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Labor market effects of exporter pricing behavior: Evidence from a developing economy[☆,☆☆]

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ABSTRACT

Despite an extensive literature on exporter pricing behavior, the labor market consequences of exchange rate changes remain relatively under-studied. Using product-level trade data from India, we document incomplete exchange rate pass-through to traded goods prices, suggesting potential adjustments through both output and input markets. Motivated by this, we estimate the effects of currency depreciation on product market power (markup), labor market power (markdown), and overall market power using plant-level data. We find that currency depreciation benefits workers in exporting firms by raising wages toward competitive levels, with stronger effects for managerial than non-managerial workers. Although exporters experience higher markup due to local currency depreciation, a substantial decline in markdown leads to an overall reduction in combined market power. We exploit exogenous exchange rate variations along with historical export shares to address endogeneity concerns. The above findings introduce a novel distributional dimension to the exchange rate pass-through literature.

1. Introduction

Exchange rate pass-through (ERPT) is one of the most extensively researched issues in international macroeconomics, focusing mostly on pass-through to prices. The observed pass-through of exchange rate changes to traded goods prices has been overwhelmingly shown to be incomplete due to sluggish price adjustment driven by markup adjustment by exporters following changes in costs or movements in their currency (Feenstra, 1989; Campa and Goldberg, 2005; Mallick and Marques, 2008; Bergin and Feenstra, 2009; Nakamura and Zerom, 2010; Gopinath et al., 2010; Mallick and Marques, 2012; Burstein and Gopinath, 2014; Amiti et al., 2014; Gopinath et al., 2020; Chen et al., 2022).[1] This literature has extensively documented that exchange rate changes are, at best, weakly associated with changes in traded goods prices at the consumer level (Devereux and Engel, 2002; Devereux and Yetman, 2003; Auer and Chaney, 2009). It has been shown that ERPT is largely symmetric: exporters tend to absorb appreciations of their currency through downward price adjustment while they tend to increase prices following depreciation of their currency (Mallick and Marques, 2017, 2010). Although the relation between exchange rate changes and markup adjustment, i.e. product market power has been explored extensively, its implications for adjustment in markdown, i.e. labor market power and combined market power, are not established.[2] A recent literature (Brooks et al., 2021a,b; Yeh et al., 2022)

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[1] The regression of product prices (USD) on bilateral Rupee/USD exchange rate suggests significant but incomplete pass-through in India. Mallick and Marques (2008, 2006) also found incomplete pass-through for India in the post-liberalization period; further, we find heterogeneity in pass-through. The pass-through to export prices is lower compared to import prices. These results are given in Appendix A.

[2] It is important to mention that markup is the same as market power in the absence of input market power only.

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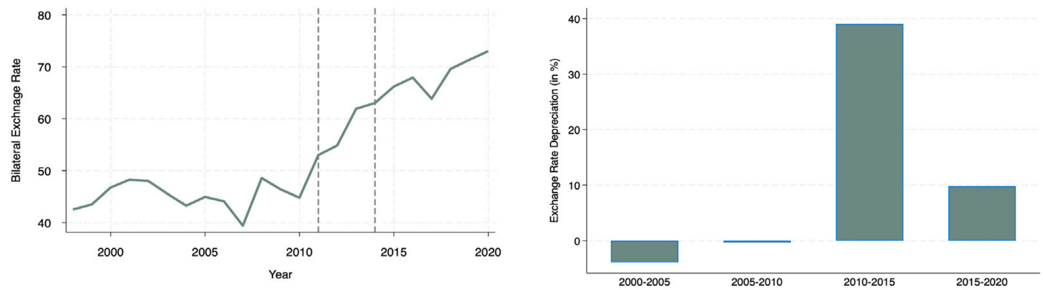


(a) Bilateral Exchange Rate (b) Exchange Rate Depreciation

Fig. 1. Bilateral exchange rate is Rupee/USD.

suggests that firms enjoy significant market power in input markets, and hence it is important to understand the effect of exchange rate changes on exporters combined market power considering both these sources: product- and input-market power.

In this paper, we examine the impact of exchange rate changes on exporters' product market power (markup), labor market power (markdown), and combined market power.[3] Fig. 1(a) shows the bilateral exchange rate (Rupee/USD) for India. As we can see from Fig. 1(b), in 2010s the bilateral exchange rate depreciated significantly and before that in 2000s, it was appreciating, giving us useful variation to capture the effects. We employ a very detailed plant-level dataset from India widely used in empirical studies, such as Hsieh and Klenow (2009) and Bertrand et al. (2025). This dataset provides comprehensive information on plant characteristics, including exports and the use of imported inputs.

We calculate markup as the ratio of price to marginal cost, using the method proposed by Loecker and Warzynski (2012) and De Loecker et al. (2020). Markdown, defined as the ratio of competitive wages to actual wages, is estimated following Brooks et al. (2021a,b), based on the assumption that firms hold market power in the labor market. Both markup and markdown estimations require a flexible input that is not subject to market power. In the existing literature, this input is typically materials. The plant-level markup is calculated as the ratio of the elasticity of output with material to the material share in revenue. Similarly, the labor markdown is derived as the product of the ratio of labor to material elasticities and the ratio of material to labor share in revenue. We show that with the assumption that firm is a price taker in the material input market, and labor is the only input with market power, the combined market power is the ratio of elasticity of output with labor and labor share in revenue.

Further, we argue that temporal variations in markup, markdown and combined market power are driven by changes in the material share, ratio of material to labor share, and labor share respectively. De Ridder et al. (2026) argue that even in the case of unobserved prices the temporal variation in markup is similar to the true markup. This is not surprising, given that the temporal variation is primarily driven by the material share. Given the challenges in obtaining precise estimates of elasticities due to unobserved prices and productivity at the plant level (Bond et al., 2021; Gandhi et al., 2020), we estimate the effects of exchange rate shocks on markup, markdown and combined market power using material share, ratio of material to labor share, and labor share respectively. We use a wide range of variables to control for elasticities as suggested by Bond et al. (2021), which allows for a more flexible technology instead of estimating the elasticities at two-digit industry level as in De Loecker et al. (2020).[4] The approach used in this paper implies that the percentage change in markup equals the negative percentage change in material share (flexible and price-taking input), the percentage change in markdown equals the percentage change in the ratio of material to labor share (input with market power), and the percentage change in overall market power equals the negative percentage change in labor share, as we show in Section 3. The flexibility of the framework allows for the estimation of these effects using different types of flexible inputs, such as fuel share, instead of material share. Further, this also allows for comparing the effect on different types of labor such as managerial and non-managerial by using their respective shares instead of labor share.

