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Adjusting to Trade Opening: The Case of Labor Share in India's Manufacturing Industry

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Keywords

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ADJUSTMENT TO TRADE OPENING: THE CASE OF LABOR SHARE IN INDIA'S MANUFACTURING INDUSTRY

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Abstract

The objective of this paper is to study how manufacturing plants in India adjusted to trade liberalization during the period 1998–99 to 2007–08. We estimate how the labor share changed due to tariff reduction. Our results indicate that a decline in output tariffs led to an increase in the labor share of income. In contrast, a fall in input tariffs led to a decrease in the labor share. Controlling for factor intensity, we find that in technology intensive and human capital resource intensive sectors, both a decline in input and output tariff rates led to a decline in labor share. A fall in tariffs only led to an increase in labor share for labor intensive and low-technology plants. Hence, India’s bias towards capital and technology intensive production explains the overall decline in labor share in the post reform period. Furthermore, the empirical results show that labor adjustment occurred more efficiently in Indian states with flexible labor laws.

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JEL Classification: F13, F16, F66, L60

Contents

1. INTRODUCTION

The impact of the opening of trade on labor market outcomes has been a contested issue for many decades. The question has recently attracted additional interest, as governments in developed countries, such as in the United Kingdom and the United States, announced protectionist measures to shield domestic workers from foreign competition. Most scientific work has focused on labor market outcomes in developed countries,[1] especially the United States (e.g., Autor and Dorn 2013). Recently, more and more evidence has emerged of how labor markets in developing countries have adjusted to trade opening (e.g., McCaig and Pavcnik 2015). This paper aims to contribute to this literature.

Trade opening typically implies a change of market access and prices. We know from economic theory that a change in market access triggers a reallocation of resources within an economy. While some sectors expand, others contract. The so-called "new new" trade theory shows that, within sectors, the most productive firms are able to benefit from trade opening, while the least productive firms exit. Trade theory thus predicts an adjustment of the economy due to changes in factor prices; however, this theory is somewhat mute with regard to the process of adjustment itself. It is typically assumed that the economy fully uses its resources (including full employment) prior to, and after trade opening.

In this paper we study empirically how manufacturing plants in India have adjusted their labor shares due to trade opening during the period 1998 to 2008. We add to the current literature by studying how the adjustment differs across sectors. Our paper significantly extends upon the work of Ahsan and Mitra (2014) by adding input tariffs and controlling for different levels of technology and factor intensity across firms.

We find that a decline in output tariffs was associated with an increase in the labor share. In contrast, a fall in input tariffs led to a decrease in the labor share. This general result becomes more nuanced once we take into account the factor intensity of sectors. We find that, in technology intensive and human capital resource intensive sectors, both a decline in input and output tariff rates led to a decline in labor share. When dividing the sample into the Indian states with flexible and inflexible labor laws, our results suggests that Indian plants subject to inflexible labor laws adjusted to trade opening by systematically replacing labor with capital.

2. BACKGROUND

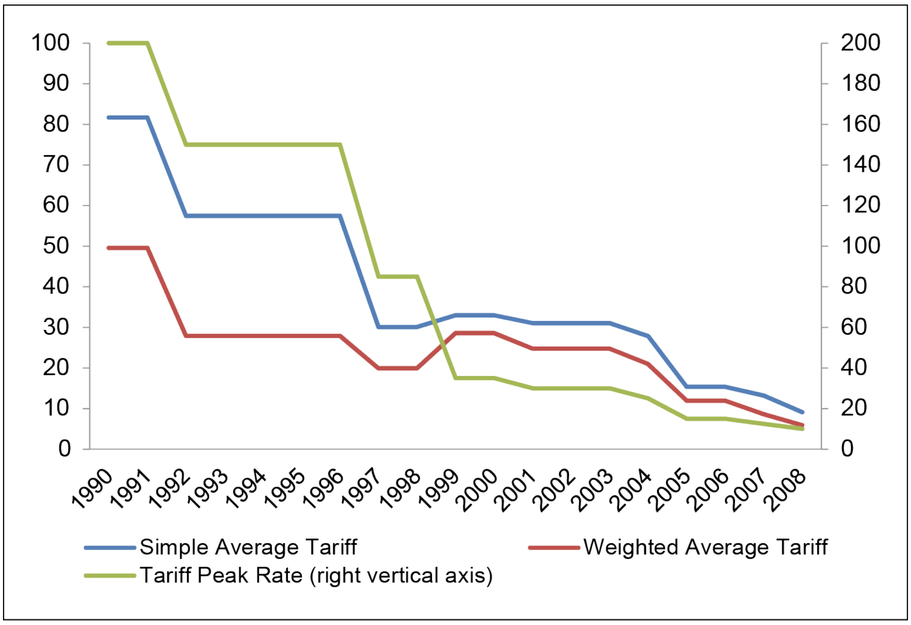
Until the reforms of 1991, India pursued a protectionist regime that insulated the domestic industry from the rigors of market competition. The idea was that imports should be avoided in order to promote domestic production and development. The public sector was given a central role in the running of the economy. However, in contrast to the economic objective of rapid industrialization with equitable growth, this policy regime created an economy of complacent rentiers rather than competitive entrepreneurs and stifled the growth of the industrial sector. In addition, government expenditures spiraled and made the Indian economy vulnerable to external shocks.

[1] See Görg (2011) for an excellent review on evidence in developed countries.

In 1991, external economic shocks hit the Indian economy, and the Indian government approached the International Monetary Fund and the World Bank for support. The two international organizations made their assistance conditional on the implementation of profound structural reforms. This created a milieu for the political will to undertake large-scale economic reforms, which had already been discussed in economic circles in India in the 1980s. Starting in 1991, the Indian government started a comprehensive liberalization strategy that gradually dismantled the protective shield for domestic producers. One important pillar of the new strategy was the opening-up of India's highly protected trade regime. The government first started by opening its market for raw materials, intermediate goods and capital goods. The market for consumer goods remained highly protected throughout the 1990s.

