-family employees.

[25] We thank Xuepeng Liu for sharing the output tariff data and the concordance between ISIC Rev. 3 and CIC. The concordance between HS6 and ISIC Rev.3 is available through WITS.

The rates for 2002 are missing and we use average tariffs in 2001 and 2003 to replace the missing values. We also impute tariffs for some years by interpolation in some ISIC Rev. 3 industries. Input tariffs are constructed using the off-diagonal elements of the 2002 Chinese input-output table, as described in the Appendix.

Table 1 provides a list of variables used in our regression analysis and basic descriptive statistics. The unbalanced panel contains over 1.7 million firm-year observations. The number of firms in the sample increases over time, in large part because of rapid growth in the Chinese manufacturing sector. The number of unique firms more than doubled from 129,579 in 1998 to 309,657 in 2007. There are about 300,000 firm-year observations in the balanced panel we create using firms present throughout the period 2000 to 2007, representing 40,112 unique firms.

5. Results

Figure 1 illustrates trends in the average output tariff, input tariff, and industry effective rate of protection (IERP) constructed for the period 1998-2007. Both input and output tariff generally decline over time. Over the period, the average output tariff falls from close to 20% to nearly 9% while the input tariff falls from slightly over 15% to a little over 7%. These trends imply a generally declining IERP and they mirror those found by Brandt *et al.* (2012) who report that output tariffs exceed input tariffs and that the difference between them falls over time.

We next consider two groups of industries – those that experience above average tariff cuts over the period, and those that experience below average tariff cuts over the period. This partitioning is done on the basis of output tariffs and, alternatively, on the basis of input tariffs. Both industry groups (above-average cut group and the below-average cut group) experience fairly steady downward trends in average labor share, as the overall share of labor in national income falls throughout the period. While we note this economy-wide decline in labor shares, our paper

addresses deviations from economy-wide trends and their relationship to tariff cuts. In other words, our work helps us answer two questions: (1) Would the decline in labor shares in firms within an industry have been greater or smaller in the absence of the tariff cuts that actually took place in that industry, taking as given the tariff cuts in the rest of the economy? (2) Do the industries experiencing relatively deeper tariff cuts see larger or smaller labor share declines than others?

Figure 2 illustrates the trend in average labor share for the group of industries with above-average tariff cuts relative to the group of industries with below-average tariff cuts. Whichever of the two tariffs (output or input) is used as a basis for partitioning, the ratio of the average labor share in high-tariff-cut industries relative to that in the low-tariff-cut industries begins only slightly above unity in 1998, but rises to 1.2-1.25 by 2007. This pattern is consistent with our regression results below in that labor shares in firms facing deeper tariff cuts increased relative to economy-wide trends (*i.e.*, at the firm level, controlling for time, changes in labor shares and changes in tariffs are negatively correlated). Figure 2 also suggests that industries with larger tariff drops initially had a slightly higher average wage bill share, raising concern about the relation between tariff cuts and initial conditions. We address this concern in two ways in our empirical work: first, by including firm fixed effects in our labor share regression and, secondly, by taking long differences of the data and including initial tariffs among the regressors. Additionally, we use an instrumental variables approach similar to that used by Goldberg and Pavcnik (2005). These instrumental variables regressions also allow us to test the joint exogeneity of our right-hand side variables, *i.e.*, a test for consistency of the OLS estimates.

Figure 3 illustrates the trend in the markup, which we estimate using firm-level data and then average for the full sample in each year. Interestingly, the markup trend bottoms out in 2001, the year China enters the WTO and begins rising thereafter as the accession-related tariff cuts are

implemented. It is important to note that China's WTO accession did not generally result in lower tariffs for Chinese exporters as China already enjoyed most-favored-nation (MFN) rates in trading with WTO members.[26] For Chinese domestic producers, the most important trade-related aspect of WTO accession was the reduction in Chinese tariffs.

Table 2 provides the results of estimating equation (14): the regression of labor shares of sales on (lagged) output tariffs using both the full unbalanced panel (columns 1 and 2) and a balanced panel (columns 3 and 4). We include firm fixed effects to control for time-invariant cross-sectional variation in labor shares. We estimate (14) using year dummies, as shown in columns 1 and 3, or region-by-year dummies, as shown in columns 2 and 4. The inclusion of these year dummies allows us to interpret the estimated coefficient on output tariffs as the effect of trade reform on labor shares, relative to economy-wide trends.[27]

Regardless of the set of controls or sample used, the estimated coefficient on the lagged output tariff is always negative and statistically significant. The estimated coefficients of -1.993 in column (2), estimated with the full sample and region-year fixed effects, implies that a one standard deviation decline in the output tariff leads to a 0.024 standard deviation increase in the labor share relative to the region-wide trends. For the balanced panel, the effect is larger: the estimated coefficient (column 4) of -3.096 implies a one standard deviation increase in the labor share of 0.035 relative to region-wide trends.

[26] Handley and Limão (2013) note that U.S. tariffs on Chinese imports did not change with China's WTO accession. Rather, they argue that the resolution of uncertainty over the annual granting of MFN status by the United States to China was the key aspect of accession affecting Chinese export markets. Another policy change over our sample time period was expiration of the Multi-Fiber Arrangement (MFA). In our web appendix, available at http://faculty.maxwell.syr.edu/dmitra/klm_webappendix.pdf, we present regression results estimated by excluding textiles and apparel firms. Our inferences regarding tariffs and labor shares are robust to this exclusion.

[27] Some researchers, including Bai and Qian (2011), also include a measure of the capital stock. We choose not to do so because tariff changes should lead to changes in all factor input choices and if we control for these, we remove part of the response from the tariff coefficient. We include firm fixed effects, so we control for the time-invariant capital stock of the firm. Estimating equations (15) and (16) including a measure of firm-level capital and, alternatively, capital and firm size, does not affect the signs or significance of our variables of interest.

We now turn to estimation of equation (17), which explores the relationship between our markup estimates and tariff levels. Table 3 provides results for the regression of the estimated firm-level markups on both the (lagged) output tariff and (lagged) input tariff. As controls, we include firm fixed effects and year effects or, alternatively, firm fixed effects and region-year fixed effects. We estimate a significant relationship between the markup and the industry input tariff, while the coefficient for the output tariff is statistically insignificant. The negative and statistically significant coefficient on the input tariff is consistent with the findings of De Loecker *et al.* (2012, Table 9) for India.