The baseline regression results indicate that exchange rate depreciation reduces markdown, increases markup, and decreases overall market power, primarily driven by a substantial decline in labor market power. Although the reduction in markdown and the increase in markup are more pronounced for exporters, they still experience a decline in overall market power due to the significant drop in labor market power. Hence, we argue that understanding their labor market consequences is important for estimating the effect of exchange rate changes on market power of exporters. The main coefficient of interest in this paper is the interaction between export share and exchange rate, which gives the effect of exchange rate depreciation on exporters' markup, markdown, and market power. This coefficient is prone to endogeneity issues related to both variables. The exchange rate may fluctuate for various reasons that cannot be fully controlled in this regression, and these factors may also influence different components of market power, leading to omitted variable bias. Although reverse causality between exchange rate movements and market power is likely to be less problematic, it cannot be entirely ruled out. In contrast, for export shares, both omitted variable bias and reverse causality pose more serious endogeneity concerns, as changes in market power can directly affect a plant's export performance. To deal with endogeneity of exchange rate, we obtain exogenous exchange rate shocks using a structural vector autoregression (SVAR) model with short- and long-run zero restrictions as well as sign restrictions. We impose minimal theoretical restrictions and identify demand, supply, monetary policy, exchange rate, global persistent, and global transitory shocks. The identified exchange rate shock explains around 20% of the forecast-error variance in the exchange rate. Furthermore, the historical decomposition of exchange rate depreciation suggests that the identified exchange rate shock aligns well with the major historical events.

However, the endogeneity of export shares still remains, which we address through two approaches. First, we use the historical average export share at the two-digit industry level as an instrumental variable for the export share of plants within that industry. We demonstrate that these historical averages are persistent and serve as a highly

[3] To the best of our knowledge this paper is the first to estimate these effects of exchange rate changes in a unified way.

[4] For example, if we assume that elasticities are plant specific and remain constant over time, they can be absorbed by plant fixed effects, which is much better than estimating elasticities at two-digit level. Moreover, additional plant-level and sector level controls with year fixed effects allow elasticities to be plant specific and vary overtime.

relevant instrument. Combining these two, we use historical average of industry export share and its interaction with exchange rate shock as instrumental variables for two endogenous variables, i.e. export share and its interaction with exchange rate. This instrumental variable approach yields similar results, albeit with higher magnitudes, confirming that the reduction in markdown and increase in markup are greater for exporters. However, exporters still experience a decline in market power due to a substantial reduction in labor market power. Second, we use historical export shares of plants in shift share design by estimating a regression that interacts historical export shares with the exchange rate. In these regressions, we use exchange rate shocks as an instrumental variable for exchange rate only, i.e., we use historical export share interacted with exchange rate shock as an instrumental variable for historical export share interacted with exchange rate. The strategy is similar to shift share design or Bartik instruments assuming historical exports share as 'share', and exchange rate as 'shift'. But unlike Bartik Instruments, our approach is not directly based on accounting identities, which are commonly used in the case of Bartik Instruments (Goldsmith-Pinkham et al., 2020; Ferri, 2022). We show that historical export share of plants relates to the current export share and the instrument is relevant. These regressions incorporate plant-fixed effects to control for time-invariant plant characteristics, influencing historical export shares. The results consistently show that exchange rate depreciation leads to a greater reduction in markdown and an increase in markup for exporters, but overall market power still declines significantly due to reduced labor market power.

Furthermore, leveraging the flexibility of our approach, we use an alternative flexible input, petrol (fuel), and obtain similar results. Although the magnitudes are larger, the qualitative findings remain consistent with those obtained using materials as flexible input. Additionally, we distinguish between managerial and non-managerial labor and find that exchange rate depreciation causes a larger decline in markdown for managerial labor compared to non-managerial labor among exporters. As we show later in the paper, markdown is inversely related to the labor supply elasticity. These results suggest that exchange rate depreciation increases labor supply elasticity, i.e., making them more sensitive to wages by increasing outside options. This increase in labor bargaining power reduces the labor markdown. Further, the results suggest that these effects are stronger for managerial workers, leading to a larger decline in markdown for managerial workers.

The rest of the paper is structured as follows. Section 2 provides a brief overview of the recent related literature. Section 3 outlines the theoretical framework, explaining the concepts of markup and markdown, and discusses how, for temporal variation in markup and markdown, the revenue and output elasticities are not required. Section 4 presents the empirical framework, including instrumental variable regression and shift share regressions. Section 5 presents the empirical results, followed by the concluding remarks and implications for policy.

2. Related literature

This paper is related to several recent studies that explore the effect of aggregate shocks on markup, markdown, and labor market. This is because these distortions caused by markup and markdown affect the efficiency and aggregate outcomes and have welfare consequences. Weinberger (2020) finds that firm heterogeneity significantly affects markup adjustments in response to global shocks, with importing firms increasing their markup following real exchange rate appreciations. Similarly, Steiner and Stucki (2025) shows that large, profitable Swiss manufacturing firms reduce their markup substantially after currency appreciation, while smaller firms show little to no response, highlighting heterogeneity in markup adjustments. Amiti et al. (2014) demonstrate that large exporters who are also major importers experience low exchange rate pass-through due to rising input costs and markup adjustment.

Goldberg and Tracy (2000) and Mishra and Spilimbergo (2011) investigate the labor market outcomes of exchange rate movements. Goldberg and Tracy (2000) focus on job market turnover, while Mishra and Spilimbergo (2011) show labor mobility when adverse currency fluctuations make firms exit from exporting. Pham (2023) studies the impact of trade policy reform in China and finds that liberalizing input tariffs significantly reduces distortions in the labor market. In a similar context, Xie et al. (2024) investigate the effects of labor market power heterogeneity on misallocation and production efficiency, finding that input trade liberalization decreases the variance in markdown and improves allocation efficiency, while output trade liberalization has no notable impact. Brooks et al. (2021a,b) further examine labor market power by analyzing the impact of transportation infrastructure on labor monopsony in India, showing that new highways reduce labor markdown and enhance labor income shares. All these studies have explored either product market or input market power; they have not considered the total effect, which can be summarized as combined market power. We address this dimension in this paper and contribute to this literature.

This paper is also related to a large literature that uses SVAR to analyze monetary policy transmission, and the effect of other aggregate shocks, such as technology and exchange rate in the economy (Blanchard and Quah, 1989; Gali, 1999; Shambaugh, 2008; Canova and De Nicolo, 2003; Erceg et al., 2005; Carriere-Swallow and Cespedes, 2013; Rubio-Ramirez et al., 2010; Fry and Pagan, 2011; Binning, 2013; Forbes et al., 2018). Since we estimate pass-through in this paper, this paper is also related to a large literature on exchange rate pass-through to export and import prices which have been studied extensively (Mallick and Marques, 2008; Shambaugh, 2008; Gopinath et al., 2010; Mallick and Marques, 2012; Burstein and Gopinath, 2014; Amiti et al., 2014; Gopinath and Stein, 2021; Chen et al., 2022).