Figure 1 illustrates how the average and weighted tariff rate for industrial products were drastically reduced from 81.9% and 49.5% in 1990 to 57.4% and 27.8% in 1992. The process of tariff rationalization continued over the next two decades. By the end of the 1990s, in 1999, the average and weighted tariff rates stood at 33% and 28.61% and the peak tariff was reduced to 35%. The Effective Rate of Protection (ERP) was reduced from 125.9% in 1986–1990 to 80.2% in 1990–95 and to 40.4% in 1996–2000 (Das 2003).

Figure 1: Average Tariff for Industrial Products (1990–2008)

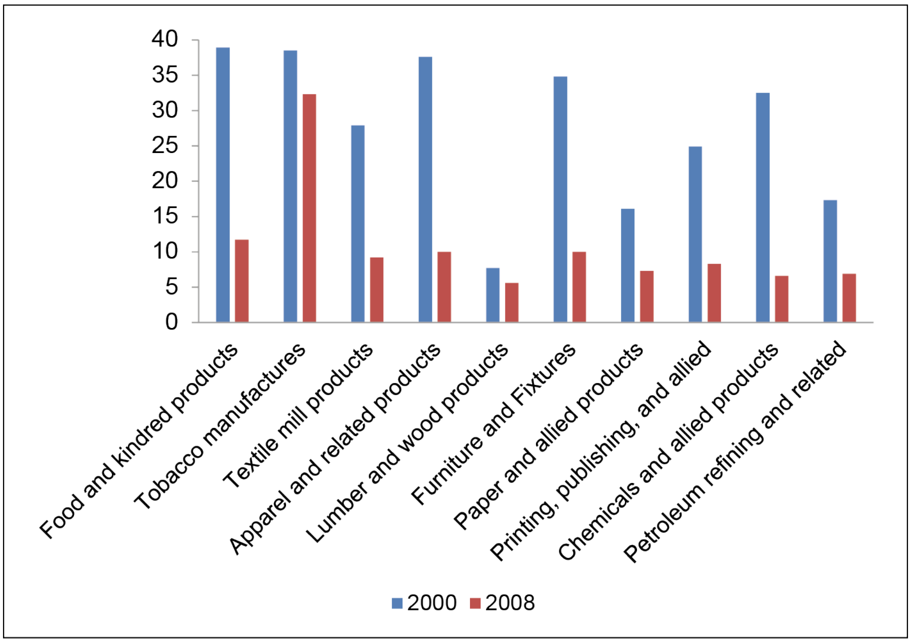


Source: Author's calculation based on UNCTAD (2012) p. 8.

While in the 1990s, during the first decade of reforms, tariff rates declined substantially, some experts argued that the level was still sufficiently high to substantially discourage imports (Goldar 2012). Furthermore, imports of most products were still subject to a range of non-tariff measures. Das (2003) estimated the nominal and effective rates of protection and found that they remained high until the year 2000, reaching almost 100 per cent for intermediate and final goods.

It was only in 2000, after India lost a WTO dispute against the United States on quantitative restrictions (QR), when the Indian government decided to remove a large number of non-tariff restrictions (UNCTAD 2011). In the 2000s, the long-protected consumer sector was opened to trade, which led to a sharp rise in India's imports of final goods, leading, in turn, to a significant increase in competition for domestic producers. At the same time, the fall in the price of intermediate inputs allowed Indian manufacturers to boost their productivity. Consequently, the manufacturing sector grew by 8.5% annually during the 2000s, compared to 7.5% in the preceding decade. Figure 2 shows the fall in tariffs for the ten most important industries in India. The decline was most dramatic in the apparel sector, which employed roughly one quarter of the workers in the manufacturing sector.

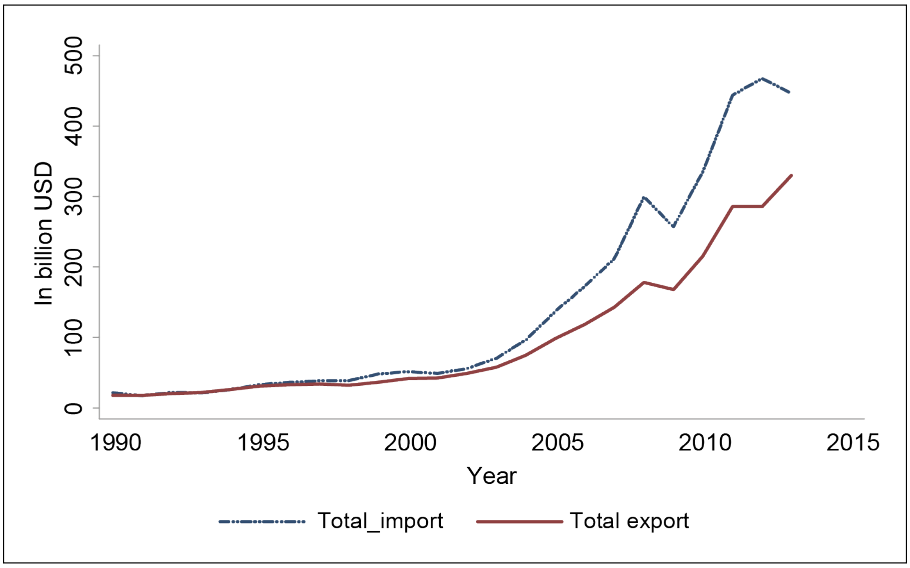
Figure 2: Tariff Rates by Industry 2000 and 2008



Source: Author's calculation based on UNCTAD (2012) p. 10.