Table 4 shows the results of estimating equations (15) and (16), where we include both the output and input tariffs, as seen in columns 1 and 2, and then also include the markup (lagged one period) in columns 3 and 4. The estimated coefficients on the output and input tariff are negative across all columns (irrespective of whether we control for lagged markups or use our unbalanced or balanced panel or include year or region/year effects). While the input tariff is statistically significant throughout, the output tariff is significant only when the markup is excluded, suggesting that output tariff reductions work mainly through their effect on markups. The beta coefficients for the output tariff in columns 1 through 4 indicate that a one standard deviation reduction in the output tariff, holding the firm's markup constant, raises labor share by about 0.026 of a standard deviation. The beta coefficients of the input tariff, on the other hand, indicate that one standard deviation reduction in the input tariff raises labor share by about 0.034 of a standard deviation. The markup itself has a positive and highly significant coefficient, suggesting that a part of the additional rent created by trade liberalization is passed along to labor. The estimated markup coefficient in column 3 and 4 of 0.21-0.22 implies that a one standard deviation increase in the markup raises the labor share of sales by roughly 0.008 of a standard deviation.

Comparing the results from the unbalanced panel to the balanced panel in Table 4, we find that the estimated impact of output tariffs on the labor share of incumbent firms is larger (a coefficient of -2.311 versus -2.087, using columns 2 and 6) but qualitatively the same. Indeed, the beta coefficient implies that a one standard deviation decline in the output tariff leads to a 0.026 standard deviation increase in the labor share of incumbents, very similar in magnitude to the impact estimated for the full sample. The coefficient size of the input tariff is also about 40 percent larger in the balanced panel compared to the unbalanced panel and we consistently find evidence of rent sharing, as indicated by the positive and highly significant estimated coefficient on the markup. In contrast to the full sample, these coefficients suggest that incumbents pass a larger share of rents along to workers – the coefficient rises from 0.211 for the full panel to 0.557 for the balanced panel.

We allow for heterogeneous effects by interacting output and input tariffs with the firm's remoteness, as measured by its distance to the nearest international port, as shown in Table 5. These results provide strong statistical support for spatial differences in the effect of trade liberalization on firms. With or without controlling for firm markups, we find that the positive impact of tariff cuts on labor shares is attenuated by distance from an international port. Comparing results in Table 4, column 3, to results in Table 5, column 2, we see that accounting for a spatial dimension barely changes the value or significance of the markup variable. However, the average effect of the tariffs found in Table 4 is seen to mask much spatial variation: estimated coefficients of the output tariff and its interaction with remoteness in Table 5, column 2, imply a marginal effect of the output tariff of -1.879 for firms in Fuzhou, located in the Coastal region, a marginal effect of -1.797 for Huangzhou, located in the Central region, -1.072 for Xi'an, located in the Northwestern region, and -0.140 for Chengdu, located in the Southwestern region. The

corresponding marginal effects of the input tariff are -3.871, -3.585, -1.033 and 2.247 respectively. Tariff cuts have their strongest positive impact on labor shares in those regions most exposed to international trade and, indeed, our estimates suggest that input tariff cuts reduce labor shares in interior provinces.

Because available evidence suggests that state firms have less flexibility in adjusting employment, we expect tariff cuts, especially input tariff cuts, to have a larger impact on non-state firms than on those in the state sector. Table 6 allows the impact of trade liberalization on the labor share of sales to differ for domestic private firms and for foreign-invested enterprises from that for state firms. Looking at either column, we find that the estimated labor-share-enhancing impact of both input and output tariff cuts are greater in a statistically significant way for foreign firms than those estimated for state firms. While the input tariff impact on domestic private firms is not significantly different statistically from that of state owned enterprises, the estimated magnitude of the impact is smaller. For a firm located in a port city, the estimated coefficient for output tariff increases from -1.69 for domestic private firms to -6.56 for foreign firms, which is almost a 300% increase in magnitude. In the case of the input tariff, the corresponding increase is -4.55 to -15.78, almost a 250% increase in magnitude. It may be that foreign firms use larger shares of imported intermediates or are better able to compete with imported varieties. We leave for future research an exploration of these differences between these firm types.

Table 7 provides evidence concerning the role of labor unions in adjustment to liberalization. Estimating our regression on the entire sample, as in columns 1 and 2, we find that both lower output and lower input tariffs raise labor share for all firms, but the magnitude of the input tariff effect is smaller when a union is present. This result is consistent with a process in which the union uses its “collective voice” to slow the introduction of imported intermediates, but

such an interpretation cannot be directly tested with our data. Given that most state-owned firms have a union present, we next estimate the regression separately for private enterprises (columns 3 and 4) and for foreign-invested enterprises (columns 5 and 6) and in both samples we find that the effect of input tariff cuts is smaller for union firms. Interestingly, we find a significant relationship between firm markups and labor shares in domestic private firms. In contrast, foreign firms with a union present exhibit no significantly different rent sharing behavior than do those without a union. One possible explanation is that foreign firms already pay a wage premium tied to profitability (Harrison and Scorse, 2009), and thus do not need to offer further concessions regardless of whether or not a union is present in the enterprise.

Table 8 checks the applicability of our findings to the labor share of value added instead of labor share of sales. With this switch in the dependent variable, we substitute the industry effective rate of protection (IERP) for the output and input tariff. Looking across the columns, we see that the estimated coefficient for IERP is negative and significant, whether or not we control for firm-level markup. We continue to find significant spatial variation in the impact. The estimated coefficients shown in column 2 imply a marginal effect of -0.761 for firms in Fuzhou, located in the Coastal region, -0.658 for Huangzhou, located in the Central region, 0.256 for Xi'an, located in the Northwestern region, and 1.432 for Chengdu, located in the Southwestern region. Compared to the results shown in Table 5, a decrease in the effective rate of protection raises labor's share of value added, but the positive impact falls off more quickly with distance than is the case for labor's share of sales. In sum, substituting labor share of value added for labor share of sales as the dependent variable leads to the same conclusion: reductions in protection lead to higher labor shares, *ceteris paribus*, and this effect attenuates with distance from international ports. We also continue to find robust evidence that firms pass a share of rents to workers.

Our final empirical explorations consider long-differences in the data. These may be interpreted as long-run effects and they provide additional support for a causal interpretation of our findings. [28] We calculate five-year differences in the labor shares and regress them on five-year differences in lagged output and input tariffs. We also include the change in markup, which, for given output elasticity, is measured by the negative of the change in log material share. In additional specifications, we again allow the impact of output and input tariffs to vary with remoteness.[29]

Table 9 presents results of the five-year difference regressions. As in the level regressions, cuts in output and input tariffs are significantly associated with increases in the labor share of sales. Without additional controls, as shown in column 1, the estimated coefficient on the change in output tariff implies that a one percentage point cut in the output tariff raises labor share by 0.037 percentage points, while a one percentage point cut in the input tariff increases labor share by 0.087 percentage points. These estimates are more than 50% higher than those implied by the level regressions shown in Table 4, and it suggests that the long-run impact of tariff cuts may exceed the one-year impact. In these long-difference regressions that the estimated coefficients on output and input tariffs shrink a little upon the inclusion of the firm-level markup. The markup continues to have a positive relationship with labor's share of sales. When we allow the tariff coefficients to vary with remoteness, we again find that remoteness significantly reduces the pro-labor impact of input tariff cuts.

