Openness and Factor Shares: Is Globalization Always Bad for Labor?*

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Abstract

The secular decline in the labor share since the 1980's is a global phenomenon, and a trend that is concurrent with large liberalization episodes worldwide. In this paper we investigate the liberalization episode in India during the 1990's, which has been characterized by large and unexpected changes in trade and foreign investment policies. Contrary to what might be expected given the reduction in the aggregate data, we uncover a trade channel that *raises* the labor-to-capital relative factor shares in India. Our results reveal access to foreign capital as a new mechanism through which openness affects factor shares. An increase in the variety and share of foreign capital in the capital stock enhances capital-augmenting technology, which in turn raises real wages and the relative labor share. We find capital and R&D intensities, importing status, and the borrowing capacity of the firm to be important determinants of the factor share response to openness. Finally, we identify domestic deregulation policies and credit expansion as potential determinants of the observed decline in the labor share.

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1 Introduction

The secular decline in the labor share since the 1980's is a global phenomenon (Karabarbounis and Neiman (2014)), and a trend that is concurrent with large liberalization episodes worldwide. It is therefore imperative to study how liberalization reforms – either through lower barriers of trade or more open financial markets – might play a role in the determination of factor shares. Globalization – outsourcing in particular – has been brought forth as a primary suspect for the decline in the labor share in developed countries (Elsby et al., 2013). For developing countries it's been argued that globalization can lower or raise the labor share depending on the bargaining power of labor and price-to-cost margins (Ahsan and Mitra, 2014; Kamal et al., 2015). However, openness can have very different implications for factor shares in developing countries also due to under-developed financial markets and the gap from the technological frontier. In this paper we uncover a new mechanism – access to foreign capital – through which openness can have important distributional implications for factor income. We show that trade openness and FDI liberalization can in fact have positive implications for labor in a way that contrasts with the common perception in developed countries.

To analyze the impact of openness on factor shares, we investigate an important liberalization episode of a developing country, that of India in the 1990's, which has received attention in the trade literature due to the size and unexpected nature of the reforms. In 1991 India passed several major regulatory reforms in response to a balance of payments crisis that led to a severe recession, and a need to borrow from agencies such as the World Bank and the IMF. The structural reforms included large reductions in import barriers, a liberalization of foreign direct investment (FDI) policies, and industrial policy reforms such as a reduction in the licensing requirements for capacity enhancements. A vast literature has documented numerous outcomes that can be attributed to these reforms, which we summarize below. We follow this literature in the construction of plausibly exogenous policy shocks, which can be split into variations in output, input, and capital tariffs, in addition to changes to the restrictiveness of FDI and licensing. We leverage these reforms, through differential exposure across industries, to study the response of firm-level factor shares. Our contribution is to apply a setting that allows us to identify a causal relationship to show how improving firms' access to foreign capital impacts relative factor shares.

In addition to providing robust evidence on the firm-level responses to openness reforms, we present strong evidence for the mechanisms underlying our findings. Before describing the regression specification and discussing the results, we clarify how reforms to reduce the barriers to foreign capital can affect factor shares using a standard general equilibrium model.

The model features a production function that exhibits a constant elasticity of substitution between labor and capital that comprises domestic and imported equipment. We follow the framework of Raval (2018), which provides an intuitive expression to separate changes in non-neutral factor productivity from changes in factor prices, and allows us to abstract from changes in markups. To assess the impact of openness, we consider two changes through which liberalization affects firm's optimal decisions: a reduction in the tariffs on imported capital goods, and an increase in the variety of foreign equipment available for use.[1] The former operates through a *price channel* by lowering the price of imported capital and its rental rate. The latter, an increase in variety, raises the productivity of the capital stock, and is propagated through a *composition channel* that triggers changes in the overall rental rate of capital and the capital-to-labor factor productivity. These changes through the composition channel do not necessarily move the labor share in the same direction. On the one hand, the increase in the availability of different foreign capital types promotes capital-augmenting technology as firms start using more sophisticated machinery. In the case where capital and skill are complements – which we find to be the case for the firms in our sample – an increase in the capital-augmenting technology raises the wage rate and the share of labor in total income. On the other hand, the shift in the composition of capital towards more sophisticated equipment can raise the rental rate of the total capital stock since the more advanced capital goods are more expensive.[2] We turn to the data to answer which channel is more dominant.

To conduct the main empirical analysis, we use a panel data-set on Indian manufacturing firms obtained from the Center for Monitoring Indian Economy (CMIE) Prowess database for the period from 1989 to 1997.[3] We combine the firm level data with policy measures of tariffs and industry regulations at the 3-digit national industry classification (NIC) level, in addition to the industry-state measures of wages and other economic measures provided by the Indian statistics agency (ASI). The firm data include total labor compensation, the capital stock, and firm's imports of capital. We construct rental rates at the industry level using the input-output table, which allows us to construct payments to capital along with payments to labor. As in Raval (2018), we consider the share of income paid to labor relative

[1] We focus on the reduction of capital tariffs in terms of openness reforms for illustration purposes and to keep the model simple and tractable. One could extend the model to include a reduction in the barriers to foreign multinationals that bring in their technology capital and influence the factor payments.

[2] As a way to support the potential channels highlighted in the theory, we provide a descriptive analysis of capital imports to India during the liberalization period in Section 3.4. There is strong evidence of not only a surge in the value of capital imports, but in the variety of high-technology products sourced from the top technology-producing countries.

[3] This is the period when policy changes are most likely to be exogenous given the impetus for the reform after the 1991 crisis.

to the share paid to capital as our main measure of factor shares, although we show that similar patterns hold also for the labor share of income. The identification of the policy reforms' effects on factor shares is possible due to the firms' differential exposure to the changes depending on the industry they operate in.

We investigate a broad set of policy reforms that were part of India's early 1990s reforms and that might influence factor shares. Contrary to what might be expected given the reduction in the aggregate data, we find that trade reforms mostly *raise* the labor share in India. When we examine the changes in tariffs by splitting up output, input, and capital tariffs, we find that only a reduction in the capital tariff has a significant positive effect on the share of labor in value added relative to the share of capital. The observed industry-average reduction in effective capital tariffs raised the wage-to-capital expenditure ratio by 8.5 percentage points. There is also a significant impact from relaxing constraints on foreign ownership, which can also be interpreted as an improvement in the access to foreign capital. Similar to the results on the changes in capital tariffs, we find a statistically significant increase in the wage-to-capital-expenditure ratio in response to FDI liberalization: a fully liberalized industry has an average increase in the wage-to-capital expenditure ratio equal to 11 percent. These results overturn the narrative that trade liberalization is a definite mechanism through which labor loses its share of total income. We provide an intuitive explanation for our finding: the reduction in trade barriers propels firms to shift towards high-technology capital, which represents a labor-biased technical change that raises wages.

To make sense of the secular decline in the labor share, we point to some domestic policy reforms that have had the opposite effect on factor shares. Measures that are not necessarily related to openness, such as de-licensing and credit expansions, have negative effects on the labor share. These results are consistent with the findings in the previous literature, in particular with Aghion et al. (2008), who find that relaxing license requirements for entry and capacity enhancements had a very large positive impact on economic growth in India, and that this effect was especially significant in states that were "less pro-worker." Additionally, the adverse impact of credit expansion on the labor share is similar to the result in Leblebicioglu and Weinberger (2017), who use a credit expansion episode in the United States that provides causal evidence that labor share declined following state-by-state credit banking deregulation. Taken all together, our findings show that the aggregate trends could have been worse for labor if the deregulatory reforms in India had not included trade and FDI liberalization.

As a way to test our proposed mechanism, we check whether the factor share responses to changes in policy measures differ across types of firms. Most resoundingly, we find that the rise of labor payments relative to capital payments is observed predominantly for importers.

We also find the capital intensity, and the borrowing capacity of the firm (measured by the debt-to-equity ratio) to be important determinants of the increase in the relative labor share. Lastly, we show that the factor share response is larger among small/medium sized firms, consistent with the reduction in barriers acting through the extensive margin of potential capital importers. Using the intuition provided by our theoretical framework, we argue that these characteristics point to the technology advantage of foreign capital in driving the changes in the factor shares. The theoretical model suggests that firms employing imported capital goods benefit from trade reform not only through a reduction in the price of goods they are using but also through an improved access to a larger set of foreign equipment. The increase in variety elevates the capital augmenting technology, which in turn leads to higher wages. This is what we find when we examine the industry-level data: lower capital tariffs raised the average wage rate and resulted in an increase in the payments to labor relative to capital.[4] Moreover, we find that the average rental rate of capital faced by industries also increased, which shows that the change in the composition of capital towards more sophisticated equipment boosted the payments to capital and negated the effects of price reductions.

The estimates on the effects of FDI liberalization also support the capital-productivity mechanism in influencing the factor shares. Once again we find that capital intensive firms and those with higher debt-to-equity ratios raise payments to labor more relative to capital. The results conform with the idea that the potential spillovers of FDI can be exploited only by more technologically advanced firms, and that the lower tariffs are taken advantage of relatively more by capital intensive firms. Finally, the loss to labor after de-licensing reforms are concentrated among medium to large firms, which are the ones that can expand to a more efficient size. They appear to do so through a larger demand for capital. Overall, our results indicate that domestic policies to promote expansion of productive medium/large sized firms play a role in the aggregate reduction of the share of payments to labor relative to capital. *However, the policies to promote foreign capital work to mitigate some of that effect.*

Related Literature This study fits within the strand of literature that explores the different mechanisms for the observed non-stability of factor shares, especially those that focus on the trade angle. Elsby et al. (2013) conclude that globalization – more specifically offshoring – deserves most of the blame in the United States. Also focusing on the United States, Oberfield and Raval (2014) find that the decline in the labor share originates from

[4]We only observe total labor payments in the firm-level data. Because we do not have information on the number of workers, we cannot analyze the impact of reforms on the average wage rate at the firm-level.

factors that affect technology, including automation and offshoring. For the case of developing countries, Ahsan and Mitra (2014) find that import competition – through its impact on worker bargaining power – has a negative effect on the labor share for large firms. Kamal et al. (2015) find that liberalization raises the labor share in China. The mechanisms in either of these papers are very different than ours as they argue that workers receive a part of the increasing rents. A recent study by Gupta and Helble (2018) also studies the labor share in India as a response to trade reforms, however they study the period *after* liberalization (1998 to 2007). Our paper explores a different channel since we concentrate on reforms that reduce the barriers to foreign capital.[5] Furceri and Loungani (2017) and Harrison (2005) document a negative impact of capital account liberalization and trade on the labor share for panels of developed and developing countries. A separate mechanism that focuses on the growing role of capital in production is explored in Karabarbounis and Neiman (2014). In that case the cost of capital decreases due to the lower price of investment goods. We focus on foreign capital, obtained through imports or FDI, and allow for both non-neutral factor productivity changes and changes in the rental rate of capital.

Our paper is also related to the literature on trade liberalization and inequality – see Goldberg and Pavcnik (2007) for an early summary. In a study of regional inequality in India, Topaloval (2010) tracks how inequality between rural and urban areas responds to liberalization. She finds that localities with a higher exposure to import competition experience relatively lower reductions in the poverty rate.[6] Our analysis differs in that we compare across factors instead of across workers in different regions. A separate literature on inequality tracks the growing gap between types of workers, or the skill premium (Attanasio et al., 2004; Burstein et al., 2013). The closest to this study is Raveh and Reshef (2016), which finds that the composition of capital imports is important for explaining the skill premium across workers. The type of inequality we study is across broader factors – labor and capital – which has different implications for inequality. In fact, with a rise in capital productivity wages rise unambiguously so all labor is better off, although our data does not allow us to explore the composition within worker skill.

There is also an extensive literature on India's trade liberalization. It is well established that the trade liberalization increased productivity of Indian firms. Krishna and Mitra (1998) and Topalova and Khandelwal (2011) link this to increased competition, although the latter also highlights the importance of cheaper imported inputs. Goldberg et al. (2009) were the

[5]Kamal et al. (2015) extends their analysis until 2004. We restrict our sample to 1988-1997 to assure the exogeneity of the reforms.

[6]This type of regional analysis has since been done in other developing *and* developed countries with similar a similar interpretation of the results (Autor et al., 2013; Pierce and Schott, 2016; Hummels et al., 2014; Dix-Carneiro and Kovak, 2017).

first to document the rise in imported inputs in India. Our findings on factor shares can be linked to productivity improvements because a rise in value added is not necessarily shared equally across factors, nor does it have to be paid out to factors – De Loecker et al. (2016) find that markups increased in response to trade reform in India. We find that the effect on factor shares acts through capital-specific tariffs and not output and input tariffs, which have been the focus of previous work on productivity improvements. However, capital tariffs are embedded into the input tariffs in previous work. Relatedly, Bas and Berthou (2017) and Kandilov et al. (2017) look at the decision to import capital goods and the investment in foreign capital goods in India, respectively. The latter finds that investments in foreign capital increase in response to a drop in capital tariffs, which is consistent with our findings that Indian importers are the ones that raise their labor income share the most.

The remainder of the paper is organized as follows. Section 2 presents a model that illustrates how an increase in openness is a channel for varying factor income shares. In section 3, we present the data that we use in our empirical analysis, describe the liberalization episode, and provide a descriptive analysis of factor shares and capital imports in India. The empirical specification, analysis, and results are discussed in Section 4. Section 5 concludes.

2 Openness and Factor Shares

In this section we consider a stylized model that motivates the relationship between factor shares, foreign capital, and openness. It shares many features with the seminal papers in the literature – e.g. Oberfield and Raval (2014) and Karabarbounis and Neiman (2014) – but is extended to differentiate between domestic and foreign capital used in production. The model contains a final good, produced with a continuum of intermediate inputs, which can be consumed or invested. We assume that the intermediate input firms combine labor with domestic and foreign capital in order to produce their product. For illustration purposes and to keep the model simple and tractable, we model foreign capital as imported goods. One can extend the model to include foreign multinational firms that use their own technology capital as in McGrattan and Prescott (2009). In what follows, we describe the problem of the intermediate input producers, final good producers, and the households. Then, we illustrate how the equilibrium factor shares depend on the price of the foreign capital goods, in addition to the productivity embodied in the domestic and foreign capital goods. Finally, we discuss how trade and FDI liberalization can affect the factor shares.

2.1 Final Good Producers

We assume that there are perfectly competitive firms that purchase intermediate inputs from a continuum of monopolistically competitive producers and combine the varieties $z \in [0,1]$ with the following CES technology to produce the final good:

$$Y_t = \left(\int_0^1 y_t(z)^{\frac{\epsilon-1}{\epsilon}} dz \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{1}$$

where $y_t(z)$ is the quantity of input z used in the production of the final good, and $\epsilon > 1$ denotes the elasticity of substitution between the inputs. The final good can be used as the consumption good or the domestic investment good. Normalizing the price of the final good to 1, and letting $p(z)$ denote the price of input variety z, the demand for z can be written as $y_t(z) = p_t(z)^{-\epsilon} Y_t$.