Overall, the 2000s can be described as the period in which Indian consumers and firms started to be exposed to the benefits and challenges of world markets. Figure 3 depicts the evolution of India's imports and exports from 1990 to 2013. As we can see, India's trade with the rest of the world started to surge in the early 2000s. In our study we cover this decisive period (years 1998 to 2008) of India's integration into the world economy.

Figure 3: India's Import and Export in Current US Dollars
(billion)



Source: Authors' calculation based on trade data downloaded from WITS.

3. LITERATURE REVIEW

India's experience with trade opening has attracted scholarly attention for many years. Development economists have attempted to evaluate the impact of trade opening of various dimensions of the Indian economy.

With respect to the impact on poverty, the evidence remains mixed. Using four rounds of Household survey data (1983–84, 1987–88, 1993–94, and 1999–2000) Topalova (2007) finds that districts that were more exposed to tariff reductions experienced a lower reduction in rural poverty. Contrary to her study, Hasan, Mitra, and Ural (2007), using household survey data, undertake a state-level analysis and find no evidence for worsened poverty due to the reductions in trade protection. Instead, they find that states whose workers were on average more exposed to foreign competition had lower rural, urban and overall poverty rates.

Another dimension covered was the impact on inequality. Using Indian household expenditure survey data from 1988–2005, Krishna and Sethupathy (2011) find that income inequality fell between 1988 and 1994, rose between 1994 and 2000, and fell again after 2000. They find that the changes to the state-level measures for trade protection had no significant impact on changes in inequality across households within states. This is in line with the findings of Topalova (2007), who also finds no discernible effect of trade reforms on rural and urban inequality in India.

More closely related to our study are the empirical papers that evaluate the impact on firms. One strand of literature looks at the link between trade and firm productivity. Sivadasan (2009) analyzes the impact of tariff reduction and FDI reforms on cross-sectional data of manufacturing plants during the period 1986–87 to 1994–95. The study finds a positive impact of FDI and tariff reforms on plant level productivities for 1995–95, as compared to 1987–90. Topalova and Khandelwal (2011) use firm level data for the period 1989–2001 and analyze the impact of the reduction in output and input tariffs on firm level productivity growth. The study finds the reduction in both tariffs to have had a significant impact on firm level productivity growth, and gains are found to be larger with respect to the fall in input tariffs. Gupta (2016) uses plant level data of Indian manufacturing for the period 1998–88 to 2007–08 and analyzes the channels through which trade can drive productivity growth. Her study finds that technology spillovers, in addition to input and output variety growth, significantly contributed to higher plant level productivity in the case of India. In contrast to the above, the studies by Balakrishnan et al. (2000) and Bollard et al. (2013) find no significant role for trade reforms in the generating of productivity gains in Indian manufacturing.

Our study builds on previous attempts to gauge the impact of trade opening on employment and labor shares. Hasan et al. (2012) find urban unemployment to have declined after trade opening in states with more flexible labor markets and larger employment shares in net exporting industries. Workers in industries experiencing greater reductions in trade protection were less likely to become unemployed, especially in net export industries. Using aggregate industry level data, Hansan et al. (2012) evidence that trade liberalization had a positive impact on labor demand elasticity. They also show that trade reforms led to a reduction in labor share due to a decline in the bargaining power of workers. However, using micro-level data, Ahsan and Mitra (2014) uncover variation in terms of the impact of trade liberalization on labor shares. For small and labor-intensive firms, the trade reforms seemingly led to an increase in labor shares, while the impact was found to be the opposite for the larger and less labor-intensive firms. Mishra and Utsav (2005) use household survey data and find that, over time, a negative relationship forms between changes in trade policy and changes in industry wage premiums. Since tariff reductions were proportionately larger in sectors that employ a larger share of unskilled workers, their findings imply that unskilled workers experienced an increase in their relative incomes due to the trade reforms.

Traditional trade theory (the Heckscher-Ohlin model) predicts that gains from trade favor abundant factors. In the case of a developing country with abundant low-skilled labor, like India, this would imply that unskilled labor would benefit the most from globalization. However, new theories, such as Marjit, Beladi and Chakrabarti (2004) suggest that, even in a labor-abundant country, trade liberalization can reduce the wages of unskilled labor, thereby widening the gap between the rich and the poor. Moreover, such adjustments may be costly, with the burden falling disproportionately on the poor (Banerjee and Newman, 2004).

4. DATA AND VARIABLES

4.1 Plant Level Data

The data for this study come from the Indian Annual Survey of Industries (ASI). We use the plant level panel data of the ASI covering the period between 1998–99 to 2007–08. The ASI is the principal source of industrial statistics in India.[2] The ASI extends to the entire country, except the States of Arunachal Pradesh and Mizoram and the Union territory of Lakshadweep. It covers all factories that are registered under the sections 2(m) (i) and 2(m) (ii) of the Factories Act of 1948. This implies that all factories employing 10 or more workers using power, and those employing 20 or more workers

[2] Many studies in the Indian context have earlier used industry level and plant-level cross sections from the ASI (Hasan et al. 2007; Hsieh and Klenow 2009; Sivadasan 2009; Harrison et al. 2012; Bollard et al. 2013), however, the earlier data of the ASI did not disclose plant identifiers. This study uses the recently released data with plant identifiers launched by the ASI, which enables us to create a panel of manufacturing plants in India.

without using power are surveyed under the ASI. The primary unit of enumeration is a plant/factory in the case of the manufacturing industry.

The ASI data is collected annually by the Field Operations Division of the National Sample Survey Organization (NSSO) in consultation with the Chief Inspector of Factories in the States. Under the ASI framework, factories are classified into two sectors, namely the ‘Census’ sector and the ‘Sample’ sector. In the census sector, the data from all the factories employing 100 or more workers is collected on a complete enumeration basis. The remaining factories fall under the sample sector, for which data is collected by drawing a representative sample using sampling techniques. since continuous data is only available for this set, this study covers only those plants that fall under the census sector of ASI and can be successfully analyzed in a panel form. The data is an unbalanced panel and contains detailed information on production related factors like output, fixed assets, inventories, working capital, inputs, employment, labor costs, raw materials, electricity, power and fuel consumption, location, ownership, year of incorporation, etc.