[28] Because we estimate the level equations with firm fixed effects, they are close to estimates obtained from first-difference regressions. Consequently, we interpret differences between the five-year-difference results and the fixed-effect regression results as differences between short-run and long-run impacts.

[29] We also estimate nine-year differences and obtain qualitatively similar and statistically significant results. These regression results are available at http://faculty.maxwell.syr.edu/dmitra/klm_webappendix.pdf .

In Table 10, we present our regressions using five-year differences with initial tariff levels included as additional controls. These results indicate that controlling for initial output and input tariff levels does not alter our findings regarding the significant and positive impact of input tariff cuts markups on labor shares. The output tariff coefficients, while retaining their signs, show weaker significance. Moreover, initial output and input tariff levels are never significant determinants of long-run changes in labor shares.

To create instruments for tariff levels, we rely upon the tariff compression nature of Chinese policy reform. Initially highly protected industries received the largest cuts, with the schedule for further tariff reductions fixed by China's WTO accession agreement. Based on these observations, we run instrumental variables regressions in long differences using nine-year lags in levels as instruments for five-year differences. We assume that five-year differences in the error term are uncorrelated with 9-year lagged output and input tariffs, given the significant time difference between the *differenced* error term and the instruments.

We estimate regressions using five-year differences in labor shares and nine-year lags in tariff levels and also, for comparison, one-year differences in labor shares and five-year lags of the suspected endogenous variables. The results, presented in Table 11, are qualitatively very similar to those presented in Tables 9 and 10. Both the estimated output and input tariff coefficients are negative. Across all specifications, the output tariff is significant, while the input tariff is significant when we account for the influence of market access. The remoteness interactions indicate that all tariff effects on labor share fade with distance from the nearest international port. The change in markup, as measured by the negative of the change in the log of material share, is positive and significant, consistent with rent sharing between the firm and workers.

Note that our instrumental variable regression equations are exactly identified. The first-stage Shea's partial R^2 s for the one-year difference regressions lie in the range 0.04-0.09, while for the five-year difference regressions this range is 0.28-0.48. The first-stage F-statistic is very high throughout, with the corresponding *p*-value less than 0.01 for all specifications. Running our instrumental variables regressions also lets us perform a test of joint exogeneity of our right-hand side variables that are suspected to be endogenous, i.e., a test of consistency of our OLS estimates. The Durbin-Wu-Hausman statistic is insignificant indicating that our OLS estimates are consistent.

6. Conclusion

Previous research has found that the impact of trade liberalization on firm behavior depends on local production conditions. China is unlike many other countries in its extensive use of imported materials, almost exclusive reliance on eastern ports for trade, a lack of effective collective bargaining, and a disproportionate presence of state enterprises in protected sectors. Drawing upon a theoretical model that permits trade reform to affect firm's input choices and the extent of rent sharing, we find support for a positive and significant effect of liberalization on the labor shares, operating through both channels. These results suggest that workers share part of the productivity gain from China's WTO accession documented by Brandt *et al.* (2012).

The estimated economic magnitude of tariff cuts on labor shares of value is significant. Using the regression results shown in Table 5, column 2, we calculate predicted labor shares for every firm in 2007 assuming that firms experienced no tariff changes after 1998. The predicted average labor share in 2007 with 1998 tariff levels is 6.89. Given an actual average labor share of 8.14 in 2007, these estimates suggest that an industry that experienced no reductions in output or input tariffs would have a 15.7% lower labor share of value in 2007 than it actually did, on average, assuming the same economy-wide trends.

We cannot fully investigate the mechanisms by which firms altered input choices because the Chinese manufacturing census does not provide information on imported intermediates. Our results are consistent, however, with complementarity between domestic labor and imported intermediates, so that lower tariffs on imported inputs lead to higher labor productivity and labor share of value. Previous research has shown the importance of intermediate imports to domestic capabilities. In their study of Indian trade liberalization, Goldberg, Khandelwal, Pavcnik, Topalova (2010) find that new imported varieties generated an annual 4.7 % decline in the imported input price index, and that firms' access to new imported inputs increased their ability to manufacture new products. Khandelwal and Topalova (2011) find that lower tariffs on final goods, as well as access to better inputs due to lower input tariffs, increased firm-level productivity, with input tariffs having a larger impact. Given the productivity enhancing effect of trade reforms in China, it is not surprising that our regression results suggest that some of these gains came through lower input prices and that this contributed to higher labor shares.

Other possible explanations for our findings also bear further investigation. An important alternative to input complementarity focuses on skill upgrading. Firms that face increased import competition may respond by increasing the education or experience of the workforce. Recent evidence from Indonesia suggests skill upgrading may be important: Kasahara, Liang, and Rodrique (2013) find that importing intermediates increases the relative demand for educated workers at the plant level. More highly educated or experienced workers earn higher wages and, thus, may be one reason for higher wage bills in liberalized sectors. Such responses are consistent with our interpretation of the coefficient we estimate for the output tariff as evidence of changes in firms' input choices, with a focus on changes in the type of worker hired.

Our empirical findings also suggest that firms share rents with workers, a result that may be somewhat surprising given the view that workers have no bargaining power in China. As developed in theory, fairness concerns can also give rise to rent sharing. Moreover, evidence of a positive link between profits and wages is consistent with the recent empirical contributions of Ge (2013) and Nee and Opper (2012). By examining how this link may be influenced by a union presence, we are able to offer additional evidence on how labor market institutions influence firm behavior in the developing world.

Appendix

Construction of Markups

The method proposed by De Loecker, Goldberg, Khandelwal, and Pavcnik (2012) requires estimation of a production function but does not require the specification of how firms compete in the product market. To implement the method, we begin by estimating production functions for every two-digit CIC industry to obtain output elasticities and input shares in total revenue.

Assuming a translog production function, the estimating equation is

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_{ll} l_{it}^2 + \beta_k k_{it} + \beta_{kk} k_{it}^2 + \beta_m m_{it} + \beta_{mm} m_{it}^2 + \beta_{ml} m l_{it} + \beta_{kl} k l_{it} + \beta_{mk} m k_{it} + \omega_{it} + e_{it} \quad \text{(A1)}$$

where y_{it} is log of real gross industrial output value for firm i in period t, l_{it}, m_{it}, k_{it} are the log values of labor, real intermediate inputs (or materials), and real capital, ω_{it} is the component of productivity shock observed by the firm but not the econometrician, and e_{it} is the component of productivity shock that is unobserved by both the firm and the econometrician.