2.2 Intermediate Input Producers

The producer of the intermediate input variety z rents domestic ($k_t^d(z)$) and a set of foreign capital ($\{k_t^{fj}(z)\}_{j\in\Omega}$) from the households and combines them with labor $n_t(z)$ using a constant returns to scale technology to produce output, $y_t(z) = F\left(n_t(z), k_t^d(z), \{k_t^f(z)\}_{j\in\Omega}\right)$. The number of foreign capital varieties is determined by the size of the set Ω. Producer of input z chooses labor, each type of capital and the price of its product in order to maximize profits given by

$$\prod_t(z) = p_t(z)y_t(z) - R_t^d k_t^d(z) - \int_{j\in\Omega} R_t^{fj} k_t^{fj}(z)dj - W_t n_t(z) \tag{2}$$

subject to

$$y_t(z) = c_t(z) + x_t^d(z) = p_t(z)^{-\epsilon}\left(C_t + X_t^d\right), \tag{3}$$

where R_t^d and R_t^{fj} are the rental rates of domestic capital and foreign capital type j, and W_t is the wage rate. The first order conditions yield the following demand equations for capital and labor:

$$R_t^{fj} = \frac{1}{\mu_t} F_{fjk,t}(z)p_t(z), \forall j \in \Omega \tag{4}$$

$$R_t^d = \frac{1}{\mu_t} F_{dk,t}(z)p_t(z) \tag{5}$$

$$W_t = \frac{1}{\mu_t} F_{n,t}(z)p_t(z), \tag{6}$$

where F_{fjk}, F_{dk} and F_n denote the marginal product of foreign capital type j, domestic capital and labor, and $\mu = \frac{\epsilon}{\epsilon - 1}$ is the mark-up that the firm charges over the factor prices.

2.3 Household

The representative household consumes the final consumption good, provides labor to the intermediate good producers, and accumulates domestic and foreign capital through purchases of investment goods from domestic and foreign firms. The purchases of imported capital goods are subject to a tariff, τ.[7] The household receives dividends from the firms they own at the end of each period. Additionally, the household holds an international bond B_t that pays the world interest rate r_t. The household chooses $\{C_t, X_t^d, \{X_t^{fj}\}_{j\in\Omega}, K_{t+1}^d, \{K_{t+1}^{fj}\}_{j\in\Omega}, B_{t+1}, n_t(z)\}$ to maximize

$$\mathbf{U} = \sum_{t=0}^{\infty} \varphi^t U(C_t, N_t), \tag{7}$$

subject to the capital accumulation equations $K_{t+1}^{fj} = (1-\delta)K_t^{fj} + X_t^{fj}$ $(\forall j \in \Omega)$, $K_{t+1}^d = (1-\delta)K_t^d + X_t^d$, and the budget constraint

$$\begin{aligned} &C_t + X_t^d + \tau \int_{j\in\Omega} p^{fj} X^{fj} dj_t + B_{t+1} - (1+r_t)B_t = \\ &\int_0^1 \left(W_t n_t(z) + \int_{j\in\Omega} R_t^{fj} k_t^{fj}(z) dj + R_t^d k_t^d(z) + \prod_t(z) \right) dz + \Lambda_t, \end{aligned} \tag{8}$$

where φ denotes the discount factor; X_t^{fj} denotes the imports of capital good type j; Λ_t is the transfers from the intermediate good producers to the household; and aggregate labor supply and and the aggregate capital stocks are given by $N_t = \int_0^1 n_t(z)dz$, $K_t^d = \int_0^1 k_t^d(z)dz$ and $K_t^{fj} = \int_0^1 k_t^{fj}(z)dz$, $\forall j \in \Omega$.

2.4 Labor and Capital Share in Equilibrium

The equilibrium of the model is symmetric with $p_t(z) = P_t = 1$, $k_t^{fj}(z) = K_t^{fj}$, $k_t^d(z) = K_t^d$, $n_t(z) = N_t$, $c_t(z) = C_t$, $x_t(z) = X_t$, and $y_t(z) = Y_t = F(\{K_t^{fj}\}_{j\in\Omega}, K_t^d, N_t)$. In order to express the factor shares in terms of the parameters of the model, we adopt the following CES production function for the intermediate input producers

$$Y_t = F(\{K_t^{fj}\}_{j\in\Omega}, K_t^d, N_t) = \left[(1-\eta) \left(\left(A_t^{Kf} K_t^f \right)^{\gamma} \left(A_t^{Kd} K_t^d \right)^{1-\gamma} \right)^{\frac{\sigma-1}{\sigma}} + \eta \left(A_t^N N_t \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \tag{9}$$

[7] For simplicity we assume that all foreign capital are subject to the same tariff rate.

where σ denotes the elasticity of substitution between total capital and labor; η is the distribution parameter determining the capital intensity in production; A_t^N is the labor augmenting technology, and A_t^{Kd} is the capital augmenting technology that is embodied in the domestic capital goods. The effective composite foreign capital used in production is given by

$$A_t^{Kf} K_t^f = \left[\int_{j \in \Omega} \left(A_t^{fj} K_t^{fj} \right)^{\frac{\theta-1}{\theta}} dj \right]^{\frac{\theta}{\theta-1}} \tag{10}$$

where $\theta > 1$ is the elasticity of substitution between different types of imported capital. With this formulation, we are allowing labor and the overall capital to be substitutes ($\sigma > 1$) or complements ($\sigma < 1$), but assuming that the domestic and foreign capital are imperfect substitutes (elasticity of substitution equal to 1), with γ determining the share of foreign capital in the overall capital used in production.

As in Oberfield and Raval (2014), we combine the equilibrium conditions with the intermediate good producers' optimality conditions in (4), (5) and (6), and write the ratio of labor share to capital share as[8]

$$\frac{s_{L,t}}{s_{K,t}} = \frac{W_t N_t}{R_t^d K_t^d + \int_{j \in \Omega} R_t^{fj} K_t^{fj} dj} = \Gamma \left(\frac{W_t}{A_t^N} \right)^{1-\sigma} \left(\frac{A^{Kd}}{R_t^d} \right)^{(1-\gamma)(1-\sigma)} Q_t^{\gamma(1-\sigma)} \tag{11}$$

$$Q_t = \left[\int_{j \in \Omega} \left(\frac{A_t^{fj}}{R_t^{fj}} \right)^{\theta-1} dj \right]^{\frac{1}{\theta-1}}, \tag{12}$$

where Q is an index of imported capital productivity-per-cost, and Γ is a constant.[9]

In this framework the impact of trade openness on relative labor share can be illustrated with two changes, both of which operate through the index Q_t: a reduction in the tariff on foreign capital goods (τ) that would affect the rental rates R^{fj}, and an increase in the number of imported capital varieties used in production, which implies an increase in the size of Ω. The first change can be interpreted as a price effect on investment and raises the productivity-cost index through lower cost of foreign capital. The second change alters the composition of the capital stock and we interpret it as an enhancement of the capital-augmenting technology through an increase in variety. We consider these two effects of trade openness separately in the theory, although it is of course difficult to disentangle them

[8]Estimating the ratio of labor share to capital share allows us to identify the elasticity of substitution between total capital and labor, σ, directly. Given the importance of this parameter in interpreting the results, we choose to focus on the ratio between the labor and capital shares as opposed to just the labor share.

[9]The expression for Γ is given by $\Gamma = \left(\frac{\eta}{1-\eta}\right)^{\sigma} (1-\gamma)^{(1-\gamma)(1-\sigma)} \gamma^{\gamma(1-\sigma)}$.

empirically. In the empirical analysis of section 4, the impacts of policy reforms on factor shares reflect both changes, and therefore are interpreted as the combined effect.

Before demonstrating the impact of openness on factor shares through these two channels, we can first show the general response of relative labor share to foreign capital's productivity-per-cost index, Q. To that end, we take the derivative of the log of relative labor share in equation (11) with respect to the log of Q and obtain

$$\frac{\partial ln\left(\frac{s_{L,t}}{s_{K,t}}\right)}{\partial ln(Q_t)} = (1-\sigma)\frac{\partial ln(W_t)}{\partial ln(Q_t)} + \gamma(1-\sigma) = \gamma(1-\sigma)\left[\frac{1}{\theta-1}\frac{s_{K,t}}{s_{L,t}} + 1\right]. \tag{13}$$

The expression above shows that in addition to its direct impact, changes in Q affect factor shares also through wages. As discussed in Acemoglu and Restrepo (2018), an increase in capital augmenting technology raises the wage rate, which implies welfare gains for workers aside from its distributional implications. Equation (13) also shows whether the labor share increases or decreases relative to the capital share after an increase in Q depends on the elasticity of substitution between capital and labor. If $\sigma < 1$, that is if labor and capital are complements (which we show is true in the Indian data), then an increase in foreign capital productivity-per-cost index Q will increase the labor share directly and indirectly by raising the wage rate.[10]

To clarify the channels through which trade openness can affect factor shares through changes in foreign capital's productivity and/or cost, we first consider a trade liberalization where the tariff on foreign capital is lowered, making it cheaper to invest in these goods. For illustration purposes, let us assume that the productivity of foreign capital is the same across the different varieties ($A^{fj} = A^{Kf}$, $\forall j$), and that their prices are equal to each other ($p^{fj} = p^f$). The latter assumption implies that the rental rates of foreign capital goods are also equal to each other, which allows us to simplify the foreign capital productivity-cost-ratio index as

$$Q_t = \frac{A^{Kf} \mid \Omega \mid^{\frac{1}{\theta-1}}}{R^f}. \tag{14}$$

From the household's optimality conditions we have the following expressions for the rental rates of foreign capital and domestic capital:

$$R_t^d = r_t + \delta, \tag{15}$$

$$R_t^f = \left(\tau p^f\right) R_t^d, \tag{16}$$

[10]The data allows us to measure the effect on real wages at the industry level, and we do find a significant rise in section 4.3. This provides a mechanism for the factor share responses we measure at the firm level.

showing that a reduction in the tariff lowers the rental rate of foreign capital. Substituting the expression for (16) in equation (14), it is straight-forward to see that lower tariffs imply a higher productivity-per-cost (Q), and therefore a higher relative labor share as shown in equation (13). Second, consider the impact of openness through the increase in the number of foreign capital varieties used in production. As can be seen from equation (14), an increase in the number of varieties (an increase in the size of Ω) increases the foreign capital productivity-cost ratio index, which in turn increases the relative labor share.

In short, trade liberalization can increase labor share relative to capital share by lowering the rental rate of imported capital, and by enhancing capital-augmenting-technology through an increase in the number of imported capital varieties.[11] The results above could be magnified or dampened if one considers the fact that a developing country like India needed to import R&D intensive capital equipment goods in order to use them in production, and trade liberalization transformed the composition of India's capital to include more productive foreign capital.[12] Table 1 lists the top countries from which India imports capital. Over half of India's imports of capital come from the U.S. (20%), Japan (16%), and Germany (16%) – technologically advanced countries. For this reason, we find it is plausible to interpret imported capital as having an intrinsic efficiency advantage over domestic capital.[13] On the one hand, the compositional change toward foreign capital raises rental rates if foreign capital is costlier, thus possibly dampens the price channel. However, an increase in the number of varieties that embody a higher level of technology works to magnify the productivity effect that raises Q_t and leads to an unambiguous increase in real wages. Ultimately, the overall response of relative factor shares becomes an empirical question.

[Table 1 about here.]

While the model we outlined mainly focuses on reductions in the tariffs that distort the price of the imported capital goods, we argue that FDI liberalization can affect factor shares through a similar mechanism of bringing in more efficient capital goods. As foreign firms enter the domestic economy, they bring their technology capital, which can generate an increase in the capital-augmenting technology, especially in developing countries. FDI

[11] In subsection 3.4 we show that the variety of foreign capital India imports indeed increased following trade liberalization.

[12] Eaton and Kortum (2001) document that the production of R&D intensive capital equipment is concentrated in a few developed countries for the time period we are considering. Similarly, Caselli and Wilson (2004) document large cross-country variation in investment across types of equipment.

[13] In the next section we also report the percentages of each type of capital goods India imported (Table 3). These show that *half* of capital imports are Machinery (except Electrical), a category that embodies a high level of technology.

can also improve the domestic firms' productivity through spill-overs, as shown by a number of studies. For example, Javorcik (2004) and Blalock and Gertler (2008) find productivity spill-overs from FDI into downstream industries in Lithuania and Indonesia, respectively. Using data from the U.S., Keller and Yeaple (2009) show substantial productivity gains from horizontal FDI. Moreover, multinationals can also enhance aggregate productivity through market reallocation and between firm selection (Alfaro and Chen (2015)).[14] Firms' factor shares can respond to FDI through all of these mechanisms, since each of them could alter the wages, cost of capital and the firms' input choices. In our empirical analysis, we highlight the channels through which FDI liberalization can facilitate the use of foreign capital, enhance capital-augmenting technology, and thereby alter the relative factor shares.

3 Data and Descriptive Analysis

India during the late 1980's and 1990's constitutes a great case for studying the role of openness on factor shares because the removal of the highly restrictive trade and foreign investment policies provides exogenous policy "shocks". Prior to the late 1980's, India utilized a variety of restrictive policies. On the trade side, high tariff and nontariff barriers severely restricted imports of final goods, intermediate inputs, and capital goods. India also restricted imports of inputs in specific industries and discouraged foreign ownership in most industries. Changes in the regulatory regime are discussed in much of the previous literature cited in the introduction, and summarized in Sivadasan (2006). Therefore, in the next subsection we mostly describe the construction of the openness measures and report the summary statistics for all the policy measures. It is also worth noting that studying the case of India brings with it the advantage of availability of data from various sources to measure the changes in the structure of the economy in response to these reforms. In the following subsections we describe the industry and firm level data that we use in the empirical analysis and show the evolution of factor shares in India during the liberalization episode. We end with a descriptive analysis of India's capital imports during this time, as a motivation for the theoretical mechanisms described above.

3.1 Background and Data on the Liberalization Episode

Before the liberalization in the 1990's, India's economy was characterized by high tariff and non-tariff barriers on imports, as well as restrictions on foreign investment. Following the

[14]Using a cross-country firm-level panel dataset, Alfaro and Chen (2015) show that the latter mechanism account for the majority of the productivity gains.

standby arrangement with the IMF, which ensued the balance of payment crisis in 1991, India launched a structural adjustment program and commenced liberalizing its economy. As part of the reforms, the levels and dispersions of tariffs on imports were lowered, and the industries gradually opened up for foreign investment. Since the timing and the magnitude of the reforms were heterogeneous across industries, we utilize the variation in the tariff measures and the FDI liberalization indicator to identify the effects of openness on firm-level factor shares. Goyal (1996) describes the reforms as "shock therapy" designed to minimize opposition. Moreover, previous papers have convincingly argued that the reforms came mostly as a surprise. For example, using data from the Annual Survey of Industry and focusing on a range of industry characteristics such as employment, wages and average factory size, Topalova and Khandelwal (2011) check the endogeneity of the changes in tariffs between 1987 and 1997 across industries. They find no correlation between tariff reductions and pre-reform (1987) industry characteristics. However, they show that in the years after 1997, tariff cuts may have been more selective to protect less efficient industries. Following their findings, we also confine our study to the pre-1997 period.[15] The fact that policy changes are uncorrelated with pre-reform firm characteristics that determine factor shares relieves potential omitted variable problems, though we check these in more detail in Section 4.