As per the National Industrial Classification (NIC), factories are classified into industry categories up to the 4-digit level of disaggregation in ASI.[3] In this study, we only focus on those plants which operate in the manufacturing sector; that is, which belong to the NIC15 to NIC36 two-digit industry groups. Labor share in this study is defined as the share of total wages in the net total sales revenue of a plant (See Tables 1 and 2 for summary statistics).

Table 1: Average Labor Share of Income for the Period 1999–2008

	Mean	Standard Deviation
1999	0.126	0.130
2000	0.132	0.135
2001	0.124	0.131
2002	0.124	0.130
2003	0.124	0.129
2004	0.119	0.123
2005	0.108	0.113
2006	0.106	0.111
2007	0.100	0.106
2008	0.100	0.104

Source: Authors’ estimates.

Table 2: Summary Statistics

	Mean	Standard Deviation
Age (years)	22.02	22.06
No of Workers	313.93	851.17
Capital stock (In Rs million)	544.14	4,172.80
Output (In Rs million)	1,146.53	9,619.45

Source: Authors’ estimates.

[3] NIC classification of Indian industries closely corresponds to the ISIC classification

4.2 Tariff Data

Output tariffs: To measure the trade openness of a given industry, we use the most disaggregate level of output tariff data possible. In our study, this corresponds to the four-digit level data as per ISIC Rev 3. Since the ASI categorizes factories in this panel data per the NIC 1998 classification, we construct a concordance table between four-digit ISIC rev 3 and 4 digit NIC 1998 in order to match the tariff data with the ASI panel. The primary data series of tariffs was obtained from the TRAINS database of UNCTAD. However, tariff data was not available in TRAIN for some of the years, for which instances we used data obtained from the IDB database of the WTO.

Input tariffs: In addition to output tariffs, which measure competition faced by domestic producers from the import of final goods, trade liberalization also facilitates access to cheaper and advanced intermediate inputs. To capture the impact of improved access to advanced intermediate input, we construct a measure of input tariffs following Topalova and Khandelwal (2011). It is defined as follows:

$$In\_tariff_{it} = \Sigma_j \alpha_{ij}\ Out\_tariff_{jt} \qquad (1)$$

For example, if we assume that the shoe manufacturing industry (*i*) uses two intermediates (*j*) (namely, leather and rubber with tariffs of 10 and 20 percent, respectively) and value shares of 0.8 and 0.2, respectively, then, using the above formula, the input tariff faced by the shoe industry stands at 12%. The input shares, αij's is the share of input *j* in the total input cost of industry *i*. We estimate the input-shares in this study by using the Input-Output Table (2003–04) for India obtained from the Central Statistical Office (CSO).

Effective rate of protection: We use an alternate variable to measure protection, namely, the Effective Rate of Protection (ERP). Instead of using input and output tariffs separately, we construct a single variable to measure overall protection faced by the industry; since nominal tariff rates on final goods or output tariffs do not take into account the fact that the degree of protection conferred on an industry also depends on the tariff rates levied on intermediate inputs used in production, in addition to those levied on final goods. The use of ERP addresses this issue as it measures the percentage excess of domestic value added that is made possible by the tariff structure, as relative to the situation in the absence of tariffs on final and intermediate goods. Following Cordon (1966) we define ERP_{it} as follows:

$$ERP_{it} = (Out\_tariff_{it} - In\_tariff_{it}) \,/\, (1 - \Sigma\alpha_{ijj}) \qquad (2)$$

Here *i* is the industry and *t* is the time and αij is the input share. Table 3 displays the average output tariffs, input tariffs and ERP for the manufacturing sector in India during the period 1997 to 2008.

Table 3: Average Tariff for Manufacturing Industry Groups Analyzed in the Study (1997–2008)

Year	Average Output Tariff	Average Input Tariff	Average ERP
1997	32.58	14.97	35.55
1998	33.86	15.83	36.10
1999	35.02	16.47	36.62
2000	34.90	16.60	36.27
2001	33.84	16.14	34.98
2002	30.94	14.81	31.49
2003	30.76	14.71	31.39
2004	30.87	14.73	31.61
2005	20.50	8.83	22.90
2006	17.96	16.51	20.38
2007	18.52	7.75	21.15
2008	14.90	5.78	18.62

Source: Authors' estimates using TRAINS and IDB databases accessed through the WITS software of the World Bank.

4.3 Controls

Mandays lost: We suspect that the conditions of labor market regulations may affect labor share adjustment due to trade liberalization. Different states in India have different levels of labor market flexibility due to the fact that industrial relations fall under the concurrent subject in the Indian constitution. This allows State governments to make their own amendments to the Industrial Disputes Act (IDA), which is the key regulation that governs industrial relations in India. As a result, labor markets have evolved differently across the various states in India (Besley and Burgess, 2004). To measure state level labor market frictions (condition), we estimate an index named mandays lost in strikes and lockouts per industrial worker, which is the ratio of the total number of mandays lost in strikes and lockouts to the total number of industrial workers in the state. Data on mandays lost has been obtained from the Labour Bureau, Government of India, while data on the state-wise number of industrial workers employed has been obtained from the aggregate ASI data.