To control for ω_{it}, the Olley and Pakes (1996) method employs the investment decision function. This approach is based on the assumption that future productivity is strictly increasing with respect to current productivity, so that conditional on current capital usage, firms that observe a positive productivity shock in period t will invest more in that period.

$$y_{it} = \beta_l l_{it} + \beta_{ll} l_{it}^2 + \beta_m m_{it} + \beta_{mm} m_{it}^2 + \beta_{ml} m l_{it} + \emptyset(i_{it}, k_{it}, l_{it}, m_{it}) + e_{it} \quad \text{(A2)}$$

where i_{it} is log investment and

$$\emptyset(i_{it}, k_{it}, l_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \beta_{kk} k_{it}^2 + \beta_{kl} k l_{it} + \beta_{mk} m k_{it} + h(i_{it}, k_{it})$$

and $h(.)$ is approximated by a second order polynomial series in capital and investment so that,

$$\emptyset(i_{it}, k_{it}, l_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \beta_{kk}(2k_{it}^2) + \beta_{kl} k l_{it} + \beta_{mk} m k_{it} + \beta_i i_{it} + \beta_{ii} i_{it}^2 + \beta_{ki} k i_{it}.$$

Equation (2) is estimated using OLS and the coefficient estimates for the variable inputs will be consistent because $h(.)$ controls for unobserved productivity. To control for selection bias, a survival probability, $\hat{P}_{it}$, is estimated for each firm as a function of lagged i and k, their squares and cross products. To consistently estimate the capital coefficients we regress,

$$y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_{ll} l_{it}^2 - \hat{\beta}_m m_{it} - \hat{\beta}_{mm} m_{it}^2 - \hat{\beta}_{ml} m l_{it} =$$

$$\beta_k k_{it} + \beta_{kk}(2k_{it}^2) + \beta_{kl} k l_{it} + \beta_{mk} m k_{it}$$

$$+ g\left(\widehat{\emptyset}_{t-1} - \beta_k^* k_{it-1} - \beta_{kk}^*(2k_{it-1}^2) - \beta_{kl}^* k l_{it-1} - \beta_{mk}^* m k_{it-1}, \hat{P}_{it}\right) + e_{it}, \qquad \text{(A3)}$$

where $g(.)$ is approximated by a second order polynomial series in $\left(\widehat{\emptyset}_{t-1} - \beta_k^* k_{it-1} - \beta_{kk}^*(2k_{it-1}^2) - \beta_{kl}^* k l_{it-1} - \beta_{mk}^* m k_{it-1}\right)$ and $\hat{P}_{it}$.

The coefficients, $\hat{\beta}_l$, $\hat{\beta}_{ll}$, $\hat{\beta}_m$, $\hat{\beta}_{mm}$, and $\hat{\beta}_{ml}$ are consistent estimates for the variables from the first stage. β_k^*,β_{kk}^*, β_{kl}^*, and β_{mk}^* can be any candidate value so that a prediction for the unobserved productivity can be computed up to a scalar constant. We use a non-linear estimation routine in this stage and set the initial parameters to the OLS estimates from the first stage.

Once all coefficients of the translog production function have been consistently estimated, the markups are estimated as the output elasticity, $\hat{\theta}_{it}^j$, with respect to an input, j, divided by the input's share in revenue, α_{it}^j. Since we focus on material markups, output elasticity for material is given by $\hat{\theta}_{it}^M = \hat{\beta}_m + 2\hat{\beta}_{mm} m_{it} + \hat{\beta}_{lm} l_{it} + \hat{\beta}_{mk} k_{it}$ and the markup with respect to materials is given by $\hat{\theta}_{it}^M / \alpha_{it}^M$, where α_{it}^M is drawn from the data. We exclude observations with markups that are outside the 1st and 99th percentiles within each four-digit Chinese Industrial Classification (CIC) industry.

Input Tariff Construction

Data on output tariffs available at the HS6 product level are converted to ISIC Rev. 3 industry level. These data are linked to the Chinese firm level data using a concordance between the four-digit Chinese Industrial Classification (CIC) and ISIC Rev. 3. For majority of the manufacturing industries at the CIC level, there is a many to one mapping between CIC and ISIC.[30] Once output tariffs have been assigned to each four-digit CIC, they are aggregated up to the five-digit IO sector level using output in 2003 as weights (Du, Harrison, Jefferson, 2014).

The following steps were carried out to construct the input tariffs. First, the 2002 Chinese input-output (IO) table was used to generate an input-output share matrix. The IO table consists of 122 sectors of which 71 belong to manufacturing. In the special case where $i = j$, denoting the value of inputs from the own industry, we replace actual values with 0. This strategy reduces the degree of correlation between output and input tariffs that is driven by the own industry shares.[31] For example, if the auto industry uses \$50 worth of input from the auto industry itself, \$25 input from the steel industry and \$25 from the glass industry, we will compute the total value of inputs for the auto industry as \$50 and subsequently generate weights of 0.5 and 0.5 for the steel and glass industries, respectively.

The modified shares are then multiplied by output tariffs to create an input tariff: $Input\ Tariff_i = \sum_j s_{ij} * Output\ Tariff_j$, where the weights s_{ij} are taken from the IO share matrix.

[30] Four-digit CIC industries of 1529 "Manufacture of Fruit Wine", 1533 "Manufacture of Fruit and Vegetable Juice", and 1469 "Manufacture of Other Condiments and Fermented Products" map into two different ISIC industries each. Specifically, 1529 maps into 1552 "Manufacture of wines" and 1551 "Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials"; 1533 maps into 1554 "Manufacture of soft drinks; production of mineral waters" and 1513 "Processing and preserving of fruit and vegetables"; and 1469 maps into 1514 "Manufacture of vegetable and animal oils and fats" and 1549 "Manufacture of other food products n.e.c.". The output tariffs at the ISIC level are weighted equally to arrive at output tariffs at the four-digit CIC level..

[31] In our unbalanced sample spanning 1998 and 2007, the correlation between input and out tariffs drops from 0.71 to 0.43 by zeroing out the diagonal terms in the share matrix to create the input tariff measures.

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Table 1: Variable Definitions and Summary Statistics.