3. Theoretical framework

3.1. Product, Labor, and combined market power

To assess the degree of product, labor, and combined market power, we begin by considering a cost-minimizing firm without adjustment costs, operating under the following production technology:

$$Y_{it} = F_{it}\left(X_{it}^{1}, \ldots, X_{it}^{V}, L_{it}, K_{it},\right) exp\left(\omega_{it}\right)$$

where $X_{it}^{1}, \ldots, X_{it}^{V}$ are V inputs with price p_{it}^{v} respectively for plant i at time t. L_{it} and K_{it} are labor and capital, respectively. ω denotes productivity parameter. The Lagrangian of the cost minimization problem is given by:

$$\mathcal{L} = \sum_{v=1}^{V} p_{it}^{v} X_{it}^{v} + w_{it}\left(L_{it}\right) L_{it} + r_{it} K_{it} + \lambda_{it}\left(Y_{it} - F_{it}(.)\right)$$

w_{it} is the wage and r_{it} is the cost of capital. We assume that the firm has input market power only in the labor market, which implies that wages depend upon labor employed by the plant. The firm chooses the inputs $X_{it}^{1}, \ldots, X_{it}^{V}$ flexibly and is a price taker in the input markets. In this paper, we consider raw materials and fuel as two main flexible inputs. The first order condition with respect to L_{it} can be written as

$$w_{it} + L_{it}\frac{\partial w_{it}}{\partial L_{it}} = \lambda_{it}\frac{\partial F_{it}(.)}{\partial L_{it}}$$

which can be further written as:

$$w_{it}\left(1 + \frac{1}{\xi_{it}^{Lw}}\right) = \lambda_{it}\frac{\partial F_{it}(.)}{\partial L_{it}} \tag{1}$$

where ξ_{it}^{Lw} is the elasticity of labor supply. By the envelope theorem, λ_{it} is the marginal cost of producing one unit of output. The right-hand side of Eq. (1) is the competitive wage of labor, which is the product of the marginal cost of one unit of output and the marginal product of labor. The product reflects the marginal revenue product of labor.

$\left(1+\frac{1}{\xi_{it}^{Lw}}\right)=\eta_{it}$ is the labor markdown or monopsony power, which is the ratio of the competitive wage to actual wages w_{it}. As we can see, monopsony power in the labor market depends upon the elasticity of labor supply. The labor markdown from the above expression cannot be obtained, as we do not observe the marginal cost and marginal product of labor in the data. Hence, we derive an expression that can be used to estimate markdown from the data. Using $\theta_{it}^{L}=\frac{\partial F_{it}(.)}{\partial L_{it}}\frac{L_{it}}{Y_{it}(.)}$ which is the elasticity of output with respect to labor, we can write the above as:

$$w_{it}\eta_{it}=\lambda_{it}\frac{\theta_{it}^{L}Y_{it}(.)}{L_{it}} \tag{2}$$

Rearranging (2) and using the fact that the marginal cost can be expressed as the ratio between product prices and markup $\left(\lambda_{it}=\frac{p_{it}}{\mu_{it}}\right)$ where p_{it} is the price of one unit of output, and μ_{it} is the markup, we can write (2) as

$$\mu_{it}\eta_{it}=\frac{\theta_{it}^{L}}{\alpha_{it}^{L}} \tag{3}$$

Using $\alpha_{it}^{L}=\frac{w_{it}L_{it}}{p_{it}Y_{it}(.)}$, as the labor share in the revenue, and Eq. (3) gives the combined market power as a product of markup and labor markdown. Eq. (3) holds for any input and therefore for any flexible input v also, we can write:

$$\mu_{it}\eta_{it}^{v}=\frac{\theta_{it}^{v}}{\alpha_{it}^{v}} \tag{4}$$

Based on the assumption that the plant is a price taker in the market for input v, we have $\eta_{it}^{v}=1$ and can write (4) as given below:

$$\mu_{it}=\frac{\theta_{it}^{v}}{\alpha_{it}^{v}} \tag{5}$$

The above expression (5) is the same as in Loecker and Warzynski (2012) and De Loecker et al. (2020), if we assume that the raw material is flexibly chosen and that the producer has no pricing power in the raw material market. The assumption of one price-taking and flexibly chosen input provides a way of measuring markup in output prices without being confounded by the presence of monopsony power in the input markets. It is important to emphasize that Loecker and Warzynski (2012) gives markup relative to a chosen input which is correct markup in the absence of input market power for that chosen input. As a robustness, we also consider petrol (fuel) as a flexible input.[5] Using (3) and (5), we obtain labor markdown as given by Eq. (6):

$$\eta_{it}=\frac{\theta_{it}^{L}}{\theta_{it}^{v}}\times\frac{\alpha_{it}^{v}}{\alpha_{it}^{L}} \tag{6}$$

The labor markdown depends on the ratio of the elasticities of output with respect to labor and material inputs, as well as their respective revenue shares. It is important to mention that Eq. (6) is very general and can be extended to different components of labor such as managerial and non-managerial workers, and we can use different flexible inputs. The key equations of interest are (3), (5), and (6), which captures combined, product, and labor market power, respectively. As shown in Eq. (3), combined market power depends on the output elasticity with respect to labor supply and the labor share in revenue. While the latter is directly observable in the data, the elasticity of output with respect to labor (θ_{it}^{L}) must be estimated from the data. Similarly, to estimate the markup, we need to estimate (θ_{it}^{v}). To estimate the labor markdown, estimates of both (θ_{it}^{v}) and (θ_{it}^{L}) are required.

Given data limitations, it is not feasible to estimate plant-specific time-varying elasticities θ_{it}^{L} and θ_{it}^{v}. The elasticities are often estimated at the industry level (usually two-digit) assuming either Cobb Douglas or translog production functions (see De Loecker et al., 2020; Brooks et al., 2021b; Foster et al., 2024; De Ridder et al., 2026). The widely used control function approach of estimation of elasticity is often used at a more aggregate industry level, since the polynomial approximations are sensitive to smaller samples. It is possible to obtain these estimates at the annual frequency to allow time variation in the elasticity if the data constraints are not binding and we have enough observations.[6] Estimating the elasticity of output with respect to material and labor at even sector-level presents a significant challenge due to unobserved plant-specific prices.[7] Typically, researchers deflate nominal revenue[8] using the corresponding industry price deflators to obtain real output at the plant or firm level. However, deflating revenue with industry level price indices inherently assumes uniform pricing within an industry and hence overlooks intra-industry differences in plant-level prices. This methodological challenge has sparked considerable debate in the academic literature, particularly concerning the extent of bias introduced into markup estimates by disregarding the price heterogeneity among plants within the same industry. Loecker and Warzynski (2012) argue that markup estimated after their adjustment for prices using residual from production function results only in a downward shift in the level of estimated markup while preserving the overall pattern of their evolution over time.