We obtain the information on some of the main policy measures, namely the output tariffs plus indices of industry and investment liberalization, to construct our own measures of interest from Topalova and Khandelwal (2011) . We aggregate the indices and output tariffs from their study to the 3-digit 1987 NIC level aggregation to construct all our measures.[16] Most importantly, we split tariffs into output, input, and capital tariffs. Although it is common to split tariffs between output and input tariffs, for our purposes it also necessary to split input tariffs so that the effect on intermediate inputs and capital goods can be separated.[17] We then make use of the 1993-1994 input-output table to produce capital and input (intermediate) tariffs, following their classification of capital goods and intermediate inputs. Our construction of these tariffs follows:

$$capitaltariff_{jt} = \sum_{s} \alpha_{js} outputtariff_{st}, \tag{17}$$

[15]Some of the other papers that argue the exogeneity of the policy changes before 1997, and limit the sample to pre-1997 are Goldberg et al. (2009), and De Loecker et al. (2016).

[16]Topalova and Khandelwal (2011) use a mix of 4 to 5 digit policy measures. However, because we carry out some of our empirical analysis at the 3-digit industry level using data from the Annual Survey of Industries, we aggregate the tariff measures to the 3-digit level to be able to use the same measures consistently through out the paper.

[17]Kandilov et al. (2017) also distinguishes between the intermediate input tariffs and capital goods tariffs to study the impact of trade liberalization in India on the investment decisions of firms.

where α_{js} is the share of the capital input s (an element in the set of inputs classified as capital goods) in *total input costs* (capital plus intermediate). We construct the intermediate input tariffs the same way, this time using the set of intermediate inputs. Thus, the sum of capital and input tariffs produces an input tariff that is more commonly found in the literature (Amiti and Konings, 2007). Notice that the *effective* capital tariffs we construct seem relatively low because the sum of the IO coefficients is smaller for capital inputs – we sum over a smaller number of inputs (see Table 2). A better sense of the changes in capital tariffs is provided in Table 3, which summarizes the categories of capital imports between 1990 and 1997. For example, consider the 55 percentage reduction in the tariff on Machinery, which dropped from 76 to 21 percent. This change would have affected industries differently depending on their reliance on machinery. In an industry where machinery makes up 5% of total input costs, the effective capital tariff reduction would have been small at 2.75 percentage points. On the other hand, in an industry where machinery makes up 50% of total input costs, the drop in effective capital tariffs would have been more substantial at 27.5 percentage points. The same intuition can be used for inputs tariffs.[18]

Table 2 reports the average and standard deviation of three types of tariffs between 1989 and 1998. The output tariffs statistics line up very closely with Topalova and Khandelwal (2011) since we take these from their study (with the very slight differences being due to the aggregation from 4-5 digit to 3 digit codes). For all three types of tariffs, the mean and standard deviations start to decrease rapidly starting in 1993. The literature on firm productivity has highlighted the importance of the reduction in output and input tariffs: the former to raise competition and the latter to bring in imported inputs. By splitting up intermediate inputs and capital goods in the input-output table, we show that capital tariffs were also reduced significantly (by more than half) during this period.[19] It is important to note that, as is the case with output and input tariffs, the reduction in capital tariffs is industry specific. We find that the industry with the biggest decline in its effective capital tariffs saw a *23 percentage point reduction*, while on the other side of the spectrum the smallest decline for an industry was close to 0.

We also report a measure of FDI liberalization and a "Delicensing" index, both taken from more disaggregated data in Topaloval (2010). For the FDI measure, a liberalized industry takes the value of 1 if it is in the list of industries with automatic permission for 51 percent

[18]We differ slightly from Topalova and Khandelwal (2011), who use the value of an input relative to the output value. Therefore, their input tariffs are slightly smaller. Results using the input as a share of total value are very similar, but with a smaller level of input and capital tariffs.

[19]Studies that also make this point include Bas and Berthou (2017) and Kandilov et al. (2017).

foreign equity share at time t.[20] Similar to the tariff measures, we aggregate the FDI measure to the 3-digit level. An increase in the index signifies an increase in FDI liberalization in that industry. Before the reforms, a license was also required to establish a plant, introduce a new product and expand capacity. Through annual allotments of inputs and import licenses the government controlled the flow of inputs such as steel and fuel, as well as the licenses to purchase machinery. The "delicensing" measure aims to capture the changes in these licensing requirements. It is an indicator equal to one if the industry is subject to licensing requirements for entry and capacity enhancements, and a *reduction* in this index signals greater "delicensing". Table 2 reports that the measure of FDI liberalization starts to increase in 1992, after the passage of the new industrial policies. In the same year, the decrease in the "Delicensing" index signifies a reduction in the licensing requirements.

[Table 2 about here.]

[Table 3 about here.]

3.2 Firm and Industry Data

CMIE Prowess Data The data on the panel of Indian firms are collected by the Centre for Monitoring of the Indian Economy (CMIE), and made available by Prowess. The firms in the data-set account for about 70 percent of the organized industrial activity. In addition to the variables we need to construct the factor shares (capital stock and the total wage bill), the data also contain information on additional features, such as imports, foreign ownership status, and R&D spending, which allow us to analyze heterogeneity of the impact of openness on the factor shares.

To construct the fraction of labor share to capital share ($\frac{s_L}{s_K}$), we take the ratio of total employee compensation to total payments to capital.[21] Calculating the total payments to capital requires us to bring in new data, as we are not aware of another study that has constructed wage-to-capital payment ratios for India. Capital expenditure is the product of a firm's capital (gross fixed assets) with a measure of the rental rate of capital. In

[20] Topaloval (2010) collects data on openness from *The Handbook of Indian Statistics*.

[21] Alternatively, one can also construct labor shares as the ratio total employee compensation by the value added, where value added is constructed by subtracting total costs (total intermediate costs plus total energy costs) from the value of sales and adding the change in the stock of finished and semi-finished goods. Our ratio does not require the construction of value added.

constructing the rental rate, we follow Oberfield and Raval (2014) and use the following formula:

$$R_{jt} = \left(P_{jt-1} r_t + \delta_{jt} P_{jt}\right) / (1 - tax_t), \tag{18}$$

where r denotes the real interest rate (source: Reserve Bank of India), and tax is the corporate tax rate for India (source: World Tax Database, University of Michigan). The variable P_{jt} is the capital price index for industry j. Deflators are available for construction and machinery, so we construct a weighted average of the deflators based on the IO coefficients for construction and machinery in each of the 3-digit NIC industries. The depreciation rate (δ_{jt}) is also 3-digit industry specific. We use the ratio of total depreciation costs to the stock of fixed assets, each available at the industry-state level from the Annual Survey of Industries.

Industry-State Data The *Annual Survey of Industries* (ASI) data is made available by the Indian Ministry of Statistics, and covers the liberalization period over 1988-1997. It provides comprehensive data on the industrial sector, which is mostly manufacturing plus repair services, gas and water supply and cold storage. The Survey is conducted annually, and covers all factories registered under the Factories Act of 1948, which are defined as those factories employing 10 or more workers using power, and those employing 20 or more workers without using power. We use the ASI data that are at the state-3 digit (NIC 1987)-year level, with measures such as total value added, gross fixed capital, value of depreciated capital, and total labor compensation. Since the firm level data come from a subset of firms as provided by Prowess, the ASI data allow us to construct aggregate measures at the manufacturing level. The ASI data-set also provides useful variables not available in the firm data, such as the depreciation rate described above. Most importantly, it provides information on number of workers and total compensation, which we use to construct average wages at the industry-state level.

3.3 Factor Shares

Before we discuss our empirical results on how openness can impact factor shares *within firms*, we present some statistics on the evolution of aggregate factor shares in India during our sample period. We stress that this paper mainly aims to explore firm responses to specific trade reforms, so we present these aggregate factor shares merely to give a sense of the context through which we interpret the empirical results. Furthermore, although we mostly use relative factor shares as the outcome in the regression specifications, in this section we also show the time series of labor and capital shares (relative to value added) to

confirm they display similar patterns. Note that our main results are based on the firm level data from CMIE – which covers approximately 70% of industrial activity. For this reason, we first present factor shares using aggregate data from KLEMS and ASI, and then confirm that the same patterns hold in the firm-level data we employ in our empirical analysis.

Factor Shares at the Industry Level Figure 1 reports the aggregate labor and capital shares (relative to value added) in the manufacturing sector based on the ASI data. We aggregate total factor compensation and value added in each industry across states to get industry factor shares, and then report the unweighted average.[22] To construct the capital share, we use the information on the stock of fixed capital (gross and net of depreciation) provided in the ASI data, and combine it with our estimated rental rate of capital (described above) to construct capital expenditures.

Figure 1 depicts a decline in the labor share and an increase in the capital share over the 1988-1997 period. Aggregate labor share drops around 20 percent, while the capital share shows a secular climb that is concurrent to the labor share decline. There is slightly more variation in the capital share, partly due to the changes in the interest rate, as the real rate in India (reported by the Indian Central Bank) spikes in 1992.[23] We observe a similar downward trend in the labor share in the measure constructed with the KLEMS data. We relegate the description of KLEMS dataset and the time series of factor shares to the appendix, but we point out some minor differences here. The ASI data are reported in each fiscal year, so that for example, year 1988 refers to the 1988-1989 fiscal year. For this reason, the variation might differ slightly from the KLEMS data. The level of the manufacturing labor share constructed using the ASI data varies from 36% in 1988 to 27.5% in 1997, which on average is 10 percentage points lower than the labor share calculated using the KLEMS data. The difference might be due to the fact that the ASI data exclude firms with less than 10 employees and these small firms tend to be more labor-intensive. Nevertheless, the pattern in the labor share fits with the KLEMS data.

[Figure 1 about here.]

Figure 2 reports the time series of the compensation of labor relative to capital expenditures, which we report for the manufacturing sector as a whole. Relative factor shares

[22] We have also calculated factor shares at the manufacturing sector as a whole by aggregating observations for each state-industry per year. We present only the unweighted measures, as we do not find any different trends across industries. A decomposition of the labor share (not reported) would show that, similar to what has been documented in other countries, the factor share trends are within-industry, i.e., the reduction in the labor share in India is due to within-industry declines.

[23] However, the variation in the Indian interest rate does not affect our empirical results, since it is an aggregate picked up by year fixed effects.

eliminate the markup component that exists in the labor share of value added. Consistent with the previous graph, the figure shows that the ratio of labor compensation to capital expenditures has also experienced a steady decline throughout this period. Given the difficulties that arise when computing R_{jt}, we compare the benchmark relative factor share with one where the rental rate is assumed fixed over time. This comparison leads to a slightly more stable relative factor share, but displays a very similar pattern.[24] We therefore conclude that the decline in the labor share is consistent with capital income growing faster than labor income, and is not merely a reflection of increases in markups or other changes that move capital and labor income equally during this time.

[Figure 2 about here.]

Factor Shares with the Firm Data To check how close the factor shares in the CMIE data track the industry level trends, we also construct the time series of factor shares using the sample of firms in the CMIE data. As in the comparison between the ASI and the KLEMS data, the levels of labor share in value added are even smaller in the firm data. Figure 3 shows that the aggregate labor share is below 15%, which is much lower than the labor share calculated using the already aggregated data.[25] Even more extreme than the ASI data, which do not account for firms with less than 10 workers, the CMIE data provide information on a selection of even larger firms. This selection seems to collect firms with small labor shares. However, the trends found above with the aggregate data are still present as the labor share declines throughout the sample. Therefore, the changes in the factor shares of firms within the selected sample still represent the dynamics in the labor share observed in the economy overall. A similar picture emerges for the labor-to-capital expenditure ratios (Figure 4). The level is lower as this selection of firms are more capital intensive, but a reduction in this ratio can be seen when comparing the pre-1992 period average with the latter period.

We emphasize that this study does not aim to explain the overall trend in the labor share – in fact we find the trade reforms mostly raised the labor share, a response that goes against the aggregate trend. Our aim is to compare the relative factor share responses of firms differentially exposed to trade reforms. To complement the firm-level results, in Section 4.3 we estimate the main specification using industry-level ASI data in order to check how the

[24]We have checked that the results presented in the next section are robust to calculating factor shares with fixed rental rates.

[25]Ahsan and Mitra (2014) report very similar labor share numbers. This could point to a problem in the construction of value added, one reason we prefer our relative factor shares measure.

selection of firms in CMIE affects our results. Moreover, the aggregate estimates also reflect the reallocation across firms in response to openness that might negate some of the average within-firm changes. When compared to the results obtained with the CMIE data, changes in the capital tariffs have almost the same impact on aggregate relative factor shares. However, the rise in the labor share due to the FDI liberalization disappears in the ASI data, which likely speaks to the reallocation across firms negating the within-firm effects. We discuss these issues in detail at the end of the results section.

[Figure 3 about here.]

[Figure 4 about here.]

3.4 Descriptive Analysis of India's Capital Imports

In this subsection we present a descriptive analysis of capital imports for India during the trade liberalization period. This analysis provides preliminary evidence for the theoretical mechanism that was introduced in the previous section, which we argue drives our main results in the next section. Our structural model points towards two channels that impact relative factor shares: the price channel through cheaper capital imports, and the capital productivity channel through an increase in the variety of capital goods, as well as the change in the composition of the capital stock towards foreign technology. Next, we present data describing the compositional changes in India's capital following the liberalization, and show that India increased its capital imports substantially from the top capital exporters. We also provide suggestive evidence that India raised its imports of "high-tech" goods as classified in the trade data.

In the first set of analysis, we use detailed trade data from the UN Comtrade to study the level and the variety of India's capital imports. We focus our attention on imports from the top 10 trade partners listed in Table 1, which are high-technology-producing countries.[26] The import data is reported by the 6 digit HS codes, which we define as products. We keep only capital goods, as classified given the US Census end-use classification. Figure 5 reports the time series of total value of capital imports, as well as the number of unique capital goods imported to India as a measure of variety. As expected, the total value of capital imports drops prior to 1992, concurrent with the crisis in India. Although imports rebound

[26]These countries are: United States, United Kingdom, Germany, France, Switzerland, South Korea, Singapore, Japan, Italy, and Taiwan. Since we do not have data for Taiwan individually, we use imports from China instead.

in 1992 to 1990 levels (less than 300 million US dollars), it is clear that the largest gains in terms of value of imports (left axis) occur between 1993 and 1995, to above 500 million dollars. Importantly, this pattern is matched by the variety of products imported. We count a "variety" as a unique HS6 good-origin country combination, using a common definition in the literature that interprets a product from two different origins as two unique varieties (Gopinath and Neiman, 2014).[27] Table 4 shows that the number of varieties increases from each of the top 10 capital-exporting-trade partners. It is once again clear that India has the largest increase in the number of varieties between 1993 and 1995. The trend in the trade data is therefore consistent with a rise in the productivity aspect of the productivity-per-cost index, Q_t defined in equation (14), which increases due to an increase in variety, and this effect gets magnified by the rise in capital imports from the top technology exporters.