Variable	Definition	Mean	St. Dev.
Firm Level			
Wage Bill/Sales	Share of wage bill in total sales x 100	9.149	10.034
Wage Bill/Value Added	Share of wage bill in total value added x 100	28.166	21.389
Remoteness	Arc distance between geographic city centroid and nearest international port (Shanghai, Tianjin, or Guangzhou) in 1,000 km	0.380	0.357
Markup	Ratio of the elasticity of output with respect to materials and materials' share in total revenue; see appendix for details	1.296	0.353
Log Material Share	Log of the share of intermediate inputs in gross industrial output value	0.747	0.134
Union	Categorical variable that takes the value 1 if a union is present in the enterprise and 0 otherwise	0.519	0.500
Industry Level			
Output Tariff	Effectively applied tariff weighted by imports at the four-digit ISIC Rev. 3 level; concorded to four-digit CIC by authors	0.126	0.116
Industry Effective Rate of Protection (IERP)	Effective rate of protection at the four-digit ISIC Rev. 3 level†; concorded to four-digit CIC by authors	0.194	0.366
Input Tariff	See text for details on construction of this variable at the five-digit IO level; concorded to four-digit CIC by authors	0.113	0.058

Notes: Summary based on the unbalanced panel between 1998 and 2007; Chinese Industrial Classification (CIC); Input-Output (IO). See Madariaga and Poncet (2007) for detailed definition of city. †$\frac{Output\ Tariff_{jt} - \alpha_{jt} * Input\ Tariff_{jt}}{(1-\alpha_{jt})}$ where α_{jt} is the material share in industry j at time t.

Table 2: Labor Share of Sales and Output Tariffs, by Panel Type

	Unbalanced Panel		Balanced Panel	
	(1) Wage Bill/Sales	(2) Wage Bill/Sales	(3) Wage Bill/Sales	(4) Wage Bill/Sales
Lag Output Tariff	-2.039*	-1.993**	-3.271**	-3.096**
	(1.060)	(0.904)	(1.515)	(1.291)
Constant	9.084***	8.632***	9.783***	9.644***
	(0.238)	(0.235)	(0.255)	(0.249)
Observations	1,768,083	1,768,083	309,467	309,467
Adjusted R^2	0.62	0.62	0.65	0.65
Firm FE	Y	Y	Y	Y
Year FE	Y	-	Y	-
Region-Year FE	-	Y	-	Y

Notes: The dependent variable is (wage bill/sales x 100). The unbalanced panel spans 1998 through 2007. The balanced panel spans 2000 through 2007. Standard errors are clustered at the four-digit ISIC level. Significance: *10%, **5%, ***1%.

Table 3: Markups and Tariffs.

	(1) Markup	(2) Markup
Lag Output Tariff	-0.0267	-0.0267
	(0.032)	(0.033)
Lag Input Tariff	-0.385***	-0.377***
	(0.112)	(0.111)
Constant	1.351***	1.348***
	(0.009)	(0.011)
Observations	1,691,791	1,691,791
Adjusted R^2	0.45	0.45
Firm FE	Y	Y
Year FE	Y	-
Region-Year FE	-	Y

Notes: The dependent variable is markup. See text for details on how markups are calculated from firm-level data. Outliers in the 99th and 1st percentile of the markup distribution are excluded. The regressions are run on an unbalanced panel from 1998-2007. Standard errors are clustered at the four-digit ISIC level. Significance: *10%, **5%, ***1%.

Table 4: Labor Share of Sales and Tariffs, by Panel Type

	Unbalanced Panel				Balanced Panel			
	(1) Wage Bill/Sales	(2) Wage Bill/Sales	(3) Wage Bill/Sales	(4) Wage Bill/Sales	(5) Wage Bill/Sales	(6) Wage Bill/Sales	(7) Wage Bill/Sales	(8) Wage Bill/Sales
Lag Output Tariff	-2.087**	-2.033**	-2.084	-2.031*	-2.311*	-2.143**	-2.290	-2.122
	(1.033)	(0.873)	(1.563)	(1.213)	(1.256)	(1.036)	(1.784)	(1.403)
Lag Input Tariff	-5.275**	-5.371**	-5.241*	-5.337*	-7.409**	-7.463**	-7.299*	-7.352**
	(2.704)	(2.442)	(2.985)	(2.811)	(3.441)	(3.094)	(3.737)	(3.586)
Lag Markup			0.211***	0.217***			0.557***	0.565***
			(0.071)	(0.072)			(0.181)	(0.192)
Constant	9.699***	9.752***	9.263***	8.841***	10.447***	10.261***	9.714***	9.523***
	(0.308)	(0.284)	(0.697)	(0.613)	(0.580)	(0.506)	(0.726)	(0.662)
Observations	1,307,177	1,307,177	1,307,177	1,307,177	290,399	290,399	290,399	290,399
Adjusted R^2	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.66
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	-	Y	-	Y	-	Y	-
Region-Year FE	-	Y	-	Y	-	Y	-	Y

Notes: The dependent variable is (wage bill/sales x 100). Outliers in the 99th and 1st percentile of the markup distribution are excluded. The unbalanced panel spans 1998 through 2007. The balanced panel spans 2000 through 2007. Standard errors are clustered at the four-digit ISIC level and in specifications that include firm-level markups, bootstrapped using 400 repetitions. Significance: *10%, **5%, ***1%.

Table 5: Labor Share of Sales and Tariffs: Effect of Geographic Remoteness.

	(1) Wage Bill/Sales	(2) Wage Bill/Sales
Lag Output Tariff	-3.354**	-3.352
	(1.578)	(2.185)
Lag Output Tariff x Remoteness	2.494*	2.496
	(1.480)	(1.864)
Lag Input Tariff	-9.100**	-9.056**
	(3.667)	(3.950)
Lag Input Tariff x Remoteness	8.808***	8.784***
	(3.142)	(3.102)
Lag Markup		0.209***
		(0.069)
Constant	9.735***	9.388***
	(0.283)	(0.710)
Observations	1,305,269	1,305,269
Adjusted R^2	0.65	0.65
Firm FE	Y	Y
Year FE	Y	Y

Notes: The dependent variable is (wage bill/sales x 100). Outliers in the 99th and 1st percentile of the markup distribution are excluded. The regressions are run on an unbalanced panel from 1998-2007. Standard errors are clustered at the four-digit ISIC level and in specifications that include firm-level markups, bootstrapped using 400 repetitions. Significance: *10%, **5%, ***1%.

Table 6: Labor Share of Sales and Tariffs: Differences by Ownership.