However, a more recent study by Bond et al. (2021) challenges this notion by suggesting that the impact of neglected plant-level price variation extends beyond a mere downward bias. They argue that it also undermines the informative value of the estimated markup, casting doubt on their reliability and interpretability. But unobserved prices are not the only challenge in estimating the elasticity of output with respect to labor and other flexible inputs. The widely used production function estimates of Ackerberg et al. (2015) may be biased if firms/plants are price setters, even with quantity data. Any analysis of market power would find it hard to justify that firms do not have price setting power. In this paper, we do not estimate any of these elasticities; instead, we follow Bond et al. (2021) who argue that the temporal evolution of markup considers output elasticities as a function of inputs; those inputs can be added as controls in regressions.[9] The same argument can be extended for exploring the variation in labor and combined market power. In fact, the strategy suggested by Bond et al. (2021) and adopted in this paper allows more granular control of elasticities which would not be possible if we use estimated elasticities as we explain below. Another benefit of the strategy adopted in this paper is that we can use alternative flexible inputs in the data to estimate the effect of aggregate shocks on markup and also estimate the effect on different types of labor market power without estimating the elasticities of output with

[5] It is important to mention that Eq. (5) is only applicable if the plant is using the flexible input and the share of that flexible input in revenue is not zero; in the case of petrol, many plants which do not use petrol and hence we cannot use those plants in estimation.

[6] We can also use industry average of shares such as material and labor for output elasticity of material and labor (Foster et al., 2024). Further, we can take industry year averages to allow time variation in these elasticities.

[7] There are also frequent changes in the industry code of plants in these datasets, Abeberese (2017).

[8] Deflating materials are also problematic due to similar reasons. Moreover, creating a stock of capital at constant prices is problematic as well because we observe the stock of capital for each year. Even if depreciation data is available, the detailed information on purchase and sale of fixed assets is not available to construct an accurate measure of capital at constant prices.

[9] This is aligned with observations in De Ridder et al. (2026), confirming the downward bias in revenue-based markup estimates; they demonstrate that the temporal evolution of revenue-based markup remains consistent with that of quantity-based markup. This consistency implies that, despite the inherent downward bias, the overall trajectory of markup is preserved, maintaining the validity of revenue-based markup estimations when analyzing their evolution over time. But it is not surprising that the temporal variation in markup is preserved because that is driven by material share largely as the material elasticity of output remains constant over time if we estimate elasticity at industry level and do not allow time variation.

respect to these inputs. Taking log and using the fact that α_{it}^{L} is labor share, Eq. (3) can be written as

$$\log\left(\mu_{it}\right) + \log\left(\eta_{it}\right) = \log\left(\theta_{it}^{L}\right) - \log\left(\text{Labor Share}_{it}\right) \tag{7}$$

The left hand side of Eq. (7) gives the log of combined market power which is equal to the difference of log of elasticity of output with respect to labor and log labor share. Hence if we want to estimate the effect of exchange rate on combined market power we can regress the negative of log labor share on exchange rate and use controls for $\log\left(\theta_{it}^{L}\right)$ depending upon the production function. If we assume a standard Cobb–Douglas production function for each plant, the plant-level elasticities vary across firms but remain constant over time, which can be captured through plant fixed effects. For a more flexible translog specification, we include plant fixed effects along with polynomial terms in inputs such as labor and capital. Additionally, the use of year fixed effects allows elasticities to vary over time. Moreover, we can use sector year fixed effects with plant fixed effects to allow a much more flexible assumption about technology. It is important to mention that these strategies to control for elasticity is better than using estimated elasticities at two-digit levels with and without time variation as in De Loecker et al. (2020) and Brooks et al. (2021b); further, since we include these fixed effects anyway in our regressions, there is no point of estimating these elasticities as it would be absorbed by the respective fixed effects. For example, if we were to estimate plant-level output elasticities with respect to labor and material and include them in the regression, the plant fixed effects would absorb these elasticities. Thus, our empirical design imposes a structure with flexible assumptions on the production function, enabling us to capture time variation in different components of market power even when direct estimation of elasticities is infeasible. We can take log and use α_{it}^{v} as the material share; Eq. (5) can be written as

$$\log\left(\mu_{it}\right) = \log\left(\theta_{it}^{v}\right) - \log\left(\text{Material Share}_{it}\right) \tag{8}$$

and we can estimate Eq. (8) with different flexible inputs and using controls for elasticities. Similarly, we can also write labor markdown by taking log of Eq. (6) as given below

$$\log\left(\eta_{it}\right) = \log\left(\theta_{it}^{L}\right) + \log\left(\text{Material Share}_{it}\right) - \log\left(\theta_{it}^{v}\right) - \log\left(\text{Labor Share}_{it}\right) \tag{9}$$

where we have used material as flexible input. We can also use petrol as flexible input in Eq. (8). Furthermore, we can use Eq. (9) for different types of labor such as managerial and non-managerial labor as we do in this paper. Eqs. (7), (8) and (9) give the key relationship that we use to estimate the effect of exchange rate on product, labor, and combined market power.

3.2. Conceptual framework: Linking exchange rate and market power

In the framework used in this paper, we do not characterize the adjustments in the product and labor market but only estimate the changes in equilibrium markup, markdown, and combined market power. We understand that the equilibrium is achieved by various adjustments that determine exchange rate pass-through as-well as different components of market power. In the following discussions, we illustrate the main mechanisms through which the exchange rate can affect these components of market power.

Exchange rate depreciation affects exporters' equilibrium markup through two distinct channels. First, depreciation may raise exporters' prices in domestic currency. Second, currency depreciation affects the marginal costs depending on the input composition. Exporters relying predominantly on domestic inputs face only a modest increase in marginal costs arising from general price pressures induced by exchange rate pass-through, and consequently may experience a larger increase in markup, reflected in a greater decline in material share. In contrast, exporters with high intensity of imported-input face a more substantial increase in marginal costs, as import prices adjust incompletely to the exchange rate, thereby limiting their markup gains.

Using firm-level data from Belgium, Amiti et al. (2014) show that import-intensive exporters exhibit a pass-through rate of approximately 50%, with marginal cost and markup channels contributing roughly equally. Following this evidence, we include the share of imported inputs in our regression specification to capture the marginal cost channel of exchange rate pass-through. A higher share of imported-input amplifies the sensitivity of material costs to exchange rate fluctuations, thereby influencing both cost structures and markup.