[Figure 5 about here.]

[Table 4 about here.]

As a second piece of evidence that suggests a rise in Indian capital productivity in response to liberalization, we present an analysis of exports by the United States that are classified as "advanced technology products" (ATP). We limit the analysis to U.S. exports due to the availability of detailed (HTS 10 digit code) export data provided by Schott (2008). This level of disaggregation is consistent with the classification of ATP products. Conditioning on ATP exports by the United States between 1989 and 1998, we estimate the following difference-in-difference specification:

$$\ln(X_{dt}) = \alpha_d + \alpha_t + \alpha PostLib * India_{dt} + \zeta_{dt}, \tag{19}$$

with the outcome measure being log exports by destination (d) and year (t). The coefficient of interest is on the interaction variable $PostLib*India$, a product of a dummy equal to 1 for the years post Indian-liberalization and a dummy equal to 1 for exports to India. Exports are aggregated to destination-year observations within ATP products, so we control for destination and year fixed effects. The question of interest is whether within ATP products

[27]We find a similar pattern if we count a unique variety as an HS product from any origin. When constructing the measure of variety in Figure 5, we eliminate imports from China and Germany. China is used as a proxy for Taiwan, but includes an extreme jump in the number of goods exported in 1992. German data is only available starting in 1991. Including these countries could affect the interpretation of the count across years; therefore, we do not include them in the measure. Lastly, we should point out that there exists the possibility of an upward bias in the number of variety counts during the revision years of HS codes (1992 and 1996), although we use a consistent classification. However, the qualitative interpretation is not affected if we were to eliminate the increase in the number of products in those years.

export flows to India grew especially fast after 1993, relative to the rest of the world. Table 5 presents results for various variations of (19), each consistent with a surge of ATP exports to India after 1993.[28] The first two columns present the main specification, altering the first year of *PostLib* from 1993 to 1994. It is clear that relative to the period before Indian liberalization, there is a large increase of U.S. exports of ATP products to India compared to other destinations. In the next column we exclude the observations from 1992 due to the large drop in exports to India during the year following the crisis. We find that our results are robust, and the recovery from the crisis is not driving the results. Finally, in the last specification we change the outcome measure to the number of high-tech products exported to each destination (where the product is a 10-digit good). Consistent with Figure 5, we find that India imported a significantly larger amount of ATP products from the U.S. after the liberalization.

[Table 5 about here.]

To summarize, there is very strong evidence of a surge in Indian capital imports after its liberalization. This growth is associated with a larger variety of capital good imports coming from the top-technology producing countries. Evidence from U.S. export data also suggests that the surge in capital imports includes products classified as high-technology. In the next section we estimate the reduced form effects of the openness policy reforms on relative factor shares, and argue that the evidence provided in this subsection with import data corroborates with capital productivity channel being the main driver for these effects.

4 Empirical Results

In order to identify the effects of trade and FDI policies on the relative factor shares, we formulate our main empirical equation as follows:

$$\ln\left(\frac{s^L_{ijst}}{s^K_{ijst}}\right) = \alpha_i + \alpha_{st} + \beta Reform_{jt} + \epsilon_{ijst}, \tag{20}$$

where the subscripts denote firms (i), 3-digit NIC industries (j), states (s), and years (t). We use $Reform_{jt}$ to describe the policy measures of interest, the three types of tariff measures and the FDI liberalization indicator, as well as the delicensing indicator. The vector of coefficients β capture the *net* response of factor shares to changes in these policy measures;

[28] We also ran a similar specification with product-destination-year observations, and estimated the same coefficient but as an average across products. The results are consistent with a surge in exports of ATP products to India post 1993.

that is, they show the combined impact of liberalization on the relative factor shares through the capital cost and productivity channels described in the previous sections. We include a set of fixed effects, which contain firm fixed effects (α_i) that allow us to control for time-invariant unobservable firm characteristics, and a set of state-year interaction fixed effects (α_{st}) to control for all aggregate shocks at the state level. In the main specification, we utilize within-firm and within-state-year variation, although we also report results that eliminate state-year fixed effects in favor of just year fixed effects. Finally, in all cases we cluster standard errors at the 3-digit NIC industry level.

As demonstrated in section 2, how factor shares respond to openness through various channels depends on the complementarity or the substitutability between capital and labor. Before reporting the main results, we show that, consistent with most other firm-level studies, capital and labor are complements in the Indian firm-level data. We can obtain the elasticity of substitution between capital and labor in our data by estimating the coefficient on wages jointly with the responses to liberalization reforms using the within firm, over-time variation in equation (20).[29] However, this estimation strategy would expose us to a potential endogeneity bias in σ, since wages might be changing with the concurrent liberalization reforms in our sample. Therefore, we adopt the strategy in Oberfield and Raval (2014) and utilize the cross-sectional variation in wages *across states* to obtain an estimate of the elasticity.[30] We estimate the following specification:

$$\ln\left(\frac{s^L_{ijst}}{s^K_{ijst}}\right) = \alpha_{jt} + (1-\sigma) ln\left(Wage^{ASI}_{jst}\right) + FirmControls_{ijst} + \eta_{ijst}. \tag{21}$$

Firm controls above include dummies for exporters and importers (of both capital and intermediates), plus the firm markup and debt to equity ratio. In this case, industry-year fixed effects (α_{jt}) capture all industry specific shocks, including the trade and FDI policy changes.

Results are reported in Table 6, where we complement the pooled regression for the full sample with regressions using single years of data (before and after the reforms). In all cases, the coefficient on the wage rate is positive and less than one, yielding a value for the capital-labor substitution parameter that is below one. Hence, consistent with most other firm-level studies, we find that labor and capital are complements.[31] In the rest of the paper,

[29] If we log-linearize equation (11) in the structural model, the coefficient in front of the wage rate would be $(1-\sigma)$. In that case, we can interpret equation (20), augmented with wages, as a linear approximation of the equilibrium relative factor shares, and use the coefficient on the wage rate to interpret the elasticity of substitution.

[30] Oberfield and Raval (2014) identify the elasticity parameter with variation in wages across the U.S. metro areas, estimated separately for each year.

[31] Oberfield and Raval (2014) report an estimate of 0.7 for the US manufacturing sector, 0.84 for Colombia

we base the interpretations of our findings on this complementarity result. Also, in the next subsection, we show that our results remain unaltered if we include the wage rate in the main specification that relies on within-firm variation to estimate the impact of openness on factor shares.

[Table 6 about here.]

4.1 Main results

The results for the main specification in equation (20) are reported in Table 7, with the firm relative factor share (log of wage-to-capital expenditure ratio) as the outcome. We first show the results for a specification that only includes the trade policy measures (tariffs), then show the impact of the FDI policy measure by itself. We then pool these together to reassure the reader that the results are not driven by the inclusion or the exclusion of certain policy measures.

The first column includes tariffs as the only policy changes, and it provides evidence that neither the output nor the intermediate input tariffs have any significant effect on the relative factor shares. Therefore, we drop these from the analysis going forward.[32] The strongest effect is estimated for the tariff on capital goods: a lower tariff on capital goods significantly increases the wage-to-capital-expenditure ratio. We can interpret this result through the lens of the theoretical analysis in section 2 as follows. A reduction in the tariff on capital goods raises the productivity-per-cost of foreign capital (Q_t), and given that labor and capital are complements in the data ($\sigma < 1$), this improvement in the productivity-cost index of foreign capital increases the fraction of income going to labor relative to capital. Below, we investigate this mechanism more in detail by looking at firm characteristics, as well as the factor prices themselves. Before we quantify this impact, notice that the capital tariff rates that we construct are "effective" rates. That is, we calculate the weighted average of tariffs on capital goods that are used by an industry, where the weights are determined by the share of a particular capital good in total input costs. To illustrate the point, consider a 10 percentage point reduction in electrical computing and accounting machinery (see Table 3 for the capital good categories). If electrical computing and accounting machinery make up 10%

and Chile. Using data for 2001-2003, they estimate an average plant level estimate of 0.53 in India and calculate an *aggregate elasticity* of 1.11 for the whole manufacturing sector, where the greater heterogeneity in capital intensities account for about 70% of the overall elasticity. Our estimate for σ is the average at the firm level (without giving higher shares to larger firms) obtained for the 1990-1998 period, and it is within the range of their findings.

[32] All the results are almost identical with and without including these tariffs, so they do not seem to have any effect on factor shares.

of a particular industry's total inputs, this industry would experience a 1 percentage point reduction in its effective capital tariff rate (assuming all other tariffs remain the same). For an industry where these types of machinery make up 50% of total input costs, the effective capital tariff rates would change by 5 percentage points. The coefficient on capital tariffs show that a 1 percentage point decline in the effective capital tariffs raises the relative labor share by 1.7 percent. Hence, the 5 percentage point average effective capital tariff rate reduction between 1989 and 1998 shown in Table 2 implies a 8.5 percent increase in factor payments to relative payments to capital.

[Table 7 about here.]

In column (2), we consider the impact of FDI liberalization on the relative factor shares. An increase in "FDI Liberalization" signifies a *reduction* in the barriers to foreign direct investment, and can be interpreted as an improvement in the access to foreign capital. Similar to the results on the changes in capital tariffs, we find a statistically significant increase in the wage-to-capital-expenditure ratio in response to FDI liberalization. A fully treated industry whose FDI measure increases from 0 to 1 is expected to see a 11.3 percent increase in its wage-to-capital-expenditure ratio. One way to interpret this result is to think of FDI openness as an increase in the availability and variety of foreign capital in total production (an increase in Ω in our theoretical model, see equation (13)). As foreign firms enter India, they bring their technology capital, which then implies an increase in the capital-augmenting technology (McGrattan and Prescott (2009)). Since labor and capital are complements, given an improvement in the capital-augmenting technology relative to labor-augmenting technology, firms respond by hiring more labor leading to an increase in the labor's share relative to capital's share of income.

The specification in column (2) also includes "Delicensing", which captures a concurrent policy change during the restructuring in India. Previous literature has found that relaxing license requirements for entry and capacity enhancements had a very large positive impact on economic growth (Aghion et al., 2008), and that the effect was especially stronger in states that are "less pro-worker". In the context of factor shares, we find that the reduction of licensing requirements (a decrease in the delicensing index) lowered the relative share of labor. These results suggest that the delicensing reform, which lowered the share of products in an industry subject to licensing requirements, made it easier for firms to invest and increased the overall use of capital. Hence, by increasing the total income earned by capital relatively more than the income earned by labor, this policy change contributed to the decline in the labor share observed in the data.

When we include capital tariffs along with FDI liberalization and delicensing in column

(3), the coefficient on capital tariffs is very similar to the one in column (1), but the impact of FDI declines slightly and becomes significant only at the 10% level.[33] Using the coefficients from this specification, we can obtain a rough estimate of the total impact of the removal of restrictions to foreign capital in India between 1989 and 1998. Combining the impact of the 5 percentage point decline in the effective capital tariff rates with the FDI liberalization (an increase of the index from 0 to 0.45, see Table 2), we obtain a total increase in the relative labor share of 12 percent. In our sample the labor share declines by 46 percent relative to the capital's share (the ratio of labor to capital expenditures decreases from 1.057 to 0.57). These two numbers are not directly comparable since the latter includes across firm reallocation while our estimation captures within-firm changes in factor shares. Still, relating the two numbers provides a perspective for the magnitude of the effect of globalization. In subsection 4.3, we present a more aggregate analysis that captures the reallocation effects in addition to the within firm changes in relative factor shares.

In column (4), we show that the results remain robust to including state-industry wages in the specification. The policy reforms' impacts are almost identical to the ones in the previous column, and the coefficient on wages is less than one, consistent with the complementarity between capital and labor. In the fifth column, we add credit to GDP ratio to the specification in column (3). This variable, which captures the credit conditions in each state, varies at the state-year level; therefore, we use separate firm, state, and year fixed effects, and exclude the state-year interaction effects.[34] The negative coefficient (significant at the 10% level) shows that increases in total credit, lowered the relative share of labor. This result suggests that improvements in the availability of credit allowed the firms in India to invest more in physical capital, and unlike the reforms related to openness, contributed to the decline in the labor share observed in India.[35] Since the credit data is available at the state-level rather than state-industry level, we cannot include it in our more general specification with state-year interaction effects. Controlling for aggregate shocks at the state level is potentially important, so in the rest of the analysis we adopt the specification in column (3) as our baseline, and present the results omitting (but implicitly controlling for) state credit.

[33]In the appendix, we show that there is a strong correlation between industries that lower capital and input tariffs, and also liberalize FDI.

[34]We also re-ran the specification in column (3) with this set of separate fixed effects, and the results are almost identical.

[35]These reforms are consistent with a relaxation of capital constraints and do not reflect the shocks to openness we explore in the theory. These results also line up with our findings in Leblebicioglu and Weinberger (2017), where banking deregulation across the U.S. states led to lower loan yields and improvements in the availability of credit in the U.S. and thereby contributed to the decline in the labor share.

Our main outcome measure assumes that labor and capital only get paid through their factor payments, and the impact of mark-ups on labor-share and the capital-share cancel out. However, it is plausible that firm profits get paid fully to capital owners, increasing capital's share of total income. To address this measurement issue and to show that labor's share of value added displays similar responses to the policy changes we obtained for relative factor shares, in Table 8 we consider two alternative measures of labor share. In doing so, we lose some observations in the calculation of the alternative measures. For this reason, in column (1) we repeat the baseline specification of the previous table (column (3) in Table 7), and show that the change in the sample does not significantly affect the results. The first alternative measure we consider, presented in column (2) of Table 8, adjusts for firm's markup in the share of labor in factor payments, and is calculated as $s_{it}^L = \frac{1}{\mu_{it}} \frac{W_{it}N_{it}}{W_{it}N_{it}+R_{it}K_{it}}$, where μ_{it} is the estimated firm markup.[36] The second measure is the simple fraction of labor payments to value added. Additionally, in the last column we look at the impact of the policy changes on firm's mark-up. Columns (2) and (3) show a statistically and economically significant increase in the labor share in response to a reduction in capital tariffs. The last column suggests that mark-ups might have also increased, although this impact is not statistically significant. These results are consistent with De Loecker et al. (2016), who find that firms pass-through a part of cost reductions into markups. Still, we find that labor did benefit from trade liberalization and the changes in firm mark-ups did not wipe out the gain in labor's factor share.[37] The results for FDI liberalization display a similar picture, however, only its impact on mark-up adjusted labor share is statistically significant. Finally, the results in Table 8 once again show that the removal of the licensing requirements hurt labor, causing its share (in both mark-up adjusted and unadjusted terms) in income to decline.

[Table 8 about here.]