Factor intensity dummies: Labor share adjustment may vary across industries depending on the factor-intensity of their production. To analyze this, we use the Hinloopen and Marrewijk (2008) classification to group industries on the basis of their factor intensities. Hinloopen and Marrewijk's (2008) classification corresponds to 3-digit SITC level, with 240 items classified into five categories, namely (number of items in each category in parentheses): primary (83), natural-resource intensive (21), unskilled-labor intensive (26), human capital-intensive (43), technology-intensive (62), and unclassified (5). To match this classification with our panel data, we construct a concordance table between SITC 3 digit and NIC 3 digit to segregate plants based on the factor intensities of their production.

Technology intensity dummies: In addition to factor intensity-based classification, we also use the OECD's ISIC REV. 3 based technology intensity classification of industries. This classification primarily corresponds to 2-digit level and classifies manufacturing industries into four sub-groups: high-technology, medium-high-technology, medium-low-technology and low-technology groups.[4]

5. ESTIMATION STRATEGY

We start with a CES production function of the following form:

$$Y_i = [\alpha(A_i K_i)^\theta + (1-\alpha)(B_i L_i)^\theta]^{1/\theta} \quad (3)$$

Assuming that labor is paid its marginal product, and following Bentotial and Saint-Paul (2003), we get that:

$$LS_i = 1 - \alpha(A_i k_i)^\theta \quad (4)$$

By log-linearizing equation (4) and adding in additional variables that can drive the labor share of income, we derive the following empirical estimation model:

$$lnLS_{ijt} = \beta_0 + \beta_1 lnA_{ijt} + \beta_2 lnk_{ijt} + \beta_3 X_{ijt} + \beta_4 T_{jt} + P_i + Y_t + \epsilon_{ijt} \quad (5)$$

Where LS_{ijt} is the labor share of plant *i* in industry *j* at time *t*. A_{ijt} is the plant productivity, k_{ijt} is the plant capital output ratio, and X_{ijt} are other plant specific controls, such as age, mandays lost in strikes and locks ins, state where the plant is located, etc. T_{jt} are industry level trade openness related variables, P_i and Y_t are plant and year dummies. Labor share (*LS*) in this study is defined as the share of wages in the net sales revenue of the plant. Plant age has been calculated based on the year of establishment of the plant as reported by the plant managers. Plant capital has been estimated using the perpetual inventory method following Balakrishnan et al. (2000). Plant productivity has been estimated following Levinshon and Petrin's (2004) technique.

6. RESULTS

The regression results of estimating equation (5) are displayed in Tables 4–9. We begin with reporting the baseline results in Table 4. Columns (1)–(3) are plant fixed effects models. We find a differential impact of input and output tariffs on labor's share of income. The coefficient of *out_tariff* is found to be negative and highly significant across all specifications, indicating that a decline in output tariffs led to a rise in the labor's share of the total revenue income. This result suggests that increased foreign competition triggered firms to hire additional workers. This result hints towards a HO finding in which India expands the use of its relatively abundant endowment, namely labor.

4 Since Manufacturing n.e.c industry at 2-digit level has been allocated to more than one category we leave it as 'unclassified' for our analysis.

Table 4: Trade Liberalization and Labor Share

Variables	(1) ln_LS	(2) ln_LS	(3) ln_LS	(4) ln_LS
out_tariff	–0.0179**	–0.0208**		–0.0193**
	(0.00815)	(0.00808)		(0.00869)
in_tariff	0.0261***	0.0144**		0.0128
	(0.00672)	(0.00675)		(0.00879)
lnk_int		–0.0250***	–0.0274***	–0.0593***
		(0.00705)	(0.00716)	(0.00613)
lnp		–0.131***	–0.130***	–0.136***
		(0.00740)	(0.00747)	(0.00620)
lnage		0.0825***	0.0792***	0.144***
		(0.0134)	(0.0141)	(0.0184)
lnmlpw		0.0142***	0.0180***	0.00417
		(0.00498)	(0.00517)	(0.00558)
lnerp			–0.0151***	
			(0.00559)	
L..ln_LS				0.424***
				(0.0156)
Year FE	Yes	Yes	Yes	Yes
Observations	67,275	67,275	67,275	33,806
R-squared	0.007	0.068	0.066	
Number of fac_no	13,353	13,353	13,353	8,482

Note: Dependent variable is plant's labor share. out_tariff – one year lagged output tariff, in_tariff – one year lagged input tariff, lnk_int – plant's capital intensity, lnp – plant productivity, lnage – plant age, lnmlpw – mandays lost in strikes and lockouts, lnerp – effective rate of protection. All values are in natural log. Clustered standard errors in parenthesis. All regressions include firm and year fixed effects and constant. *** p<0.01, ** p<0.05, * p<0.1.

The coefficient of *in_tariff*, on the other, hand is positive and highly significant, which implies that a fall in input tariffs led to a decline in the labor's share. One explanation could be that, now, firms have better access to inputs, including machinery, and hence use those more intensively at the expense of labor.

The coefficients of *lnk*_int and *lnp* are both negative, as expected, and highly significant, at 1% level. This result indicates that a rise in capital input and a rise in productivity both lead to a decline in the labor's share of income. The coefficient of *lnage* is positive and highly significant, suggesting that the labor's share of the income is larger for older firms. This might be explained by the fact that older firms started their operations with relatively larger labor shares.

The coefficient of *lnmlpw* is positive and highly significant. In the case of India, this variable is closely associated with union strength; hence, a positive coefficient *lnmlpw* is indicative of a positive impact of union strength and, hence, a higher labor share of income. From the estimation results of column (2), we can say that a 10% decline in output tariffs led to a 0.21% rise in labor's share of income. On the other hand, a 10% decline in input tariffs led to a 0.14% decline in the labor's share of income for large manufacturing plants in India.