	(1) Wage Bill/Sales	(2) Wage Bill/Sales
Lag Output Tariff	-2.861**	-2.868*
	(1.110)	(1.525)
Lag Output Tariff x Private	1.192*	1.200
	(0.650)	(0.864)
Lag Output Tariff x Foreign	-3.699**	-3.681**
	(1.419)	(1.697)
Lag Output Tariff x Remoteness	1.706	1.712
	(1.057)	(1.335)
Lag Input Tariff	-3.203	-3.171
	(2.625)	(2.677)
Lag Input Tariff x Private	-1.390	-1.376
	(1.698)	(1.805)
Lag Input Tariff x Foreign	-12.62***	-12.61***
	(3.073)	(2.953)
Lag Input Tariff x Remoteness	5.791**	5.771***
	(2.349)	(2.195)
Lag Markup		0.205***
		(0.065)
Constant	9.609***	9.278***
	(0.226)	(0.626)
Observations	1,305,269	1,305,269
Adjusted R^2	0.65	0.65
Firm FE	Y	Y
Year FE	Y	Y

Notes: The dependent variable is (wage bill/sales x 100). Outliers in the 99th and 1st percentile of the markup distribution are excluded. The regressions are run on an unbalanced panel from 1998-2007. "Private" is an indicator for privately owned domestic firms and "Foreign" is an indicator for foreign invested enterprises. Standard errors are clustered at the four-digit ISIC level and in specifications that include firm-level markups, bootstrapped using 400 repetitions. Significance: *10%, **5%, ***1%.

Table 7: Labor Share of Sales and Tariffs: Effects of Union Presence.

	All Enterprises		Foreign Invested Enterprises		Private Enterprises	
	(1)	(2)	(3)	(4)	(5)	(6)
	Wage Bill/Sales	Wage Bill/Sales	Wage Bill/Sales	Wage Bill/Sales	Wage Bill/Sales	Wage Bill/Sales
Lag Output Tariff	-2.690*	-2.683	-3.365*	-3.335	-1.525*	-1.528
	(1.481)	(2.354)	(1.766)	(2.297)	(0.850)	(1.525)
Lag Output Tariff x Union	0.734	0.730	1.552	1.550	0.659	0.661
	(0.925)	(1.486)	(0.991)	(1.405)	(0.744)	(1.292)
Lag Input Tariff	-9.292***	-9.272***	-6.858*	-6.760	-6.239***	-6.256***
	(3.126)	(3.208)	(4.079)	(4.379)	(2.055)	(2.240)
Lag Input Tariff x Union	6.115***	6.158***	4.826**	4.818**	4.195***	4.276***
	(1.805)	(1.990)	(2.119)	(2.250)	(1.236)	(1.426)
Lag Markup		0.160**		0.360**		-0.008
		(0.074)		(0.140)		(0.057)
Lag Markup x Union		0.152*		0.132		0.255**
		(0.091)		(0.168)		(0.126)
Constant	9.521***	9.245***	11.79***	9.336***	7.608***	7.460***
	(0.286)	(0.671)	(0.442)	(1.043)	(0.195)	(0.446)
Observations	967,070	967,070	242,274	242,274	506,423	560,423
Adjusted R^2	0.65	0.65	0.67	0.67	0.62	0.62
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: The dependent variable is (wage bill/sales x 100). Outliers in the 99th and 1st percentile of the markup distribution are excluded. The regressions are run on an unbalanced panel from 1998-2007 and only include firms present in 2004.. Standard errors are clustered at the four-digit ISIC level and in specifications that include firm-level markups, bootstrapped using 400 repetitions. Significance: *10%, **5%, ***1%.

Table 8. Labor Share of Value Added and the Effective Rate of Protection.

	(1) Wage Bill/VA	(2) Wage Bill/VA
Lag IERP	-2.279**	-2.619**
	(0.922)	(1.142)
Lag IERP x Remoteness	2.729***	3.148***
	(1.001)	(1.062)
Lag Markup		0.372**
		(0.145)
Constant	28.80***	27.54***
	(0.435)	(0.807)
Observations	1,628,397	1,151,123
Adjusted R^2	0.54	0.58
Firm FE	Y	Y
Year FE	Y	Y

Notes: The dependent variable is (wage bill/value added x 100). Outliers in the 99th and 1st percentile of the markup distribution are excluded. The regressions are run on an unbalanced panel from 1998-2007. Standard errors are clustered at the four-digit ISIC level and in specifications that include firm-level markups, bootstrapped using 400 repetitions. Significance: *10%, **5%, ***1%.

Table 9: Labor Share of Sales and Tariffs: Five-Year Difference Regressions.

	(1) Change in Wage Bill/Sales	(2) Change in Wage Bill/Sales	(3) Change in Wage Bill/Sales	(4) Change in Wage Bill/Sales
Change in Output Tariff	-3.677**	-3.467**	-4.308**	-4.126**
	(1.705)	(1.720)	(1.826)	(1.818)
Change in (Output Tariff x Remoteness)			1.345	1.414
			(0.994)	(0.978)
Change in Input Tariff	-8.681***	-8.204***	-13.66***	-13.89***
	(3.036)	(3.024)	(3.726)	(3.684)
Change in (Input Tariff x Remoteness)			12.10***	13.76***
			(2.968)	(3.024)
-(Change in Log Material Share)		1.446***		1.449***
		(0.272)		(0.267)
Observations	281,900	268,884	279,222	266,302

Notes: The dependent variable is the five-year change in (wage bill/sales x 100). Standard errors are clustered at the four-digit ISIC level. Significance: *10%, **5%, ***1%.

Table 10: Labor Share of Sales and Tariffs: Five-Year Difference Regressions with Controls for Initial Tariffs.

	(1) Change in Wage Bill/Sales	(2) Change in Wage Bill/Sales	(3) Change in Wage Bill/Sales	(4) Change in Wage Bill/Sales
Change in Output Tariff	-1.268	-1.148	-1.910	-1.774
	(1.319)	(1.422)	(1.328)	(1.411)
Change in (Output Tariff x Remoteness)			2.680*	2.799*
			(1.614)	(1.606)
Change in Input Tariff	-6.017**	-5.911**	-9.422***	-9.811***
	(2.918)	(2.963)	(3.205)	(3.209)
Change in (Input Tariff x Remoteness)			11.01***	12.59***
			(2.855)	(2.891)
-(Change in Log Material Share)		1.451***		1.452***
		(0.271)		(0.266)
Initial Output Tariff	1.847	1.791	2.296	2.278
	(1.438)	(1.365)	(1.552)	(1.467)
Initial Input Tariff	1.626	1.359	2.457	2.316
	(1.599)	(1.629)	(1.518)	(1.530)
Observations	279,584	266,659	278,802	265,904