Robustness The analysis above leverages annual changes in tariffs and the liberalization policies at the industry level to identify the impact of openness on the relative factor shares. This is a reasonable specification since the reductions in the tariffs and the removal of the restrictions on FDI were staggered over time, and therefore we can utilize the annual variation

[36]This expression for the labor share is obtained by combining the firm's first order conditions in (4), (5), and (6) with the expression for aggregate output in (9). As a markup measure, we use a simple price-cost margin: $\frac{Y-WN-RK-Interm}{Y}$. The median markup is 18%. We also constructed markups using the DeLoecker and Warzynski (2012) method with similar results.

[37]For example, take the ratio of labor payments to value added (column (3)): a 5 percentage point reduction in the effective capital tariff leads is associated with a 3 percent increase in the labor share, which is economically important.

in the policy variables for identification. However, there might be concerns about expected policy changes affecting factor shares before the reform is implemented. Additionally, it might not obvious when the policy reforms affect the outcome variable. To alleviate these concerns, we consider a long-differences specification, where we use the difference in the policy and outcome measures between the 1989-1990 fiscal year and the 1997-1998 fiscal year. As such, we compute the total reduction in the tariff measures between these years. Since we also take the difference in the firm outcomes over these years, we are left with a sample of firms that survive over the 8 years. For this reason, the number of firms drops to 1,052 from 3,576 firms. In Table 9 we replicate the first three columns of Table 7 using a cross-section of long-differences. The results are similar to the baseline specification. Relative labor share increases in response to more liberalized FDI policies and lower capital tariffs, although only the latter impact is significantly different than zero when all reforms are considered simultaneously. These results mirror the previous ones, with less precise results for FDI liberalization but with the expected signs. Different from the baseline specification, the delicensing measure becomes insignificant when we eliminate the annual variation, although again the magnitude of the coefficient is similar.

[Table 9 about here.]

We also run a separate analysis that allows us to visualize the effects of reforms over time. For brevity, we relegate the description and results of that analysis to the appendix (Figure 7). That alternative specification has the severe downside of losing the annual variation, and the variation in the magnitudes of policy variables, as it relies on policy reform dummies. Nevertheless, it allows us compare relative factor shares across time in industries that can be labeled as "liberalized" relative to industries that were never "liberalized". This provides very noisy estimates, but the most important conclusion is that there is no evidence of differential pre-trends in factor shares between these types of industries. Although there is a large literature that argues for the exogeneity of these reforms, especially during the limited time period in which we restrict our analysis, this is a key identifying assumption and we confirm it holds with respect to the labor share as the outcome.

To summarize, the results suggest that by reducing the price of imported capital, and increasing the availability of foreign capital used in production, openness in India led to an increase in the labor share relative to capital's share of income. The theoretical model in section 2 suggests two related mechanisms through which an increase in the relative labor share is possible. Labor share can increase faster than capital's share as a result of the reduction in the rental rate of capital, especially for firms that use foreign capital. Additionally, openness can enhance the capital-augmenting technology for firms that have

access to an increased variety of foreign capital goods, through imports or foreign investment. This latter mechanism generates an unambiguous increase in real wages, thus strengthening the gains to labor since the movement in factor shares does not merely reflect a loss to capital. In the following subsection, we check whether these interpretations are consistent with the observed firm-level factor share changes by using firm characteristics that are salient to the described mechanisms.

4.2 Firm-specific mechanisms

In this subsection we provide direct evidence on the mechanisms that affect the relative factor shares working through changes in the cost of imported capital and the acquisition of technology embodied in foreign equipment. To do so, we interact the policy reforms with firm characteristics that are relevant to these two mechanisms. In Tables 10 and 11 we show the interactions with the openness reforms only, since those are the focus of this study. In Table 12, we also report how delicensing has heterogeneous impacts across the size distribution of firms, as our results on this reform relate to some of the important findings in the previous literature.

Importers We start by showing that the reductions in tariffs increased the relative labor share mainly for the firms that import capital. To that end, we create a dummy variable equal to one if the firm imports capital goods at any point in the span of our data. This allows for the endogenous extensive margin response of firms starting to import capital. Almost 60% of firms import capital at some point, a high number reflecting the fact that our data contain mostly large and medium-sized firms. Still, there are enough non-importers in our data to capture the variation between these types of firms. We check the heterogeneous response of capital importers versus non-importers by interacting the "capital importer" dummy with the liberalization measures. Given the number of policy measures that we analyze, we can potentially have many interactions in each specification. We only present the specifications that include interaction terms between the importer dummy and the relevant policy reform.[38]

Columns (1) and (2) of Table 10 provide the first set of evidence that the average labor share increased relative to capital share due to firms that import capital. Given the potential complementarities between imported capital and intermediate goods, capital importers can respond more to the changes in the tariffs on the intermediate goods, in addition to responding to the tariffs on capital. To allow for these differential responses, in the first

[38]We have checked that our results are robust to the number of policy measures we include by including the full slate of policy measures plus interactions, and then reduced the specification to the policy reforms that are of particular interest.

column we include the interaction term between the capital importer dummy and the input tariffs, as well as the capital goods tariffs. Once again, we fail to find any significant impact from the changes in the input tariffs. Therefore, in column (2) we eliminate the input tariffs and restrict ourselves to capital tariffs and FDI as openness reforms. We find that the reductions in the capital tariffs increase the labor share significantly only for the firms that import capital. For firms that do not import any capital, the impact, captured by the capital tariff coefficient, is small and insignificant. In the last column of the table we show results confirming lower capital tariffs increased the share of firms that imported capital, a result consistent with Bas and Berthou (2017) and Kandilov et al. (2017).[39] These results indicate that lower capital tariffs raise the relative share of income by allowing firms to use more foreign capital.[40] The labor share response to FDI liberalization for capital importers seems to be slightly muted. However, this effect is not very significant most likely because FDI reform does not directly affect the intensity with which firms use imported capital.

Next, we consider the firm's overall "exposure" to imports. To do so, we calculate the ratio of total firm imports (of intermediate and capital goods) relative to total sales, take the average import intensity at the firm level for all years, and interact the average with the policy measures. In this case we present the results without the interaction terms with input tariffs. Column (3) shows that a reduction in the capital tariff leads to a larger increase in the labor share for firms that have higher import exposure. That is, the large importers benefit more from the reduction in the rental rates of capital and the accompanying improvements in the capital-augmenting technology, and therefore increase their relative labor share. With this specification there is some evidence that FDI liberalization raises the labor share for more import exposed firms as well. In unreported results we confirm that controlling for intermediate input tariffs does not matter for our capital tariff results but the FDI interaction coefficient becomes smaller.[41]

Overall, there is strong evidence that the increase in the labor share found in Table 7 is driven by importing firms. We find that the capital tariff reduction increases the share of firms that import, and these importing firms experience a rise in the labor factor share

[39]The outcome measure in the last column of Table 10 is a dummy equal to one if a firm imports. Given the specification with firm and state-year fixed effects, we capture the time variation of this dummy within firms.

[40]If we restrict the importing dummy to equal one for *only firms that import in the first year of the sample*, the interaction coefficient is still negative but about half the size. This suggests that the mechanism holds for firms that imported prior to liberalization and could import a higher quantity post-liberalization. By allowing for the endogenous response of some firms to start importing, the results are stronger as we pick up the productivity effect of firms that start importing following to the reform.

[41]Recall that there is collinearity with the industries that lower input tariffs and have larger FDI liberalizations.

relative to capital. Below we also show that the results are stronger for smaller firms, which points towards an extensive margin effect: smaller firms are the ones that can start importing capital when tariffs decline and benefit most from the liberalization. The theoretical mechanism that is most consistent with these results is a rise in capital augmenting productivity. As more firms import, they take advantage of more capital variety. Furthermore, we have shown above that these imports are from advanced countries that likely send capital embodying a higher level of technology. Although we cannot measure capital productivity directly, in the appendix (Table 16) we show results for a simple regression of labor productivity (value added per worker) on importing. A cross-section specification provides unsurprising evidence that firms that import in any year are on average more productive. We then add firm fixed effects and regress labor productivity on a time-varying importing dummy. There is a large and significant increase in labor productivity in response to becoming an importer. The increase in productivity benefits labor, as it leads to rising wages, which we find as a response to policy reforms at the industry level in section 4.3.

[Table 10 about here.]

Productive Capacity and Borrowing We continue with evaluating other firm characteristics that could be important for how firms adjust their factor shares in response to openness reforms. In particular, we analyze the role of capital intensity, R&D intensity, foreign ownership status, and firm's borrowing capacity. To construct capital intensity, we take the ratio of fixed assets to a measure of labor that we calculate by dividing total compensation by the average wage rate.[42] The specification in the first column of Table 11 interacts the initial capital intensity of the firm with capital tariffs and the FDI liberalization indicator. The interaction term with capital tariffs is negative and significant, suggesting that the more capital intensive a firm is, the larger will be the relative increase in the labor share following tariff reductions. This is consistent with the interpretation that by making foreign capital more accessible, lower capital tariffs lead to an increase in the capital-augmenting technology, and it does so especially at higher levels of capital intensity. In fact, in Table 15 included in the appendix, we repeat the specification in column (1) of Table 11 but split the sample between importers and non-importers. We find that the interaction term between capital tariffs and capital intensity measure is significant only for the importers, suggesting that the imported capital raises the productivity of capital for importers, and it does so especially at higher levels of capital intensity. Moreover, we find that the impact of FDI liberalization is

[42]Our data do not include units of labor or number of workers. Therefore, we need to construct a proxy for labor with total compensation and the average wage rate.

larger for more capital intensive firms. We obtain similar results on FDI liberalization for more research intensive firms–firms that have higher average R&D spending to sales ratio– in column (2) of Table 11. These results conform with the idea that the potential spillovers from FDI can be exploited only by more technologically advanced firms (see Gorodnichenko et al. (2014) and the references therein). On the other hand, we do not find any evidence that R&D intensive firms react the most in response to lower capital tariffs.

In column (3) of Table 11, we interact the policies with a dummy equal to one if the firm has foreign ownership. Since firms with foreign ownership tend to be technologically more advanced and are financially less constrained, they might respond differently to tariff reductions. We find that the increase in the relative labor share to lower capital tariffs is stronger for foreign-owned firms. These firms are more likely to increase their use of foreign capital, which enhances the productivity embodied in their total capital, through their existing international supply networks. Not surprisingly, further FDI liberalization within an industry does not affect a firm that is already foreign-owned.

We analyze the role of financial factors in mediating the factor shares' response to openness by constructing the average debt to equity ratio of the firm and interacting it with the policy variables. The findings in the last column of Table 11 show that the firm's ability to borrow (a higher debt to equity ratio) intensifies the firm's factor share response to a reduction in capital tariffs. This could be a result of the fact that the firms who borrow more easily, can finance more imported capital. Similarly, a larger debt to equity ratio magnifies the increase in the relative labor share following FDI liberalization. The larger response could be due to the notion that financially less constrained firms benefit more from the spill-overs of FDI because it is easier for them to adopt the foreign technology brought in by the multinationals (Alfaro et al. (2010)) or to become their suppliers (Javorcik and Spatareanu (2009)).

[Table 11 about here.]

Size The last characteristic we consider that can affect firm's response to openness is its size. To motivate why this characteristic is important, we refer to trade models akin to Melitz (2003), where the extensive margin plays an important role. In our context, factor shares of smaller firms might respond more to liberalization, since lower tariffs would allow the smaller firms to import capital that was already available to larger firms at higher tariffs.[43] In terms of FDI liberalization, this effect is less obvious, though again we expect

[43]Almost two-thirds of the firms in our sample eventually become importers at some point, probably due to the selection of firms in CMIE. Therefore, new importers that are labelled "small" in our sample are still relatively big firms in the context of the whole Indian economy.

initially larger firms to have a higher share of foreign investment before the liberalization. To test these predictions, we follow Ahsan and Mitra (2014) in creating three equally-sized bins: "small", "medium", and "large". Firms are assigned to these bins in the first year they appear in the data depending on their sales relative to firms within an industry-year. Columns (1)-(3) interact each of the three policy reforms with the size dummies individually. Since we interact the policy variables with "large" and "small" indicators, these interactions show the impacts relative to "medium" sized firms (whose response is represented by the non-interaction term). With respect to the reductions in capital tariffs and FDI liberalization, columns (1) and (2) make it clear that small sized firms are driving the reallocation of factor payments to labor. This suggests that trade liberalization creates opportunities to access foreign capital for smaller firms, allows them to enhance their capital-productivity and raise payments to labor, which complements the capital.

Unlike the openness reforms, the impact of the delicensing reform is subdued, even reversed, for smaller firms. The specification in column (3) shows that the *decline* in the labor share following the reduction in the licence requirements is driven by medium sized firms, and to a lesser extent large firms.[44] Aghion et al. (2008) document the rise in production that is a result of productive firms being able to expand with the elimination of license requirements. Furthermore, they find this is only true in "pro-business" states, where labor is expected to be a smaller beneficiary of the rise in productivity. In summary, our results indicate that domestic policies to promote expansion of productive medium/large sized firms, which the previous literature documents has increased overall production, play a role in the within-firm reduction of the share of payments to labor relative to capital. Removing size constraints allows these firms to expand by becoming more capital intensive. *However, the policies to promote foreign capital work to mitigate some of that effect.*

[Table 12 about here.]

4.3 Industry Specific Mechanisms and Aggregate Impacts

To further illustrate the mechanisms through which openness can affect factor shares, we analyze the impact of the policy changes on the average real wage, the rental rate, as well as total employment and real investment at the state-industry level. These specifications are useful not only because they show how the price of labor and capital respond to policy

[44] Although the "large" interaction coefficient is negative, notice that the sum of the "License" coefficient and this coefficient is still large and positive. Large firms contribute less to the labor share decline relative to medium firms.

reforms, but also because they allow us to look at the changes in employment, which is something we cannot do at the firm level due to lack of data. Moreover, these results provide us with an estimate of the aggregate impacts of the policy reforms. In the first column of Table 13, we check the robustness of our results for the relative labor share using the ASI data. In the second and third columns, we present the results for the logarithm of real wages and the rental rates, both varying at the 3-digit NIC (1987) industry-state level. We show the response of employment to policy reforms in column (4), and conclude with the results for real investment. For all of these specifications, we include the capital and input tariffs, FDI liberalizations and delicensing reform.[45]

As in the baseline results obtained using the firm level data, we find that a reduction in the capital tariffs leads to an increase in the relative labor share at the state-industry level. Quantitatively, we find that a 1 percentage point reduction in effective capital tariffs increase the relative labor share by 1.1 percent, which is slightly lower than the 1.7 percent increase we find using the firm level data. The fact that we get a similar, albeit slightly smaller, impact using aggregate data is reassuring as it shows that the sample selection and coverage of the CMIE data are not problematic for inference. Moreover, this aggregate estimate reflects the combined effect of the *within-firm* changes in factor shares and the *reallocation* effects across firms following the liberalization. It is highly conceivable that liberalization policies changed the firm distribution in India in favor of more capital intensive firms. In particular, by making capital cheaper, lower tariff rates might have allowed more capital-intensive firms to enter the market, and have led the operating ones to grow faster than the labor-intensive firms. With these adjustments in the firm distribution, total payment to capital would have grown faster than the payments to labor, which would partly offset some of the increase in the relative labor share within firms and explain the smaller impact we obtain on the aggregate relative labor share compared to the firm-level impact in Table 7. Nevertheless, we find that the 5 percentage point reduction in the capital tariffs experienced between 1989 and 1998 led to a 5.5 percent increase in the labor share relative to capital's share of total income, suggesting that the within firm adjustments were more dominant.