Exchange rate changes also affect exporters' labor markdown through adjustments in the domestic labor market. As noted earlier, labor markdown depend on the equilibrium elasticity of labor supply. Increases in revenues and profitability in domestic currency terms induce labor market adjustments along two dimensions: the intensive margin (higher labor demand among existing exporters) and the extensive margin (entry of new firms). As exporters become more competitive internationally, their labor demand increases, pushing the equilibrium elasticity of labor supply higher. At the same time, increased profitability among domestic producers encourages firm entry, strengthening workers' outside options and bargaining power, and thereby further increasing labor supply elasticity. Both mechanisms contribute to narrowing wage markdown. These effects are likely to vary across firms depending on their input composition; hence, we control for the imported-input share in our empirical analysis. Pham (2023) highlights the role of firm entry and exit (the extensive margin) as the primary channel through which markdown decline following input tariff reductions. Similarly, the larger reduction in labor markdown observed for exporters may reflect a stronger increase in the elasticity of labor supply among these firms, resulting from improved profitability and competitiveness. The overall effect on exporters' combined market power depends on whether the decline in labor market power, driven by local labor market adjustments, outweighs the gain in markup.

Although these channels related to labor market adjustments are general in nature, they are particularly important for developing countries given that the enforcement capacity of the state is weak and the elasticity of labor supply is expected to be lower (Bardhan, 1984; Basu et al., 2010; Chau et al., 2022). Understanding how external demand shocks influence workers' bargaining power under such institutional and structural constraints is therefore crucial. Furthermore, large depreciations in short horizons in developing economies (for example, the large depreciation in India during 2010–15 shown in Fig. 1) make exchange rate changes an ideal setting to explore the effect of external shocks on the elasticity of labor supply (labor markdown) and the bargaining power of workers.

4. Empirical framework and data

4.1. Empirical framework

We estimate the effect of changes in the exchange rate on product, labor, and combined market power. The effect on product market power is obtained from a regression in which we use -log(material share) as the dependent variable, and we use a range of controls for elasticity of output with material. The regression model is given by

$$-\log(\text{Material Share}_{it}) = \beta_1 \log \text{Exchange Rate}_t + \phi' x_{it} + \psi' z_t + \theta_i + e_{it} \tag{10}$$

Material share is the money spent on materials used in production as a proportion of sales. Plant level variable (x_{it}) includes log size (sales), log size (workers), square of log size (workers), log capital (net fixed assets), square of log capital and labor concentration at two-digit industry, state, and state & two-digit industry levels. The size in terms of workers could be important due to the effect of workers' bargaining power on wages (Krueger, 2018). Labor concentration at the two-digit industry level is defined as the ratio of persons employed in plant i at time t and total persons employed in the industry to which a plant i

belongs. Labor concentration at the state level is defined as the ratio of persons employed in plant i at time t and total persons employed in the state to which the plant i belongs. Labor concentration at state & two-digit industry is defined as the ratio of persons employed in plant i at time t and total persons employed in the state and industry to which the plant i belongs. We also include export share and import share for plant i at time t but only for regressions between 2008–2019 as export share is available from 2008 onward. Effectively, these variables represent a rich set of controls for elasticity of output with respect to material and allows plant specific time-varying elasticity. θ_i represent plant-fixed effects. Essentially, we argue that these variables capture the output elasticity with respect to material at plant i at time t. z_t includes the interest rate, consumer inflation, real GDP growth, log of money supply, log of real broad effective exchange rate, log of crude oil prices, net barter terms of trade index, merchandise trade to GDP, foreign direct investment as % of GDP, and current account balance as % of GDP. These variables are important determinants of exchange rates based on relative purchasing power parity, interest rate parity, and monetary theory. We also estimate the same model with petrol share.

The effect on labor market power is obtained from a regression using log markdown as the dependent variable. In the baseline regressions, we use Eq. (6) and average material and labor share in the two-digit industry as elasticity of output with respect to material and labor and estimate markdown. We also use annual industry average for robustness. As mentioned above, these industry averages have been widely used in the literature as proxy for elasticities. These estimated markdown are based on the assumption that elasticity of output with respect to material and labor is varying at two-digit industry level and also has annual variation in the industry. The regression model is given by:

$$\log(\text{Markdown}_{it}) = \beta_1 \log \text{Exchange Rate}_t + \phi' x_{it} + \psi' z_t + \theta_i + e_{it} \quad (11)$$

As mentioned above, we also use log (Material Share/Labor Share) as the dependent variable to estimate the effect on labor market power. We use this as the dependent variable in later regressions, and as mentioned above, this mitigates the biases that may arise due to estimating these elasticities at the industry level and not at the plant/firm level. Labor share is the total wages as a proportion of sales. Further, we use petrol share as robustness and different components of labor share i.e. managerial and non-managerial, to reveal the heterogeneity in the effect of exchange rate shocks in these two types of labor. The effect on combined market power is obtained from a regression in which we use -log(labor share) as the dependent variable. The regression model is given by:

$$-\log(\text{labor Share}_{it}) = \beta_1 \log \text{Exchange Rate}_t + \phi' x_{it} + \psi' z_t + \theta_i + e_{it} \quad (12)$$

The main objective of this paper is to understand the effect of exchange rate changes on exporter's market power; we estimate these models with interaction of exchange rate and export share. Hence, we estimate Eqs. (10), (11), and (12) with the interaction of Log Exchange Rate$_t$ × Export Share$_{it}$

$$y_{it} = \beta_1 \log \text{Exchange Rate}_t + \beta_2 \log \text{Exchange Rate}_t \times \text{Export Share}_{it} + \phi' x_{it} + \psi' z_t + \theta_i + e_{it} \quad (13)$$

where y_{it} is $-\log(\text{Material Share}_{it})$, $\log(\text{Markdown}_{it})$ and $-\log(\text{labor Share}_{it})$ one at a time. The effect of exchange rate depreciation for domestic plants is captured by β_1 and the effect on exporting plants is given by $\beta_1 + \beta_2 \times$ Export Share. Since the export share is between 0 and 1, β_2 gives the difference of the effect of the exchange rate on different forms of market power between purely domestic and purely exporting plants. We further estimate these models with year-fixed effects in which we cannot include the exchange rate and this is given by:

$$y_{it} = \beta_2 \log \text{Exchange Rate}_t \times \text{Export Share}_{it} + \phi' x_{it} + \theta_t + \theta_i + e_{it} \quad (14)$$

where β_2 gives the difference in the effect of the exchange rate on different forms of market power between domestic and exporting plants, which is the key objective of this paper. Our main goal is to estimate the unbiased coefficient β_2. We argue that the omitted variable bias is the main concern associated with the exchange rate, and the inclusion of time-fixed effects in Eq. (14) mitigates these concerns to a reasonable extent. To further overcome this, we use the exogenous changes in the exchange rate as explained in the next section.

4.2. Exchange rate shock

Apart from endogeneity concerns in the above regression models, the sources of exchange rate fluctuations also pose a challenge to identify causal effects. Exchange rate depreciation can occur for various reasons, and its impact on plants can differ substantially depending on the underlying source of the change. Therefore, to estimate the structural effect of exchange rate movements on different types of plant market power discussed above, it is essential to identify exogenous variations in the exchange rate. This is analogous to interest rate changes, which can result from multiple factors with distinct economic implications; to capture their causal impact within an econometric framework, one must isolate the exogenous component of interest rate movements.

we identify an exogenous exchange rate shock along with other important shocks using an SVAR which helps in isolating the exogenous exchange rate changes. We employ a combination of short-run and long-run zero restrictions, along side sign restrictions. These identification assumptions, summarized in Table 1, are very minimal, intuitive, and consistent with standard open-economy macroeconomic models. We follow Forbes et al. (2018) but do not impose any restriction on the behavior of interest rate due to demand and exchange rate shock.