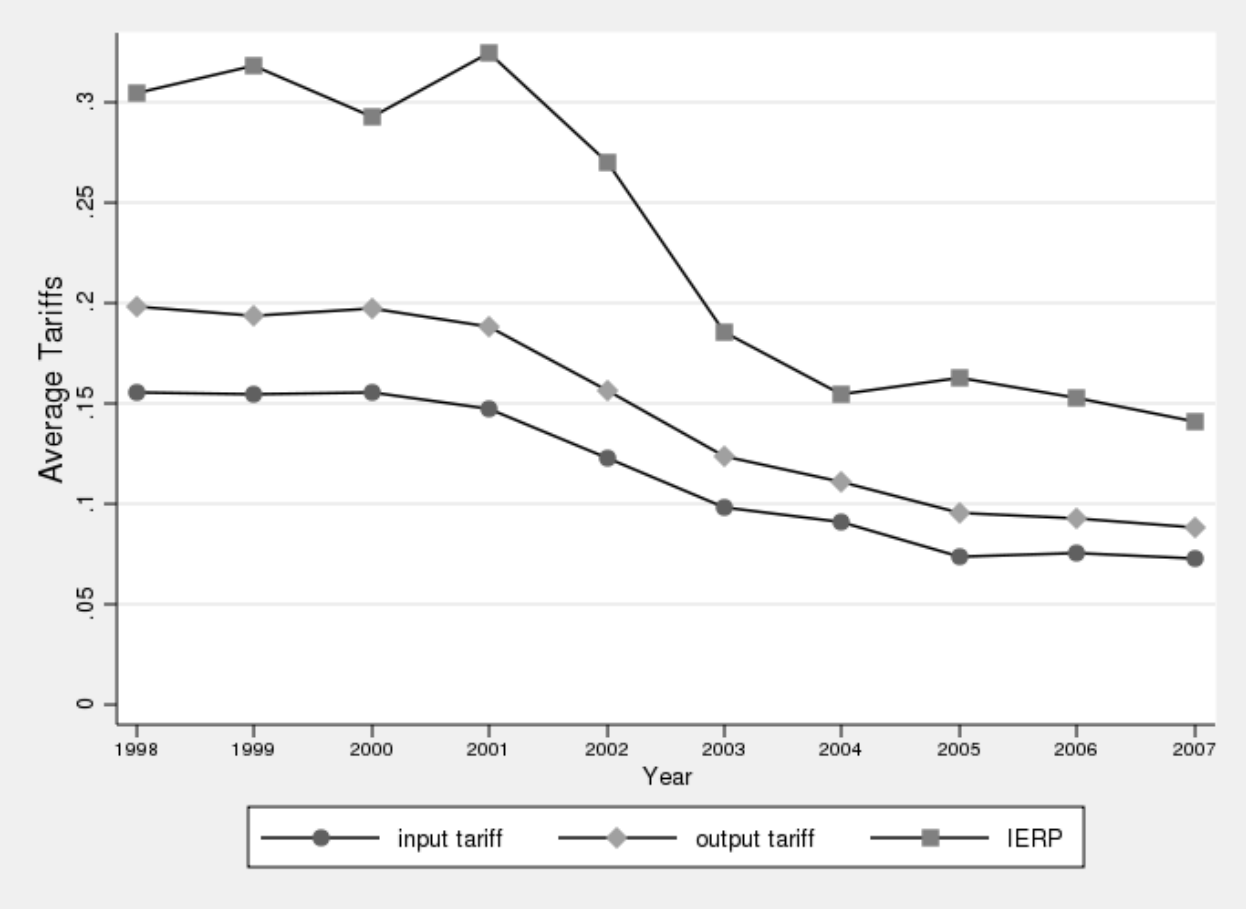
Notes: The dependent variable is the five-year change in (wage bill/sales x 100). Standard errors are clustered at the four-digit ISIC level.
Significance: *10%, **5%, ***1%.

Table 11: Labor Share of Sales and Tariffs: Difference Regressions using Instrumental Variables.

	One-Year Change				Five-Year Change			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Change in Output Tariff	-6.518**	-6.713*	-6.658*	-7.778**	-9.759**	-10.34**	-16.70**	-17.48**
	(3.204)	(3.562)	(3.859)	(3.955)	(4.913)	(4.939)	(6.850)	(6.830)
Change in (Output Tariff x Remoteness)			1.186	3.873			14.60**	14.93**
			(4.851)	(4.551)			(6.526)	(6.527)
Change in Input Tariff	-7.098	-6.295	-16.23**	-15.87**	-9.732	-8.162	-14.05*	-13.01
	(5.712)	(6.175)	(6.622)	(6.692)	(6.883)	(6.835)	(8.234)	(8.031)
Change in (Input Tariff x Remoteness)			22.29**	22.50***			11.59	13.16
			(8.757)	(8.583)			(8.853)	(8.671)
-(Change in Log Material Share)		0.428***		0.442***		1.851***		1.913***
		(0.142)		(0.143)		(0.490)		(0.479)
Observations	282,161	271,548	279,223	268,709	24,096	23,275	23,928	23,115
Durbin-Wu-Hausman Test Statistic	3.904	3.525	3.161	3.389	1.114	1.369	1.336	1.300
	(0.023)	(0.033)	(0.017)	(0.012)	(0.332)	(0.259)	(0.261)	(0.275)