When we look at the price components of the relative factor share, we find that a reduction in the capital tariffs raises both the average wage and the rental rate of capital. The results in columns (2) and (3) suggest that a 1 percentage point reduction in capital tariffs increases the average wage by 1.1 percent, compared to the 0.5 percent increase in the rental rate, which provide evidence that the return to labor rose faster than the return to capital and contributed to the increase in the relative labor share. The increase in the wages are further

[45]We estimated specifications that additionally included output tariffs. As in all our specifications, they were not significant.

indication of improvements in capital-augmenting technology (see (Acemoglu and Restrepo, 2018)), which in our model would be made possible by an increase in the variety of imported capital-goods. This increase in the variety of capital goods can also lead to an the increase in the overall rental rate of capital if firms reallocate capital towards more of the technologically advanced capital goods that are costlier. This is in fact what we observe in column (3), which suggests that the price channel of cheaper importer capital is negated by the change in composition towards more costly capital. In terms of the quantity of factors used, the results in column (4) show that capital tariffs do not have a significant impact on total employment within a particular state and industry, despite their effect on the average wage. While a reduction in capital tariffs does not seem to affect investment in column (5), when we control for industry specific time trends in the last column, we find a significant increase in total investment.[46] The weak evidence on investment suggests that reallocation towards foreign capital may be the dominant response to the reduction in capital tariffs, rather than an increase in the total volume of investment.

Unlike the firm-level results, we do not find evidence on the impact of FDI liberalization on the aggregate relative labor share. The lack of a significant result can partly be attributed a possible reallocation of factors across firms. As FDI liberalization makes it easier for foreign firms, which are more likely to be capital-intensive, to enter an industry, it can lead to a faster increase in the total use of capital compared to labor in that industry. The last two columns in Table 13 show that FDI liberalization indeed increased investment in capital. This industry expansion through capital investment could have negated the increase in the relative labor share we found *within* firms, suggesting that openness in terms of FDI did not affect the overall relative labor share. Similar to the results obtained using firm level data, we also do not find any significant effect of changes in the input tariffs. We only find a statistically significant impact of input tariffs on the average wage rate: a reduction in input tariffs increases the average wage rate.

Finally, we once again find that a reduction in the licensing requirements contributed to the decline in the labor share. The aggregate reduction of the relative labor share is slightly larger than in the firm-level specification, which suggests that reallocation magnifies the reduction in the labor share due to a policy that reduces size distortions. We do not uncover any significant effects of delicensing on the prices, employment or investment. However, the signs suggest that wages decrease while rental rates and investment increase, consistent with an increase in capital demand.

[Table 13 about here.]

[46] We find similar results to the ones we present in Table 13 when we include industry specific time-trends in columns (1)-(4).

5 Conclusion

Recent trends in factor shares worldwide have renewed interest in this topic that has potentially major implications for income inequality. With plenty of mechanisms proposed to explain the dynamics of the labor share, it is imperative to find exogenous variation in the determinants of the labor share that allow researchers to argue for causal relationships. In this paper we investigate the liberalization episode of India in the early 1990's, which provides a natural experiment with large and unexpected reforms through reduction in trade barriers and liberalized financial markets. We contribute to the literature with the first study on the effect of foreign capital on factor shares. The investigation of this relationship contributes to a broader literature that has explored how the role of capital in production, as well as automation and technical change, play a role in the observed non-stability of factor shares (Karabarbounis and Neiman, 2014; Oberfield and Raval, 2014; Eden and Gaggl, 2018). We extend a standard general equilibrium model with a production function that exhibits a constant elasticity of substitution between capital and labor by differentiating between foreign and domestic capital. Policy reforms act upon both the price of capital and the variety of foreign capital firms can access, providing us two related mechanisms through which openness can affect factor prices and non-neutral factor productivities.

Contrary to what might be expected given the reduction in the aggregate data, we find that trade reforms mostly raised the labor share in India. When we examine only changes in tariffs, but split up output, input, and capital tariffs, we find that only a reduction in the capital tariff has a significant positive effect on the share of labor in value added relative to the share of capital. The estimates imply that the observed industry-average reduction in effective capital tariffs raised the wage-to-capital expenditure ratio by 8.5 percent. The importers and the capital-intensive firms responded more substantially to the tariff changes. We also find a statistically significant increase in the wage-to-capital-expenditure ratio in response to FDI liberalization: a fully liberalized industry had an average increase in the wage-to-capital expenditure ratio equal to 11 percent. On the other hand, the domestic policy reforms we investigate – relaxing license requirements for entry and capacity enhancements plus credit expansions – have had the opposite effect on factor shares.

In analyzing aggregate state-industry level data, we find that the increase in the relative labor share following the openness reforms was accompanied with both rising wages and rental rates. The theoretical framework provides useful intuition about the mechanisms that drive these results. Overall, our results indicate that the policies to promote imported capital made a larger variety of foreign capital available, shifted the firms' capital composition towards more sophisticated equipment, and thereby enhanced the capital-augmenting

technology. Due to the complementarity between capital and labor, the increase in capital productivity raised the wage rate and contributed to a faster growth in the share of payments to labor relative to capital. At least to some degree, our results overturn the narrative that trade liberalization is a definite mechanism through which labor loses its share of total income. In fact, the aggregate trends might have been even worse for labor if the deregulatory reforms in India did not include trade and FDI liberalization. Given the proliferation of liberalization policies worldwide, this area of research provides a fruitful avenue for future research.

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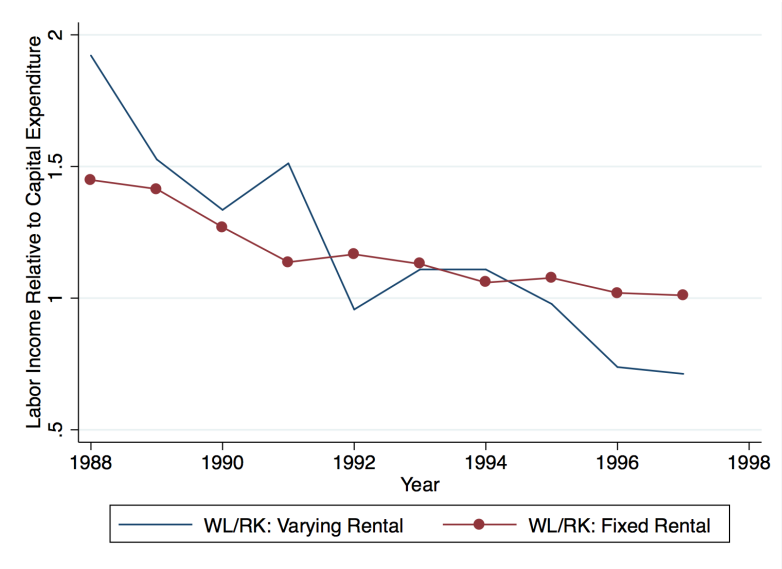
Figure 1: Labor and Capital Share in Manufacturing with ASI data

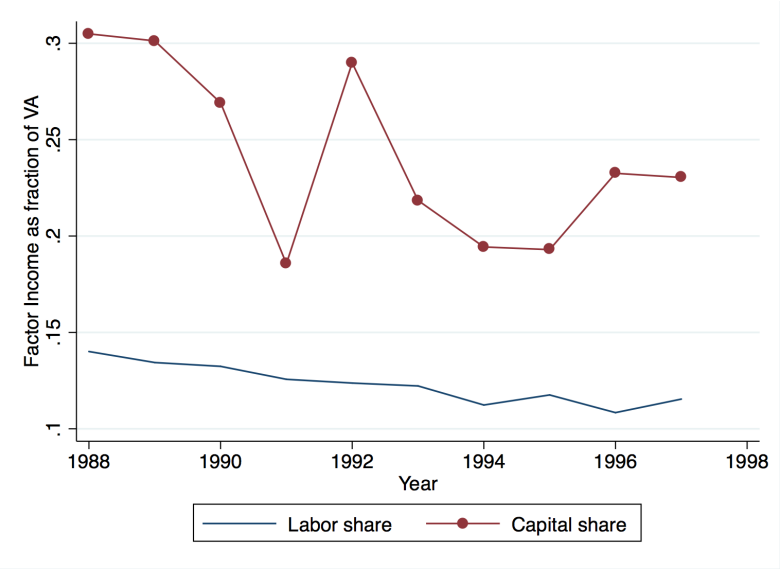
Notes: Data source is Annual Survey of Industries, which includes the Industrial sector. We construct total factor compensation and value added in the manufacturing sector as a whole by aggregating observations for each state-industry per year. Labor compensation is reported at the industry-state level by ASI, as is the value of fixed assets. To compute capital expenditure, we multiply the value of assets by the rental rate described in (18).

Figure 2: Ratio of Labor Compensation to Capital Expenditure in ASI data: Aggregate and Manufacturing



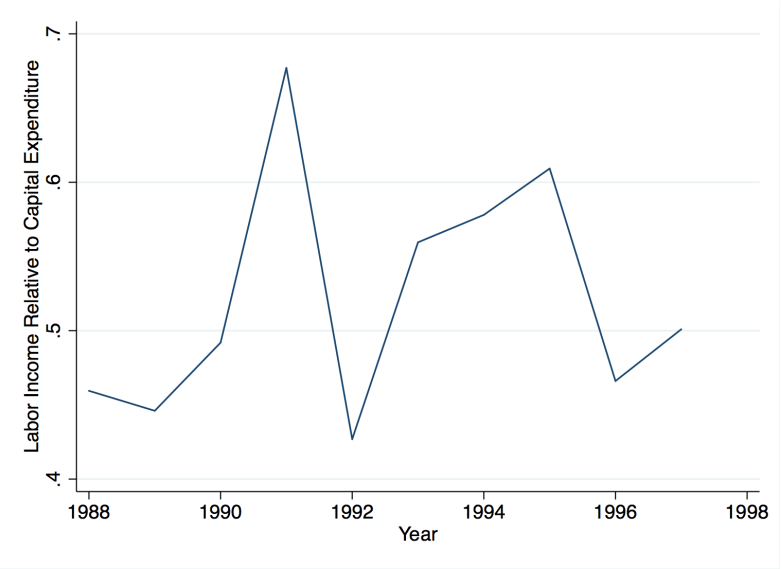
Notes: Data source is Annual Survey of Industries, which includes the Industrial sector. We construct total factor compensation in the manufacturing sector as a whole by aggregating observations for each state-industry per year. Labor compensation is reported at the industry-state level by ASI, as is the value of fixed assets. To compute capital expenditure, we multiply the value of assets by the rental rate described in (18). For the case where the rental rate is kept fixed, we take the average rental rate across all years. In this case the variation in capital expenditures over time is due only to variation in the capital stock.

Figure 3: Labor and Capital Shares with CMIE Selection of Firms



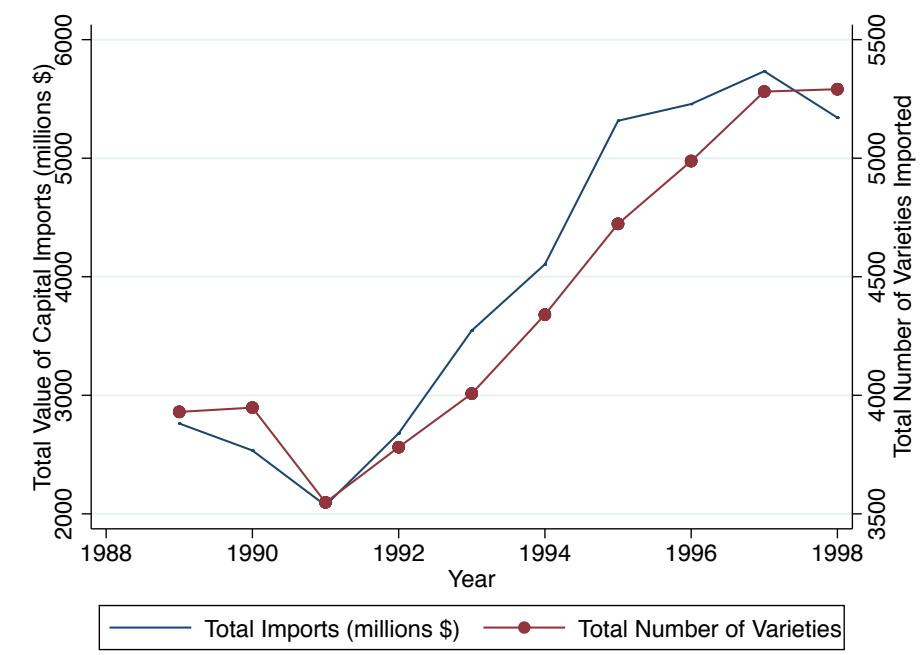
Notes: Data source is CMIE Prowess, which includes a subset of firms within the manufacturing sector. We construct total factor compensation and value added in the manufacturing sector as a whole by aggregating observations for each firm per year. To compute capital expenditure we multiply the value of assets for each firm by the rental rate described in (18).

Figure 4: Ratio of Labor Compensation to Capital Expenditure with CMIE selection of Firms



Notes: Data source is CMIE Prowess, which includes a subset of firms within the manufacturing sector. We construct total factor compensation in the manufacturing sector as a whole by aggregating observations for each firm per year. To compute capital expenditure we multiply the value of assets for each firm by the rental rate described in (18).

Figure 5: Capital Imports from Top Capital-Exporting Countries: Value of Imports and Number of Products



Notes: This figure displays the total value of imports and the total number of HS6 products imported by India, allowing only for capital goods from the top 10 capital-exporting countries. Trade values are in millions of US Dollars (left axis). The right axis is a measure of varieties imported. We count a "variety" as a unique HS6 good-origin country combination. To construct variety, we eliminate China and Germany. Although we attempt to use a consistent classification across years, there is a possibility for an upward bias during the revision years of 1992 and 1996. This does not appear to have a large effect on the results however. Data source for the trade data is UN Comtrade. Capital goods are classified using the end-use classification of the US Census.

Table 1: Trading partner share of total imported capital

Rank	Trading Partner	Imported Capital (Percent of Total)
1	U.S.	20.14
2	Japan	16.80
3	Germany	16.73
4	U.K.	6.60
5	Singapore	4.98
6	France	4.96
7	Italy	4.63
8	Switzerland	3.10
9	Korea	2.18
10	Taiwan	1.91
	All Other	17.98
	Total	100.00

Notes: The data on trading partner share of total imported capital goods are from the World Bank Trade, Production and Protection database. The percentage of total capital goods imports is an average over the sample period from 1990 to 1997.