We estimate the above SVAR model using quarterly data for India and global variables from 1996Q2 to 2020Q1. We identify six shocks using six variables; real GDP growth, CPI inflation, 15–91 days treasury bills rate, % change in Rupee/USD exchange rate, % change in import price deflator for India, and % change in global crude oil prices. The crude oil prices, exchange rate, and import price deflator are obtained from Federal Reserve Bank of Saint Louis. The variable description is provided in Appendix B. India's real GDP, CPI and treasury bills rate are obtained from RBI Database on the Indian Economy. In the case of change in the base year for GDP and CPI, we splice the series to construct a uniform series and do seasonal adjustment.

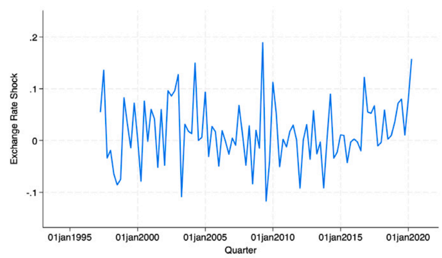
First, we assume that only domestic supply and persistent global shocks can affect domestic output in the long run. This is a standard assumption in a large number of studies based on long run restrictions in the SVAR literature (Blanchard and Quah, 1989; Gali, 1999; Shambaugh, 2008; Erceg et al., 2005). We assume that import price deflator captures a persistent global supply shock such as long-lasting disturbances or technological innovations. Second, we assume that four domestic shocks supply, demand, monetary policy, and exchange rate shocks do not influence oil prices in the short or long run. These restrictions are necessary to disentangle domestic shocks from global shocks, and the underlying assumption is that a small open economy like India is a price taker in world markets (Carriere-Swallow and Cespedes, 2013). Both global shocks (persistent and transitory) can influence oil prices, but only the persistent shock can affect output in the long run, which can help isolate these two types of shocks.

Third, we impose short-run minimal sign restrictions on domestic shocks motivated by DSGE models, which are also standard in the empirical literature (Fry and Pagan, 2011). We use negative comovement in price and GDP to identify domestic supply shock. We identify a favorable supply shock that increases output and decreases inflation (Canova and De Nicolo, 2003). In contrast, positive demand shocks are associated with a positive co-movement between GDP and CPI. A contractionary monetary policy shock is identified that leads to a decrease in prices and output. For exogenous exchange rate shocks, we assume

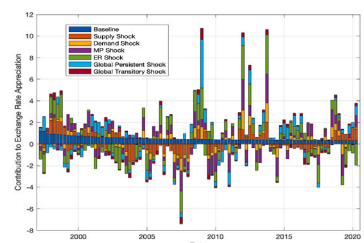
Table 1
Identification restrictions.

	Supply shock	Demand shock	Monetary policy shock	Exchange rate shock	Persistent global shock	Transitory global shock
Short-run and sign restrictions						
GDP growth	+	+	−			
Inflation	−	+	−	+		
interest rate			+			
Rupee/USD exchange rate				+		
Import price deflator						
Global oil prices	0	0	0	0	+	+
Long-run restrictions						
GDP growth		0	0	0		0
Inflation						
interest rate						
Rupee/USD exchange rate						
Import price deflator						
Global oil prices	0	0	0	0		

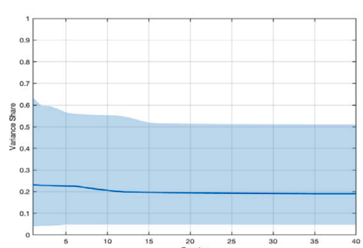
Note: A + (−) sign indicates that the impulse response of the variable in question is restricted to be positive (negative) in the quarter the shock considered impact and in the following quarter. A ‘0’ indicates that the response of the variable in question is restricted to be zero (either on impact (short run) or in the long run).



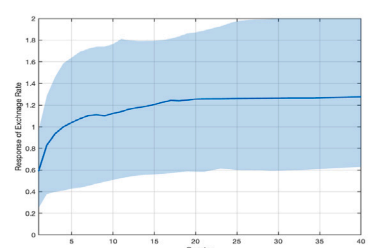
(a) Quarterly Exchange Rate Shock



(b) Historical Decomposition of Exchange Rate Depreciation



(c) Share of Exchange Rate Shock in Forecast Error Variance of Exchange Rate



(d) Response of Exchange Rate due to Exchange Rate Shock

Fig. 2. Exchange rate shock, Historical decomposition, Forecast error variance decomposition and impulse response.

that a depreciation of the nominal exchange rate causes an increase in the CPI without any effect on the interest rate. This is consistent with a large literature on exchange rate pass-through (see Burstein and Gopinath, 2014; Ha et al., 2020). This combination of sign and zero restrictions (short- and long-run) provides the minimal yet economically meaningful structure required to identify the shocks of interest. The sign restrictions shown in Table 1 are imposed for two periods (contemporaneously and in the quarter after) for each shock. These are combined with short-run and long-run zero restrictions using the algorithm suggested by Rubio-Ramirez et al. (2010) and extended by Binning (2013) for under-identified models (see also Arias et al., 2018).

Fig. 2 gives the key objects of interest from the estimated SVAR model.[10] Fig. 2(a) presents the identified exchange rate shock. It is important to note that the shocks are identified at a quarterly frequency and then summed to obtain annual shocks. Since we aggregate the shocks, potential measurement issues may arise; therefore, instead of using the aggregated shock directly, we employ it as an instrumental variable for the endogenous exchange rate. Fig. 2(b) shows the contribution of different shocks to the quarterly depreciation of the Indian Rupee. As can be seen, the sharp depreciation during the global financial crisis was predominantly driven by persistent global shocks, whereas during the taper tantrum episode, the exogenous exchange rate shock played a key role in driving the depreciation. The historical decomposition suggests that the exchange rate shock has been properly identified. Furthermore, Fig. 2(c) shows that the exogenous exchange rate shock explains around 20% of the forecast error variance of the exchange rate depreciation. Finally, Fig. 2(d) indicates that the identified shock has a persistent and long-term effect on the exchange rate.

But for export shares, both reverse causality and omitted variable bias create endogeneity issues. We approach this concern in two ways.

[10] We report only results related to the exchange rate shock which is the focus of the paper, and more results are available on request.