In column (3), instead of two tariff variables, we use a composite index of the two (i.e. the effective rate of protection) to measure the impact of overall protection on labor share. The sign of *lnerp* is negative and significant indicating that overall, in the case of the Indian manufacturing industry, a decline in trade protection (measured by reduced tariff rates) led to a rise in the labor share of income. In columns (4) and (5) we estimate the same model using alternative estimation methods. Columns (4) corresponds to dynamic panel which has been estimated using system GMM, following the Arellano Bond technique. The signs of all the coefficients remain the same as those in the fixed effects model. The coefficient of the lagged labor share is positive, as expected, and highly significant, at 1% level.

In Table 5, we analyze the differential impact of tariff reduction based on the factor intensity of production. The factor intensity of production based classification segregates industries at the 3-digit level into 5 sub-groups; however, in our regression model, we use four dummies: natural resource intensive (*FI_nat*), labor intensive (*FI_lab*), technology intensive (*FI_tech*), and human capital resource intensive (*FI_hri*). Using the four dummies and interactions with tariff rates, we find that the different sub-groups adjust the labor share of income in very different ways. Across all specifications, the coefficient of *FI_lab* dummy has a positive and significant sign, as expected. While, although positive in most cases, the coefficient of *FI_tech* and *FI_hri* dummies are insignificant. It is interesting to note that in column (2) of Table 5, as we interact *out_tariff* and *in_tariff* with the *FI_lab* dummy, the coefficients of both the interaction terms are negative and significant. This indicates that a decline in both kinds of tariffs led to an increase in the labor share of income in the labor intensive sector. Columns (3) and (4) of Table 2 display the interaction of *out_tariff* and *in_tariff* with the *FI_tech* and *FI_hri* dummies, respectively. Unlike the labor-intensive sector, the interactions are positive and significant, indicating that a decline in both input and output tariff rates led to a decline in the labor share in the technology intensive and human capital resource intensive sectors.

In Table 6, we use another classification of industries to separate the plants based on their technology intensity. This corresponds to the OCED 2-digit technology intensity classification, which is comprised of the subgroups: low technology industries, medium-low technology industries, medium-high technology industries, high technology industries and un-classified. The literature suggests that the labor share should be affected negatively in the medium technology intensive industries, where labor has an easy and high substitutability with capital. In column (1) we interact the *tech_low* dummy with the corresponding output and input tariffs. The interaction term with the output tariff is negative and significant, suggesting that, as output tariffs fall, the labor share rises in low tech industries. The interaction term with the input tariffs is positive but insignificant. In column (2) we interact the *tech_midlow* dummy with output and input tariffs. Similar to low-tech industry, the interaction term with output tariffs is negative and significant. Also, the interaction with input tariffs is negative and significant, indicating that a decline in input tariffs leads to a rise in the labor share in mid-low tech industries. In column (3) we interact the *tech_midhigh* dummy with output and input tariffs. It is interesting to note that both coefficients are positive and significant, indicating that the labor share falls as technology intensity rises. As we move to column (4) which corresponds to the most advanced technology industries, both the interactions remain positive with higher levels of significance. Overall, these results suggest that as industries become more technology intensive, tariff liberalization leads to a decline in the labor share of income.

Table 5: Trade Liberalization, Labor Share and Factor Intensity of Production (Plant Fixed Effects Model)

Variables	(1) ln_LS	(2) ln_LS	(3) ln_LS	(4) ln_LS
out_tariff	–0.0318***	–0.0123	–0.0279***	–0.0350***
	(0.00832)	(0.00859)	(0.00841)	(0.00882)
in_tariff	0.0143**	0.0284***	0.0136**	0.0162**
	(0.00674)	(0.00692)	(0.00681)	(0.00675)
lnp	–0.109***	–0.109***	–0.109***	–0.110***
	(0.00307)	(0.00308)	(0.00308)	(0.00308)
lnage	0.0900***	0.0830***	0.0850***	0.0846***
	(0.0134)	(0.0134)	(0.0134)	(0.0134)
lnmlpw	0.0141***	0.0116**	0.0139***	0.0137***
	(0.00496)	(0.00496)	(0.00497)	(0.00498)
FI_nat	–0.317***	0.147	0.155	0.135
	(0.110)	(0.0977)	(0.0967)	(0.0962)
FI_lab	0.0382	0.649***	0.0607	0.0363
	(0.0971)	(0.112)	(0.0978)	(0.0973)
FI_tech	0.0182	0.0251	–0.0712	0.0148
	(0.0912)	(0.0930)	(0.0982)	(0.0915)
FI_hri	0.0708	0.0701	0.0838	–0.0714
	(0.0932)	(0.0950)	(0.0940)	(0.103)
out_tariff * FI_nat	0.0967***			
	(0.0166)			
in_tariff * FI_nat	0.0773***			
	(0.0123)			
out_tariff * FI_lab		–0.136***		
		(0.0154)		
in_tariff * FI_lab		–0.0772***		
		(0.00877)		
out_tariff * FI_tech			0.0173	
			(0.0131)	
in_tariff * FI_tech			0.0210**	
			(0.00824)	
out_tariff * FI_hci				0.0265**
				(0.0129)
in_tariff * FI_hci				0.0209**
				(0.00925)
Year FE	Yes	Yes	Yes	Yes
Observations	67,275	67,275	67,275	67,275
R-squared	0.070	0.074	0.068	0.068
Number of fac_no	13,353	13,353	13,353	13,353

Dependent variable is plant's labor share in all regressions. out_tariff – one year lagged output tariff, in_tariff – one year lagged input tariff, lnp – plant productivity, lnage – plant age, lnmlpw – mandays lost in strikes and lockouts, FI_nat – natural resource intensive industry dummy, FI_lab – labor intensive industry dummy, FI_tech – technology intensive industry dummy, FI_hci – human capital intensive dummy. All values are in natural log. Clustered standard errors in parenthesis. All regressions include firm and year fixed effects and constant *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Trade Liberalization, Labor Share and Technology Intensity of Production (Plant Fixed Effects Model)