Table 2: Policy Variables: Averages over time

	Output Tariff	SD Output	Capital Tariff	SD Capital	Input Tariff	SD Input	FDI Liberalization	Delicensing
1989	98.9	36.7	7.01	8.86	52.0	16.0	0	0.35
1990	96.4	37.8	6.90	8.77	51.7	16.0	0	0.34
1991	86.4	37.2	5.56	7.67	43.5	14.1	0	0.34
1992	88.2	36.3	5.97	8.06	44.3	16.0	0.39	0.14
1993	61.3	30.4	3.91	5.40	30.4	10.5	0.38	0.14
1994	81.4	35.7	4.97	7.05	45.1	12.5	0.39	0.12
1995	61.1	37.5	3.70	5.49	30.9	9.13	0.40	0.12
1996	47.0	28.1	2.79	3.99	24.6	6.83	0.42	0.12
1997	42.2	27.5	2.70	3.93	18.9	6.67	0.45	0.11
1998	34.2	21.4	2.10	3.04	15.9	5.45	0.45	0.081

Notes: Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), and we take the simple average at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table following equation 17.

Table 3: Categories of Capital Goods

Capital Type	ISIC (Rev 2)	Description	Percentage of total capital imports	Real import values		Tariff rates	
				1990	1997	1990	1997
Fabricated Metal Products	381	Cutlery,hand tools,general hardware,structural metal products, furniture and fixtures primarily of metal	4.22	342	374	84.33	33.14
Machinery Except Electrical	382	Engines & turbines, agricultural machinery & equipment, metal & wood working machines, special industrial machinery & equipment except metal & wood working, office, computing & accounting machinery.	49.54	3,990	4,840	76.81	21.78
Electrical Machinery Radio,Television, & Communication Equipment	383	Electrical industrial machinery & apparatus, radio,television,communication equipment & apparatus, electrical appliances & house-ware	20.94	1,794	1,908	90.42	33.46
Transport Equipment	384	Ship building & repairing,railroad equipment, motor vehicles, motorcycles&bicycles, aircraft	16.49	1,644	1,116	65.72	30.43
Professional Goods	385	Measuring&controlling equipment, photographic & optimal goods, watches & clocks.	8.80	904	747	100	36.92

Notes: The data on imported capital good categories are from the World Bank Trade, Production and Protection database. The categories are at the 3 digit ISIC level. Average percentages of total (over the sample period from 1990 to 1997) capital goods imports are reported. Real import values are in units of millions of USD. Tariff rates are the averages of the corresponding 3 digit 1987 NIC categories.

Table 4: Number of HS6 products imported by partner country

	USA	France	Italy	Japan	Korea	Singapore	Switzerland	UK	Germany	China
1989	650	464	463	604	243	435	449	622	.	64
1990	654	452	471	624	243	444	458	602	.	52
1991	611	410	405	558	204	400	409	551	631	32
1992	642	428	458	583	232	427	423	588	667	191
1993	676	438	490	600	272	453	436	642	678	275
1994	716	475	557	610	313	528	490	651	710	349
1995	747	530	602	648	392	563	544	697	736	420
1996	804	546	655	708	437	595	519	724	787	491
1997	835	593	680	743	491	613	559	767	801	530
1998	821	610	675	749	535	626	552	723	801	551

Notes: This table displays the total number of products imported from each partner country, allowing only for capital goods from the top 10 capital-exporting countries. A unique "product" is identified through its HS6 product code. Data source for the trade data is UN Comtrade. Capital goods are classified using the end-use classification of the US Census.

Table 5: US exports of ATP to India Post Liberalization

	US Log Export Value			Number of High-Tech Products
	(1)	(2)	(No 1992)	(4)
India=1*Year≥1993	0.738***		0.636***	32.513***
	(0.069)		(0.073)	(1.552)
India=1*Year≥1994		0.390***		
		(0.067)		
Fixed Effects	Year, Country	Year, Country	Year, Country	Year, Country
# Observations	2003	2003	1802	2003

Notes: This table displays regression results for specification 19. In the first three columns, the outcome measure is log US exports of ATP products by destination-year. To compute this measure we condition on ATP products and aggregate product-destination-year data across all products. The last column replaces the export value with the number of HS10 products to each destination-year. The interaction variable is a product of two dummies: a dummy for the destination being India, and a dummy for years 1993 and later. In column (2) the $PostLib$ dummy is for years 1994 and later. Destination and year fixed effects are included in every specification. Standard errors are clustered at the destination level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 6: Identification of σ: State Cross-Section Variation in Wages

	Labor Compensation/Capital Expenditures		
	(All Years)	(1991-1992)	(1996-1997)
Average Wages (ASI)	0.115**	0.254***	0.057
	(0.053)	(0.077)	(0.063)
Capital importer	-0.255***	-0.264***	-0.187***
	(0.024)	(0.049)	(0.052)
exporter	0.145***	0.180***	0.108*
	(0.035)	(0.052)	(0.058)
Markup	0.157***	0.087	0.152**
	(0.052)	(0.095)	(0.067)
Materials importer	0.045	-0.136**	0.084
	(0.046)	(0.065)	(0.051)
Debt/Equity	-0.001***	-0.009*	-0.004
	(0.001)	(0.006)	(0.003)
Fixed Effects	Industry-Year	Industry	Industry
R^2	0.441	0.434	0.392
N	18892	1602	2564

Notes: This table displays results based on specification 21, a cross-section identification of the elasticity of substitution between capital and labor. The outcome in all columns is the relative factor share of labor relative to capital. The first column uses all years of data and includes industry-year fixed effects. In the last two columns we include only one year of data – 1991-91 and 1997-98 respectively – and include industry fixed effects. In all columns we include the following firm controls: dummy for exporter, capital importer, and intermediates importer, plus the firm markup and debt to equity ratio. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 7: Relative Factor Shares and Liberalization Policies:

	Labor Compensation/Capital Expenditures				
	(1)	(2)	(3)	(4)	(5)
Capital Tariffs	-0.017***		-0.015***	-0.015***	-0.017***
	(0.004)		(0.004)	(0.004)	(0.004)
Output Tariffs	0.001				
	(0.001)				
Input Tariffs	-0.002				
	(0.002)				
FDI Liberalization		0.113**	0.096*	0.094*	0.108*
		(0.052)	(0.056)	(0.055)	(0.064)
Delicensing		0.100**	0.112***	0.108***	0.089*
		(0.051)	(0.041)	(0.040)	(0.051)
Average Wages (ASI)				0.069**	
				(0.030)	
State Credit/GDP					-0.229*
					(0.125)
Fixed Effects	Firm,State-Year	Firm,State-Year	Firm,State-Year	Firm,State-Year	Firm, State, Year
R^2	0.888	0.888	0.889	0.889	0.885
N	18802	18802	18802	18802	18761

Notes: This table displays the main results on the estimation of (20). In all cases the outcome measure is the log of labor share to capital share ratio. The first column includes only tariff policy reforms, the second column includes only FDI and delicensing reforms, and the third column pools these reforms but eliminates input and capital tariffs. The fourth column includes state-industry wages, and the fifth column includes a state-level measure of credit. The outcome variable for all columns is the log of relative factor shares. Columns (1)-(4) include firm and state-year interacted fixed effects, plus a control for firm age. Column (5) replaces state-year fixed effects with separate state and year fixed effects. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), averaged at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 8: Labor Share, Mark-up and Liberalization Policies:

	Labor Compensation/Capital Expenditures	Lshare-Markup Adjusted	Lshare	Mark-up
	(1)	(2)	(3)	(4)
Capital Tariffs	-0.016***	-0.008***	-0.006*	-0.002
	(0.004)	(0.002)	(0.003)	(0.002)
FDI Liberalization	0.084	0.054*	0.053	0.006
	(0.054)	(0.027)	(0.035)	(0.020)
Delicensing	0.106***	0.071***	0.070**	-0.009
	(0.040)	(0.018)	(0.031)	(0.013)
Fixed Effects	Firm,State-Year	Firm,State-Year	Firm,State-Year	Firm,State-Year
R^2	0.904	0.832	0.860	0.548
N	17335	17335	17334	17335

Notes: This table displays the results on the estimation of (20) on the log of labor share and the log of firm's mark-up. The outcome measure in the first column is the same as in the previous table. The outcome variable in the second column is the mark-up adjusted labor share as defined in the text. In the third and the fourth columns the outcome variables are the log of the labor share and the log of firm's mark-up. All columns include firm and state-year interacted fixed effects, plus a control for firm age. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), and we take the simple average at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 9: Relative Factor Shares and Liberalization Policies: Long-differences

	Δ(wL/rK)		
	(1)	(2)	(3)
Δ FDI	0.190**		0.133
	(0.091)		(0.091)
Δ Lic	0.100		0.152
	(0.107)		(0.097)
Δ CapT		-0.025***	-0.022***
		(0.005)	(0.006)
Δ IntT		-0.005	
		(0.003)	
Δ OutT		-0.001	
		(0.001)	
Fixed Effects	State	State	State
R^2	0.068	0.086	0.090
N	1052	1052	1052

Notes: This table displays the results for a long-differences specification. The outcome and regressors are long-differences, which are the value in 1997-98 relative to 1989-90. Policy variables are all aggregated to the 3-digit NIC (1987) classification in each year before taking differences. All columns include only state fixed effects since this analysis is cross-sectional. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), averaged at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 10: Policy and Firm Interactions: Importing

	Labor Compensation/Capital Expenditures			Importer Dummy
	(1)	(2)	(3)	(4)
Capital Tariffs	-0.006	-0.006	-0.013***	-0.005**
	(0.007)	(0.007)	(0.004)	(0.002)
Input Tariffs	-0.002			-0.000
	(0.002)			(0.001)
FDI Liberalization	0.132*	0.144**	0.089	-0.031
	(0.068)	(0.068)	(0.055)	(0.019)
Delicensing	0.115***	0.114***	0.110***	0.017
	(0.039)	(0.041)	(0.041)	(0.014)
CapT*Kimporter	-0.013**	-0.011*		
	(0.006)	(0.006)		
InpT*Kimporter	0.001			
	(0.001)			
FDI*Kimporter	-0.049	-0.065*		
	(0.041)	(0.037)		
CapT*Firm Imports			-0.021**	
			(0.009)	
FDI*Firm Imports			0.055*	
			(0.028)	
Fixed Effects	Firm,State-Year	Firm,State-Year	Firm,State-Year	Firm,State-Year
R^2	0.889	0.889	0.889	0.618
N	18802	18802	18796	18802

Notes: This table interacts the policy reforms with firm-specific characteristics. In the first two columns the characteristic is being a capital importer, captured by a dummy equal to one if a firm imports capital in any year of the sample. In the third column the firm characteristic is its import share in total capital and materials expenditures. The outcome in the first three columns is the log of the relative factor share.In the fourth column the outcome is an import dummy for firm-year observations. All columns include firm and state-year interacted fixed effects, plus a control for firm age. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs, as well as FDI and Delicensing regulation indices, are taken from Topalova and Khandelwal (2011) and Topaloval (2010), averaged at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 11: Policy and Firm Interactions: Productive Capacity and Borrowing

	Labor Compensation/Capital Expenditures			
	(1)	(2)	(3)	(4)
Capital Tariffs	-0.001	-0.015***	-0.013***	-0.013***
	(0.006)	(0.004)	(0.004)	(0.004)
FDI Liberalization	-0.104**	0.097*	0.102*	0.089
	(0.050)	(0.056)	(0.057)	(0.055)
Delicensing	0.099*	0.111***	0.110***	0.114***
	(0.052)	(0.041)	(0.040)	(0.040)
CapT*Kintensity	-0.014***			
	(0.004)			
FDI*Kintensity	0.185***			
	(0.030)			
CapT*R&D/Sales		0.334		
		(0.329)		
FDI*R&D/Sales		0.809*		
		(0.472)		
CapT*Foreign			-0.016***	
			(0.006)	
FDI*Foreign			-0.054	
			(0.052)	
CapT*Debt/Equity				-0.001***
				(0.000)
FDI*Debt/Equity				0.003**
				(0.001)
Fixed Effects	Firm,State-Year	Firm,State-Year	Firm,State-Year	Firm,State-Year
R^2	0.891	0.889	0.889	0.889
N	17628	18776	18802	18802

Notes: This table interacts the policy reforms with firm-specific characteristics. These characteristics by column are: capital intensity, research and development relative to sales, a dummy for foreign ownership, and debt to equity ratio. Firms are categorized into these categories during their first year in the sample. All columns include firm and state-year interacted fixed effects, plus a control for firm age. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), averaged at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 12: Policy and Firm Interactions: Firm Size

	Labor Compensation/Capital Expenditures		
	(1)	(2)	(3)
Capital Tariffs	-0.009	-0.015***	-0.015***
	(0.006)	(0.004)	(0.004)
FDI Liberalization	0.097*	0.022	0.098*
	(0.056)	(0.060)	(0.056)
Delicensing	0.107***	0.109***	0.198***
	(0.040)	(0.041)	(0.059)
CapT*Small	-0.014**		
	(0.006)		
CapT*Large	-0.004		
	(0.004)		
FDI*Small		0.178***	
		(0.058)	
FDI*Large		0.035	
		(0.040)	
DeLic*Small			-0.167***
			(0.050)
DeLic*Large			-0.089*
			(0.054)
Fixed Effects	Firm,State-Year	Firm,State-Year	Firm,State-Year
R^2	0.889	0.889	0.889
N	18802	18802	18802

Notes: This table interacts the policy reforms with a firm size categorical variable. Firms are split into three bins, so that the size measure equals 1, 2, or 3 for small, medium, and large firms respectively. Each of the three columns interact a separate policy measure with the size bins. All columns include firm and state-year interacted fixed effects, plus a control for firm age. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), averaged at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 13: Industry level outcome measures

	Log $\left(\frac{s_L}{s_K}\right)$	Log wage	Log rental rate	Log employment	Investment	Investment
	(1)	(2)	(3)	(4)	(5)	(6)
Capital Tariffs	-0.011**	-0.011***	-0.005**	0.001	0.002	-0.004***
	(0.005)	(0.002)	(0.002)	(0.004)	(0.002)	(0.001)
Input Tariffs	0.002	-0.003***	-0.001	-0.002	-0.002	-0.001
	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
FDI Liberalization	-0.010	0.005	0.003	-0.023	0.064**	0.047**
	(0.047)	(0.020)	(0.027)	(0.042)	(0.027)	(0.020)
Delicensing	0.127***	0.033	-0.038	0.054	-0.021	-0.008
	(0.037)	(0.022)	(0.032)	(0.035)	(0.016)	(0.012)
Fixed Effects	Industry, State-Year	Industry, State-Year	Industry, State-Year	Industry, State-Year	Industry, State-Year	Industry, State-Year
Observations	13,726	13,726	13,726	13,726	13,726	13,726
R-squared	0.763	0.777	0.647	0.665	0.273	0.285

Notes: This table displays the response of factor shares, factor prices, and factor quantities at the industry level. The dependent variables vary at the 3-digit NIC (1987) industry-state-year level and are obtained from the ASI data. Policy reforms are identical to those in the firm-level analysis. All columns include industry and state-year interacted fixed effects. The last column additionally includes industry specific trends. Every regression is weighted with the number of factories in the state-industry-year observation (also reported by ASI). Policy variables are all aggregated to the 3-digit NIC (1987) classification. FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), averaged at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

6 Appendix

6.1 Factor Shares in KLEMS Data

This is the most aggregate available data that allows us to explore the labor share in India's economy as a whole, as well as in the manufacturing sector alone. The World KLEMS initiative provides the necessary data at the broad industry level (26 total industries). Figure 6 illustrates aggregate and manufacturing labor shares from 1980 to 2009. Total value added and labor share of value added is reported at the industry level by KLEMS. We use that data to construct implied labor compensation in each industry, then aggregate those to get total labor income and total value added in India.[47] We do the same for only manufacturing industries and report the labor share in manufacturing and non-manufacturing only. Finally, we also report the manufacturing share of value added.