The first is an instrumental variable approach in which we use the historical two-digit average of export share as an instrument for export share in the future. Since the export data are available from 2008 onwards, we use the export share in 2008 for each plant, find the average share in each two-digit industry, and use this as an instrument for future export shares for each plant.[11] The main reason for using these industries' shares as instrumental variables is that these are highly persistent and highly relevant for predicting plant-level export shares in the future. In this way, the instrumental variable approach in this paper is similar to the approach in Acemoglu et al. (2001), which argues that the persistence of institutions and use of early settlers mortality as an instrument for present-day institutions. We argue that the industry average of exports is persistent, and we use these as instruments for plant-level shares in the future. Since the empirical setting is different in this paper from Acemoglu et al. (2001), we do not need to instrument the historical averages, unlike Acemoglu et al. (2001) where the cross-sectional setting required the past institutions to be instrumented, as the factors explaining the variation in the past institution could be related to and explain the variation in present-day income. But in the empirical setting used in this paper, these industry-specific time-invariant characteristics which make some industries/plant more export extensive in 2008 compared to the other would be absorbed by the plant-specific fixed effects. Hence, we estimate the model given by

$$\begin{aligned} y_{idt} &= \beta_2(\log \text{ER}_t \times \text{Export Share}_{it}, \text{Export Share}_{it} \\ &= \text{ER Shocks}_t \times \text{Average Export Share in 2008}_d, \\ &\text{Average Export Share in 2008}_d) \\ &+ \phi' x_{it} + \theta_t + \theta_i + e_{it} \end{aligned} \tag{15}$$

where θ_i is the plant fixed effects for plant i in two-digit industry d, and we use $\text{ER Shocks}_t \times \text{Average Export Share in 2008}_d$ as an instrumental variable for $\text{Log Exchange Rate}_t \times \text{Export Share}_{it}$. Also, we use $\text{Average Export Share in 2008}_d$ as an instrumental variable for Export Share_{it}. This regression helps to mitigate endogeneity concerns to a large extent. We show later that these instruments are relevant. β_2 gives the effect of the exchange rate shock on markup, markdown, & combined market power. As we can see, the large set of control ensures that elasticities are plant specific, varies over time and depends on a range of plant, sector, and state level factors.

Since we observe the historical export share for plants, we estimate another regression model to capture the within-plant effect, and the model is given by:

$$\begin{aligned} y_{it} &= \beta_2(\log \text{ER}_t \times \text{Export Share}_{iH} = \text{ER Shocks}_t \times \text{Export Share}_{iH}) \\ &+ \phi' x_{it} + \theta_t + \theta_i + e_{it} \end{aligned} \tag{16}$$

where Export Share_{iH} is the historical export share of the plant. We use the export share from the first year of the occurrence of plant in the sample as Export Share_{iH}. This is similar to the shift-share design, where the share variable is the historical export share of plants, which captures the exposure of the plants to the exchange rate (see Goldsmith-Pinkham et al., 2020). The shift variable is the exchange rate which is likely to be endogenous as argued above, and hence we use exogenous exchange rate shocks as an instrumental variable for that. These models are estimated for a smaller number of observations as we consider only plants having more than five years of observations. Apart from this, the major difference between Eqs. (15) and (16) is the way we treat export share. In Eq. (15), we treat export share as endogenous and instrument it with average industry export share in 2008. But in Eq. (16), we do not use instrumental variable for export share and treat historical plant level export share in shift share design. In Eq. (16), we only treat the exchange rate as endogenous and use estimated exchange rate shocks as instrumental variables. We also estimate these models with two digit industry-year fixed effects. As mentioned above, we argue that the time-invariant factors driving any variation in export intensity are not a concern, as these are absorbed by plant-fixed effects. A key identifying assumption underlying our empirical strategy is that exogenous exchange rate shocks do not systematically affect the output elasticities of inputs in the short-run. This assumption is consistent with the standard markup literature that treats production function parameters as technology that evolve slowly relative to macroeconomic shocks. Under this standard and economically plausible condition, the variation in input shares captures changes in markups and markdowns rather than shifts in production technology. We also estimate Eqs. (15) and (16) with alternative flexible inputs and inputs with market power for robustness. These results also help in understanding the heterogeneity in the effect of exchange rate shock in the labor market in terms of managerial and non-managerial workers.

4.3. Data

The plant-level data used in this paper come from India's Annual Survey of Industries. This plant-level dataset is widely used in empirical studies such as Hsieh and Klenow (2009) and Bertrand et al. (2025). This is a nationally representative plant-level dataset and contains census and survey plants. Census plants are large plants that are surveyed every year together with a sample of small plants. We use data between 1998–99 and 2019–20. During this period, industrial classification changed twice (in 2004–05 and 2008–09), and hence, we concord industries at the two-digit level to obtain a uniform two-digit industry between 1998–99 to 2019–20. We use this to obtain the markdown at a two-digit industry level by estimating the elasticity with respect to material and labor, using average material and labor shares at two-digit level.

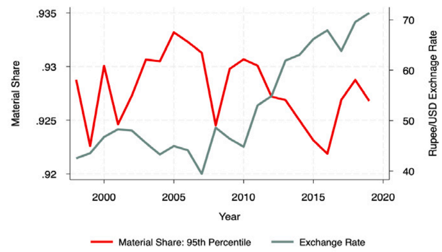
Most of the regressions done in this paper are using data between 2008–09 and 2019–20, because data for exports are only available from 2008–09. Export share allows us to understand the heterogeneous effect of exchange rates on different types of market power discussed above, which is the main objective of this paper. We use the net fixed assets, sales, material expenses, imported inputs, fuel expenses, exports, number of workers, total wages, managerial wages, non-managerial wages, and spatial location from this dataset. Using sales, material expenses, and wage bills, we obtain markdown as explained above. Labor share is defined as total wage bill/ sales revenue. Material share is defined as total material inputs/ sales revenue. All share variables used in this paper are relative to sales.

We only keep plants having material and labor share greater than 1%. We trim sales, wages, materials, and net-fixed assets by 0.5% in both the tails to mitigate the concerns related to outlier plants. Aggregate macroeconomic variables including the Rupee/USD exchange rate are obtained from the World Bank and Federal Reserve Bank of Saint Louis.[12]

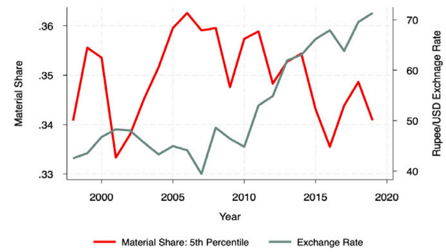
Fig. 3 gives the time series plots of the 5th, 50th, and 95th percentile of the material share (one of the dependent variables) and the exchange rate which is the main independent variable of interest in this paper; they are used to estimate the effect of the exchange rate changes on product market power of plants in the sample. These material shares are obtained from the annual distribution of the plant-level material share. We find a negative correlation between material share and the

[11] We assume that current export of the industry is not relevant for a plant's export share. We use the historical export intensity of industries to generate variation in plant's export share, as export intensity varies significantly across industries. Effectively, the instrument implies that in some industries, plants are likely to have higher exports share because of industry characteristics which have nothing to do with plant's contemporaneous decision.