Variables	(1) ln_LS	(2) ln_LS	(3) ln_LS	(4) ln_LS
out_tariff	–0.0193**	0.0157	–0.0433***	–0.0373***
	(0.00802)	(0.0106)	(0.00885)	(0.00819)
in_tariff	0.0192***	0.0585***	0.0203***	0.00615
	(0.00672)	(0.00854)	(0.00681)	(0.00675)
lnp	–0.117***	–0.116***	–0.117***	–0.117***
	(0.00320)	(0.00319)	(0.00320)	(0.00319)
lnage	0.0863***	0.0882***	0.0888***	0.0811***
	(0.0134)	(0.0133)	(0.0134)	(0.0134)
lnmlpw	0.0140***	0.0124**	0.0137***	0.0135***
	(0.00497)	(0.00495)	(0.00497)	(0.00495)
tech_ low	0.112	–0.137**	–0.0891	–0.0943
	(0.159)	(0.0660)	(0.0657)	(0.0659)
tech_ midlow	0.0298	0.510***	0.0462	0.0304
	(0.0769)	(0.0872)	(0.0761)	(0.0767)
tech_ midhigh	0.108*	0.0796	–0.147**	0.111*
	(0.0582)	(0.0580)	(0.0680)	(0.0581)
tech_high	–0.261***	–0.291***	–0.251***	–0.766***
	(0.0555)	(0.0557)	(0.0551)	(0.0724)
out_tariff * tech_low	–0.0793*			
	(0.0444)			
in_tariff * tech_low	0.0173			
	(0.0249)			
out_tariff * tech_midlow		–0.110***		
		(0.0129)		
in_tariff * tech_midlow		–0.0615***		
		(0.00790)		
out_tariff * tech_ midhigh			0.0742***	
			(0.0119)	
in_tariff * tech_midhigh			0.0138*	
			(0.00805)	
out_tariff * tech_high				0.121***
				(0.0152)
in_tariff * tech_high				0.0538***
				(0.00922)
Year FE	Yes	Yes	Yes	Yes
Observations	67,275	67,275	67,275	67,275
R-squared	0.072	0.078	0.074	0.077
Number of fac_no	13,353	13,353	13,353	13,353

In the case of India, labor laws fall under the concurrent list and are hence controlled both by the center and the state. As a result, Indian states vary significantly from each other in terms of the conditions of their labor laws, which makes some states more flexible (employer friendly) than others. To analyze whether state level differences in labor market flexibility affect the labor share of income, we ran separate regressions for plants located in states with flexible labor laws (Column 1, Table 7) and plants located in states with inflexible labor laws (Column 2, Table 7). In the case of states with flexible labor laws, the sign and significance of *out_tariff* remains similar to the baseline results; *in_tariff* is, however, insignificant. While in the case of states with inflexible labor laws, it is interesting to note that both the coefficients are positive and significant, indicating that a decline in both the tariff rates led to a decline in the labor share of income. This reflects plant-level decisions in favor of less labor-augmenting methods of production.

Table 7: Trade Liberalization, Labor Share and Labor Market Flexibility

Variables	Flexible States (1)	Inflexible States (2)
out_tariff	–0.0648***	0.0229**
	(0.0142)	(0.0108)
in_tariff	–0.0134	0.0395***
	(0.0106)	(0.00916)
lnk_int	–0.0191	–0.0312***
	(0.0127)	(0.00903)
lnp	–0.124***	–0.127***
	(0.0134)	(0.00932)
lnage	0.0707***	0.0586***
	(0.0241)	(0.0195)
lnmlpw	0.0206**	–0.000558
	(0.00933)	(0.00680)
Year FE	Yes	Yes
Observations	23,078	36,168
R-squared	0.065	0.069
Number of fac_no	4,570	7,143

Note: Dependent variable is plant's labor share in all regressions. out_tariff – one year lagged output tariff, in_tariff – one year lagged input tariff, lnk_int – plant's capital intensity, lnp – plant productivity, lnage – plant age, lnmlpw – mandays lost in strikes and lockouts. All values are in natural log. Clustered standard errors in parenthesis. All regressions include firm and year fixed effects and constant. *** p<0.01, ** p<0.05, * p<0.1.

To analyze whether industries with different factor intensities and technology intensities adjusted their labor share differently based on their location in flexible or inflexible states, we extend our sub-group analysis in Tables 8 and 9. In Table 8, we run separate regressions for flexible and inflexible states and analyze the interactive effect of tariffs with factor intensity dummies. Qualitatively, the coefficient of interaction terms remains the same. The labor share improved only for labor intensive industries. For the others, the interactions are positive and mostly significant, indicating that labor share declined. In Table 9 of our sub-group analysis, we analyze the interactive effect of tariffs with technology intensity industries. Similar to the previous case, we find that the results remain qualitatively similar. The labor share increased for low and mid-low technology industries, but declined for mid-high and high technology groups.

Table 8: Sub-group Analysis: Trade Liberalization, Labor Share and Factor Intensity of Production