Figure 6 suggests that the decline in the labor share is pervasive in the whole economy, although the drop is greater and starts earlier in the manufacturing sector. In the economy as a whole, the labor share is mostly constant until 1992, and then starts to drop. It drops from about 52% to 47% in 2000, then drops another couple of percentage points in the next 10 years. The non-manufacturing sector follows an almost identical pattern, which comes from the fact that manufacturing makes up only around one-sixth of the economy. In the manufacturing sector, the labor share drops from 46% to 42% before 1992, and then drops sharply to around 36% by 2000. It then drops to about 33% by 2009. Finally, the share of manufacturing in the economy is constant, hovering mostly around 16%. Given the nature of the firm data (survey of industries), and the emphasis on trade liberalization, we focus on the manufacturing sector. Although there does seem to be a negative pre-trend in the labor share, we leverage the difference-in-difference empirical strategy with various fixed effects to attempt to tease out the contributions of the liberalization policies themselves to the movements in the labor share.

[Figure 6 about here.]

[47] Although the construction of the dataset does assume that labor share plus capital share equal to one, the capital share itself is constructed such that they sum to one. The labor income is actually measured in the data, so that it makes sense to use the labor share of total value added. For this reason it is not useful to measure the expenditure on labor relative to the expenditure on capital.

6.2 Correlation between the policy measures

The results in Table 7 show that the effects of FDI are slightly diminished when we include the capital tariffs as well. Therefore, we investigate the correlation of the policy implementation in Table 14. We regress FDI liberalization on the other policy variables (as well as the same controls and fixed effects) in order to explain why the effect on FDI is reduced when we include capital tariffs in the specification. In both columns, with different sets of fixed effects, there is a strong correlation between industries that lower capital and input tariffs, and also liberalize FDI. Evidently, the effect of these policies is moving the wage-to-capital-expenditure ratio in the same direction. However, it is still reassuring that in the industries with less collinearity of these policy implementations, FDI moves the wage-to-capital ratio in the expected direction. There is no evidence that the reduction in output tariffs and delicensing is happening in these same industries.

[Table 14 about here.]

6.3 Robustness

We outline an event-study type of analysis that allows us to visualize the effect of reform on relative factor shares over time. We stress that we prefer the main specification, which follows the rest of the literature that captures the magnitudes of the reforms, as well as their variation across years. The following is a further robustness check that is useful to visualize the lack of any pre-trends in factor shares.

The method is as follows: for each 3-digit industry, we replace the $Reform_{jt}$ measure with a time-invariant dummy equal to one if the industry can be counted as "liberalized" by the end of the time period. Each industry will have a 0 or 1 for *every year*. We do this separately for the three main deregulation measures. This is straightforward to construct for FDI, as we label an industry as "deregulated" if the FDI liberalization measure is equal to 1 in 1997-98 (and was not deregulated in 1988).[48] For capital tariffs, we label an industry as "deregulated" if its effective capital tariff drops at least 1.65 percentage points (the median across all industries), and for delicensing we count firms whose index drops by at least 0.5 (since many industries start at a value below one).[49] Finally, we run the following

[48]Still, we lose a lot of variation as some industries might deregulate gradually. For example, the FDI measure can increase from 0 to 0.25, to 0.5 to 1, over the sample period. *More* than a majority of industries liberalize FDI during this time, but there is no clear way to try to separate this in a way where we split the number of industries in two.

[49]Still, only 40% of the sample has been "delicensed" under this definition.

specification:

$$\ln\left(\frac{s^L_{ijst}}{s^K_{ijst}}\right) = \alpha_i + \alpha_{st} + (1-\sigma)ln\left(Wage^{ASI}_{jst}\right) + \sum_{t=1988}^{t=1997} \gamma_t ReformDummy_j * year_t + \mu_{ijst}, \tag{22}$$

where $ReformDummy_j$ is time-invariant and equal to one for industries that we count as "deregulated" by the end of the period, and it is interacted with year dummies for each year of the sample. This allows us to plot the set of $\{\gamma_t\}$ over time, which can be interpreted as the reform's effect of the labor share in that year, relative to the effect in 1992 (the dropped year dummy). Given the results in Table 7, we expect γ to be positive for capital tariffs and FDI after 1992, and negative for delicensing, with no clear trend before then.

Figure 7 plots the coefficients over time for each reform, with capital tariffs on the top figure, FDI reform in the middle, and delicensing on the bottom. As expected, the results are quite noisy, but there are a couple of takeaways. First, in all cases there does not appear to be any trend in the labor share before 1992 (which is dropped, and is also the year before India implements its reforms as shown in Table 2). Although we have cited a large literature that argues for the exogeneity of these reforms, this visualization provides a nice confirmation with respect to the labor share as the outcome. Second, there is a clear increase in the coefficients after 1992 for capital tariffs and FDI, and a reduction for delicensing. This confirms the results above that found that firms raised their labor share on average in response to FDI reform and lower capital tariffs, but that they lowered the relative labor share in response to lower licensing requirements. Finally, there is also some evidence that these grow over time, especially in the case of capital tariffs. Again, the standard errors are large as we try to exploit variation only across a cross-section of industries, but the coefficients do mostly increase starting in 1993 and continue to do so especially for capital tariffs, though seemingly not at all for delicensing.

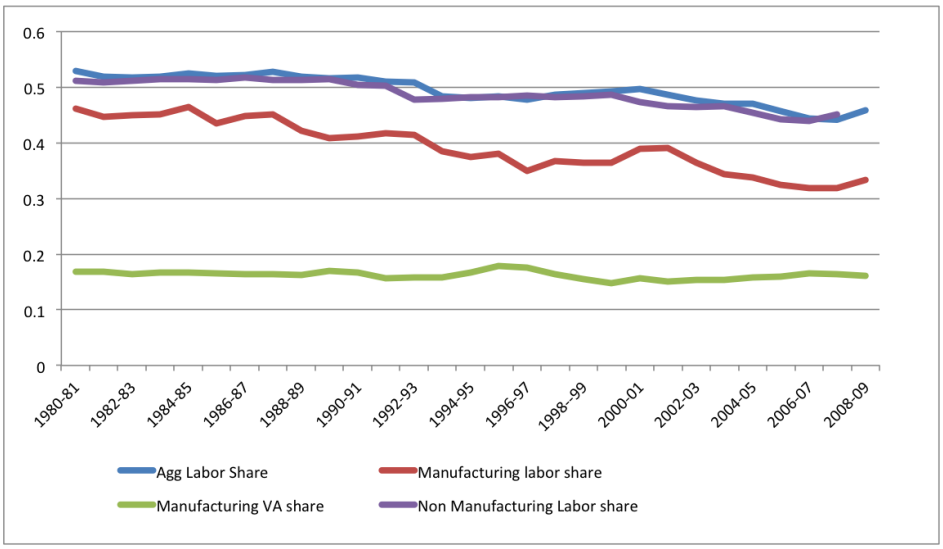
[Figure 7 about here.]

6.4 Subsamples: Importers and non-importers

[Table 15 about here.]

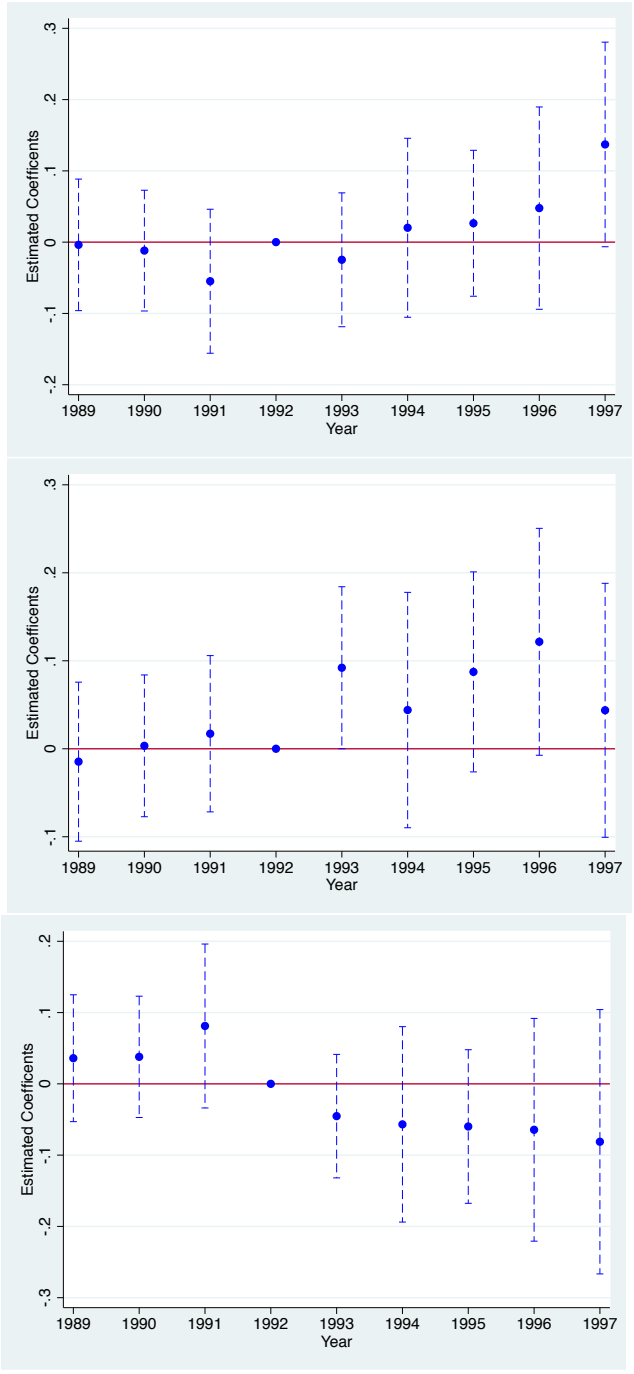
[Table 16 about here.]

Figure 6: Labor Share in India using KLEMS data: Aggregate and Manufacturing



Data source is the KLEMS World Initiative.

Figure 7: Reform Dummies Interacted With each Year



Notes: Each figure plots the γ's estimated from specification (22). In the top figure, the reform measure is the capital tariff, the middle figure plots the effect of FDI liberalization over time, and the bottom figure plots the delicensing deregulation. The reform dummy is time-invariant and equal to 1 for all years in the industries that can be counted as "deregulated". For FDI, we label an industry as "deregulated" if the FDI liberalization measure is equal to 1 in 1997-98 (and was not deregulated in 1988). For capital tariffs, we label an industry as "deregulated" if its effective capital tariff drops at least 1.65 percentage points (the median across all industries). In the case of delicensing, the index must drop at least 0.5 points for the industry between 1988 and 1997.

Table 14: Correlation of Policy Measures

	FDI Liberal.	
	(1)	(2)
Capital Tariffs	-0.011***	-0.012***
	(0.004)	(0.004)
Output Tariffs	0.001	0.001
	(0.001)	(0.001)
Input Tariffs	-0.004**	-0.004**
	(0.002)	(0.002)
Delicensing	0.027	0.037
	(0.083)	(0.093)
State Credit/GDP		0.077
		(0.051)
Fixed Effects	Firm,State-Year	Firm, State, Year
R^2	0.878	0.872
N	18802	18761

Notes: All columns include firm and state-year interacted fixed effects, plus a control for firm age. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), and we take the simple average at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 15: Firm characteristics with subsamples

	Labor Compensation/Capital Expenditures			
	Importer	Non-Importer	Importer	Non-Importer
Capital Tariffs	-0.001	0.004	-0.015***	-0.002
	(0.004)	(0.013)	(0.004)	(0.007)
FDI Liberalization	-0.085	-0.139	0.106**	0.066
	(0.052)	(0.085)	(0.050)	(0.086)
Delicensing	0.099*	0.107*	0.118***	0.118*
	(0.057)	(0.064)	(0.042)	(0.061)
CapT*Kintensity	-0.016***	-0.007		
	(0.003)	(0.008)		
FDI*Kintensity	0.171***	0.235***		
	(0.028)	(0.054)		
CapT*Debt/Equity			-0.001***	-0.000
			(0.000)	(0.001)
FDI*Debt/Equity			0.000	0.007***
			(0.002)	(0.002)
Fixed Effects	Firm,State-Year	Firm,State-Year	Firm,State-Year	Firm,State-Year
R^2	0.890	0.896	0.886	0.896
N	10566	7044	11415	7376

Notes: In this table we repeat the interactions of policy reforms with firm capital intensity and debt/equity ratio (from Table 11), but separately for importers and non-importers. A firm is categorized as an importer if it imports in any of the years. All columns include firm and state-year interacted fixed effects, plus a control for firm age. Policy variables are all aggregated to the 3-digit NIC (1987) classification. Output tariffs as well as FDI and De-licensing regulation indices are taken from Topalova and Khandelwal (2011) and Topaloval (2010), and we take the simple average at the 3 digit level. Capital and input tariffs are calculated using output tariffs and the 1993-1994 input-output table. Standard errors are clustered at the 3-digit NIC industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 16: Firm Productivity and Importing

	Labor Productivity (Y/L)			
	(Across Firms)	(Across Firms)	(Within Firms)	(Within Firms)
Capital-Importer Ever	0.168***			
	(0.042)			
Materials-Importer Ever		0.102*		
		(0.056)		
Capital-Importer by Year			0.058***	
			(0.012)	
Materials-Importer by Year				0.103***
				(0.015)
Fixed Effects	Industry,State-Year	Industry,State-Year	Firm,State-Year	Firm,State-Year
R^2	0.593	0.590	0.908	0.908
N	18967	18967	18518	18518

Notes: This table tests the productivity response from importing. The first two columns display a cross-section specification where the regressors include dummies for firms that import capital (column 1) and materials (2) *in any year*. The first two columns include industry and state-year fixed effects. The latter two columns display a fixed effects panel specification where the regressors include a dummy for importing capital (3) and materials (4) in year t. The last two columns include firm and state-industry fixed effects. In all cases we include a control for firm age, and we add controls for whether the firm is an exporter and a measure of firm markups. Standard errors are clustered at the 3-digit NIC industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.