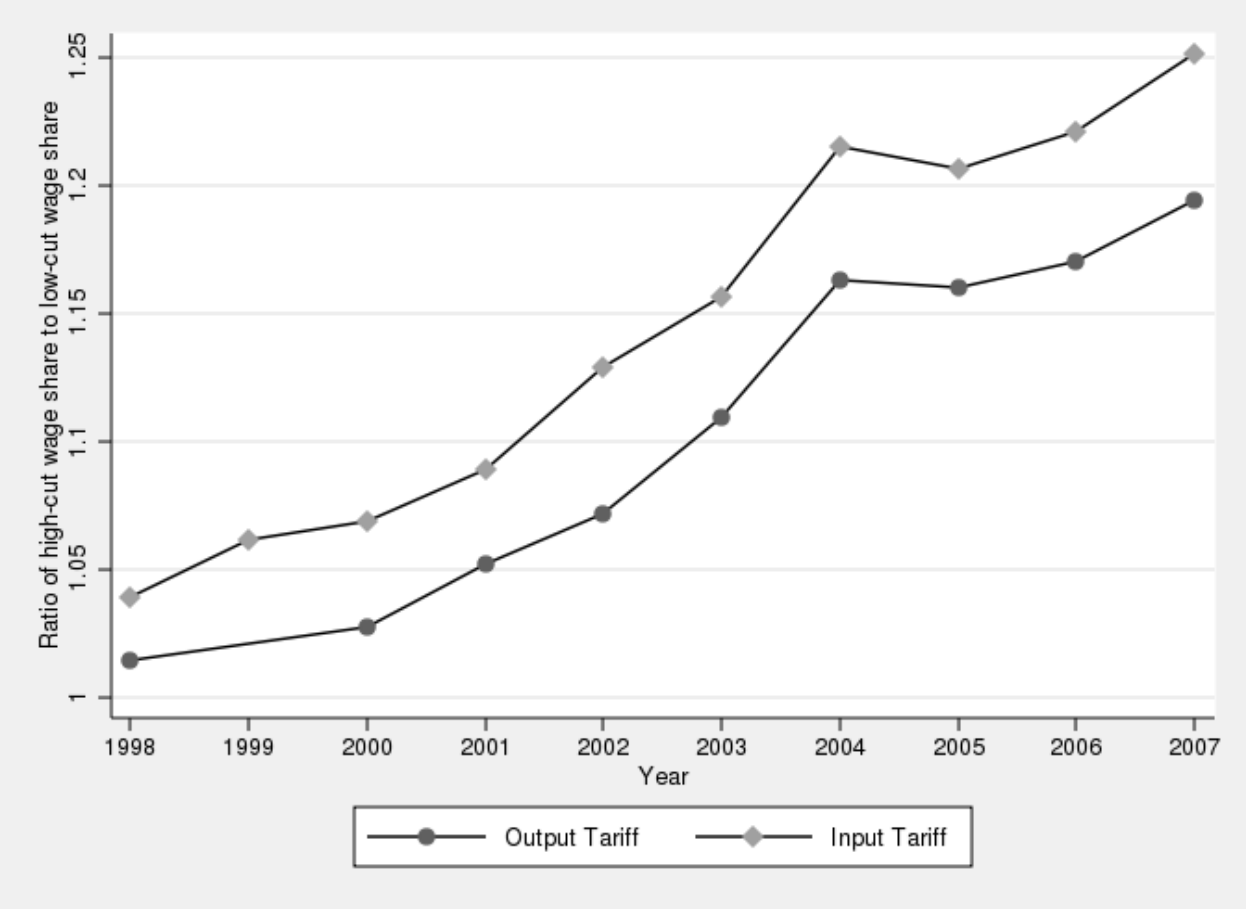
Notes: The dependent variable is the one (five) year change in (wage bill/sales x 100) in columns 1 - 4 (5 - 8). The one (five) year change in output and input tariff variables is instrumented with the five (nine) year lag of each variable, respectively. The one (five) year change in output and input tariff variables interacted with distance to the nearest port is instrumented with the five (nine) year lag of each variable and its interaction, respectively. Standard errors are clustered at the four-digit ISIC level. Significance: *10%, **5%, ***1%.

Figure 1. Trends in Average Tariffs, 1998-2007



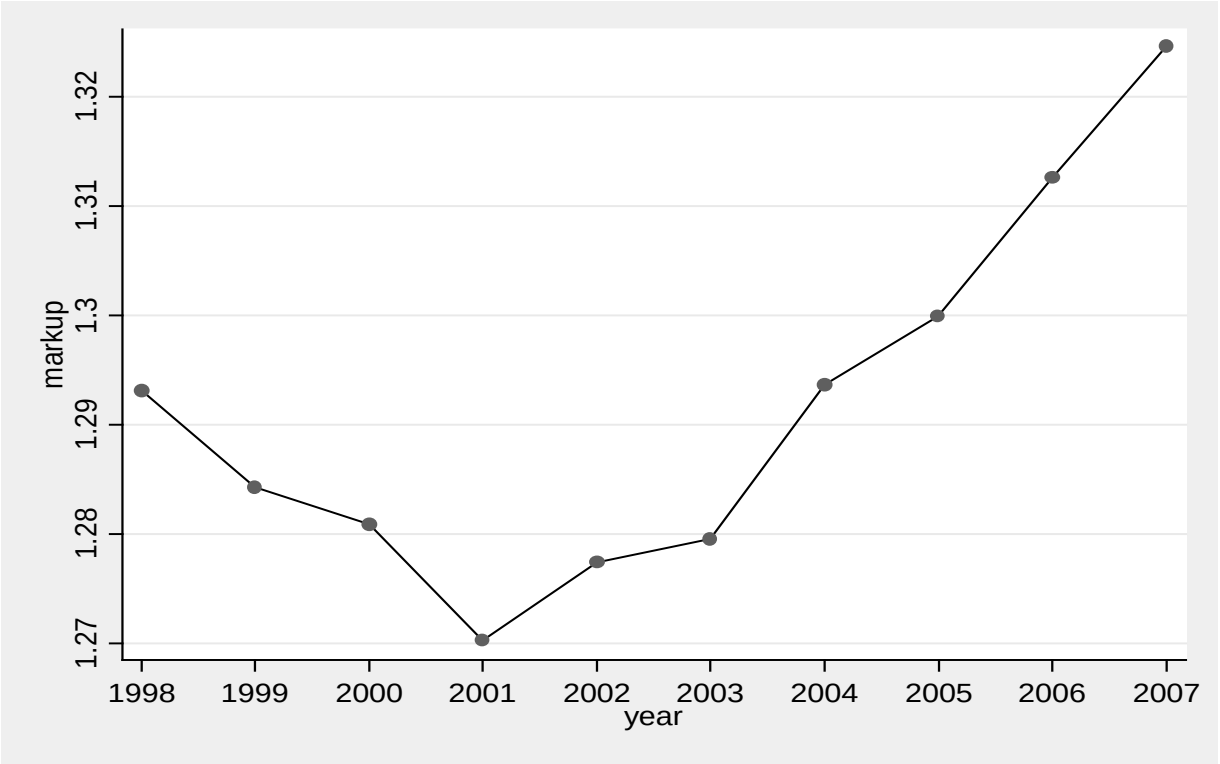
Notes: Output tariff is the effectively applied tariff weighted by imports at the four-digit ISIC Rev. 3 level. Input tariff is a weighted average of the output tariffs at the five-digit IO sector level where weights are obtained from the 2002 Chinese input-output matrix. IERP is the industry effective rate of protection. All tariff measures defined in Table 1.

Figure 2: Ratio of Average High Tariff-Cut Industry Labor Share to Average Low Tariff Cut Industry Labor Share, 1998-2007



Notes: Labor share is wage bill as a share of sales. High tariff cut industries are those with tariff cuts exceeding the average for all industries over the period. Low tariff cut industries are all others.

Figure 3: Estimated Average Markup, 1998-2007



Notes: Markups estimated using an unbalanced panel from the ASIP. See appendix for details on construction.