Variables	Flexible States				Inflexible States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
out_tariff	–0.0728***	–0.0555***	–0.0730***	–0.0851***	0.0128	0.0326***	0.0121	0.0123
	(0.0144)	(0.0152)	(0.0146)	(0.0149)	(0.0113)	(0.0114)	(0.0115)	(0.0116)
in_tariff	–0.0165	–0.00229	–0.0189*	–0.0139	0.0414***	0.0545***	0.0447***	0.0410***
	(0.0106)	(0.0108)	(0.0106)	(0.0106)	(0.00917)	(0.00932)	(0.00924)	(0.00920)
lnp	–0.108***	–0.107***	–0.108***	–0.108***	–0.0995***	–0.0993***	–0.0996***	–0.0996***
	(0.00536)	(0.00539)	(0.00539)	(0.00540)	(0.00390)	(0.00390)	(0.00392)	(0.00391)
lnage	0.0752***	0.0699***	0.0726***	0.0722***	0.0697***	0.0582***	0.0610***	0.0627***
	(0.0241)	(0.0240)	(0.0241)	(0.0240)	(0.0197)	(0.0194)	(0.0195)	(0.0195)
lnmlpw	0.0194**	0.0132	0.0202**	0.0213**	–0.000576	–0.00264	–0.00155	–0.00171
	(0.00926)	(0.00936)	(0.00933)	(0.00931)	(0.00680)	(0.00676)	(0.00679)	(0.00680)
out_tariff * FI_nat	0.108***				0.0720***			
	(0.0349)				(0.0209)			
in_tariff * FI_nat	0.0944***				0.0643***			
	(0.0291)				(0.0143)			
out_tariff * FI_lab		–0.124***				–0.155***		
		(0.0245)				(0.0217)		
in_tariff * FI_lab		–0.0883***				–0.0735***		
		(0.0134)				(0.0131)		
out_tariff * FI_tech			0.0240				0.0383**	
			(0.0223)				(0.0172)	
in_tariff * FI_tech			0.0321**				0.00402	
			(0.0147)				(0.0111)	
out_tariff * FI_hri				0.0486**				0.0152
				(0.0223)				(0.0179)
in_tariff * FI_hri				0.0188				0.0302**
				(0.0158)				(0.0121)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,078	23,078	23,078	23,078	36,168	36,168	36,168	36,168
R-squared	0.068	0.073	0.066	0.066	0.070	0.075	0.069	0.069
Number of fac_no	4,570	4,570	4,570	4,570	7,143	7,143	7,143	7,143

Note: Dependent variable is plant's labor share in all regressions. out_tariff – one year lagged output tariff, in_tariff – one year lagged input tariff, lnp – plant productivity, lnage – plant age, lnmlpw – mandays lost in strikes and lockouts, FI_nat – natural resource intensive industry dummy, FI_lab – labor intensive industry dummy, FI_tech – technology intensive industry dummy, FI_hri – human capital intensive dummy. All values are in natural log. Clustered standard errors in parenthesis. All regressions include firm and year fixed effects and constant. Factor intensity dummies included but not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Sub-group Analysis – Trade Liberalization, Labor Share and Technology Intensity

	Flexible States				Inflexible States			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
out_tariff	–0.0603***	–0.0257	–0.0852***	–0.0776***	0.0235**	0.0665***	–0.00259	0.00507
	(0.0139)	(0.0196)	(0.0150)	(0.0143)	(0.0108)	(0.0132)	(0.0123)	(0.0111)
in_tariff	–0.0102	0.0407***	–0.00770	–0.0181*	0.0453***	0.0704***	0.0480***	0.0297***
	(0.0105)	(0.0152)	(0.0106)	(0.0106)	(0.00910)	(0.0109)	(0.00933)	(0.00923)
lnp	–0.118***	–0.116***	–0.118***	–0.117***	–0.106***	–0.106***	–0.107***	–0.106***
	(0.00557)	(0.00556)	(0.00556)	(0.00555)	(0.00410)	(0.00410)	(0.00411)	(0.00409)
lnage	0.0742***	0.0739***	0.0756***	0.0695***	0.0620***	0.0645***	0.0666***	0.0587***
	(0.0241)	(0.0240)	(0.0241)	(0.0241)	(0.0194)	(0.0193)	(0.0194)	(0.0194)
lnmlpw	0.0211**	0.0178*	0.0197**	0.0205**	–0.000721	–0.00269	–0.00101	–0.00128
	(0.00930)	(0.00931)	(0.00932)	(0.00930)	(0.00679)	(0.00675)	(0.00679)	(0.00676)
out_tariff * tech_low	–0.0722				–0.115*			
	(0.0730)				(0.0662)			
in_tariff * tech_low	0.00735				–0.00690			
	(0.0448)				(0.0291)			
out_tariff * tech_midlow		–0.0991***				–0.133***		
		(0.0221)				(0.0176)		
in_tariff * tech_midlow		–0.0616***				–0.0482***		
		(0.0131)				(0.0110)		
out_tariff * tech_ midhigh			0.0919***				0.0708***	
			(0.0205)				(0.0157)	
in_tariff * tech_midhigh			0.0192				0.00261	
			(0.0145)				(0.0106)	
out_tariff * tech_high				0.128***				0.0968***
				(0.0257)				(0.0198)
in_tariff * tech_high				0.0479***				0.0555***
				(0.0161)				(0.0120)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,078	23,078	23,078	23,078	36,168	36,168	36,168	36,168
R-squared	0.070	0.076	0.072	0.074	0.073	0.079	0.074	0.077
Number of fac_no	4,570	4,570	4,570	4,570	7,143	7,143	7,143	7,143

Note: Dependent variable is plant's labor share. out_tariff – one year lagged output tariff, in_tariff – one year lagged input tariff, lnp – plant productivity, lnage – plant age, lnmlpw – mandays lost in strikes and lockouts. All values are in natural log. Clustered standard errors in parenthesis. All regressions include firm and year fixed effects and constant. Technology intensity dummies included but not reported. *** p<0.01, ** p<0.05, * p<0.

7. CONCLUSION

This paper analyzes the impact of trade liberalization, which has been measured in the form of tariff reductions on the labor share in the Indian manufacturing sector. Using plant-level panel data for the period 1998–99 to 2007–08, overall, we find that a fall in output tariffs led to a rise in the labor share, while a fall in input tariffs led to a decline in the labor share. However, segregating industries based on factor intensity and technology intensity classifications yields a different picture. We find that the overall decline in both input and output tariffs led to a decline in the labor share in technology intensive and human capital resource intensive sectors. On the other hand, a fall in input and output tariffs led to a rise in the labor share for labor intensive and low-technology plants.

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