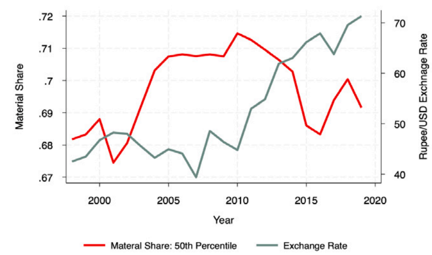
[12] The second source of the data is UN-Comtrade. Appendix B gives the data sources and definitions. We use monthly data at 6 and 4 digits between January 2011 and December 2019 and estimate the simple pass-through regressions using this data. These results are given in Appendix A.



(a) Material Share: 95th Percentile

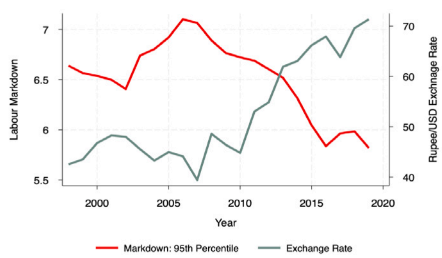


(b) Material Share: 5th Percentile

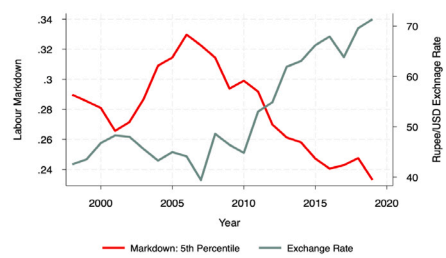


(c) Material Share: 50th Percentile

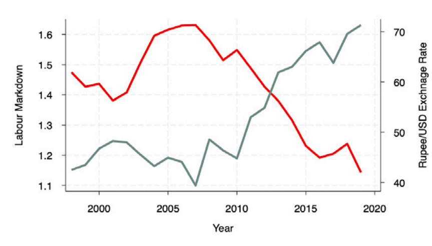
Fig. 3. Exchange rate and material share: The correlation between the 5th percentile, 50th percentile, and 95th percentile of material share and the exchange rate is −0.31, −0.03, and −0.32. These annual correlations are not statistically significant.



(a) Labor Markdown: 95th Percentile



(b) Labor Markdown: 5th Percentile



(c) Labor Markdown: 50th Percentile

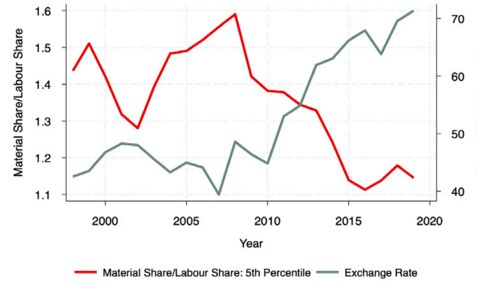
Fig. 4. Exchange rate and labor markdown: The correlation between the 5th percentile, 50th percentile, and 95th percentile of labor markdown and the exchange rate is −0.87, −0.89, and −0.88. These annual correlations are statistically significant. The markdown is calculated using average material and labor share as at two-digit industry level as proxy for material and labor share.

exchange rate which implies an increase in markup due to exchange rate depreciation. The correlation between the 5th percentile, 50th percentile, and 95th percentile of material share and the exchange rate is −0.31, −0.03, and −0.32. These annual correlations are not statistically significant.

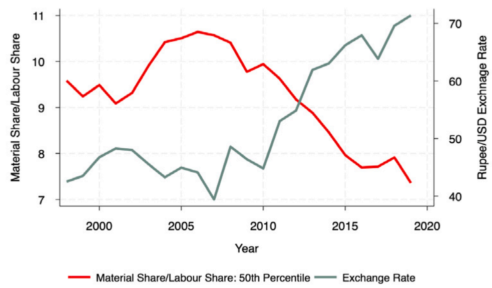
Fig. 4 gives the time series plots of 5th, 50th and 95th percentile of markdown (another dependent variable) and exchange rate, which is the main independent variable of interest in this paper. This markdown has been calculated at the two-digit industry level and is for a longer period.

These markdown estimates are obtained from the annual distribution of the plant-level markdown estimated at a two-digit level. As mentioned above, we use the average of the material and the labor share at the two-digit industry level as the elasticity of output with material and labor. As we can see, the post-2011 exchange rate depreciation has been associated with a significant decline in the markdown. Indeed, we find a very high and negative correlation between markdown and exchange rate; the correlation between the 5th percentile, 50th percentile, and 95th percentile of labor markdown and the exchange rate is −0.87, −0.89, and −0.88. These annual correlations are statistically significant. These negative correlations suggest

(a) Material Share/Labor Share: 95th Percentile

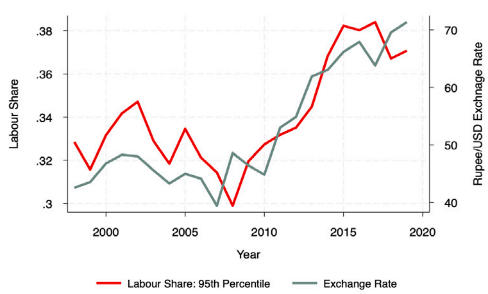


(b) Material Share/Labor Share: 5th Percentile

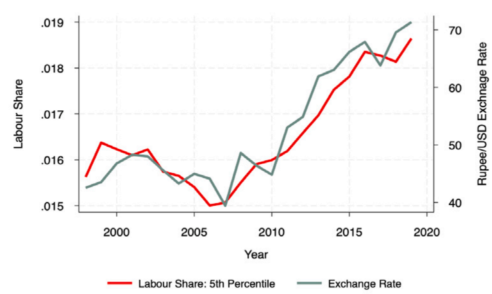


(c) Material Share/Labor Share: 50th Percentile

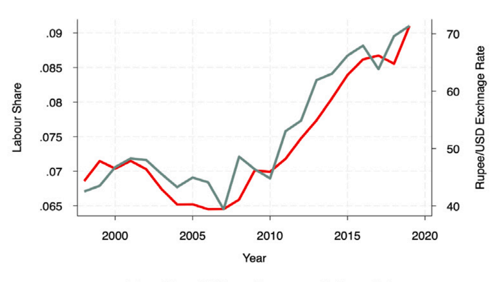
Fig. 5. Exchange rate and Material Share/Labor Share: The correlation between the 5th percentile, 50th percentile, and 95th percentile of material share/labor share and the exchange rate is −0.85, −0.90, and −0.80. These annual correlations are statistically significant.



(a) Labor Share: 95th Percentile



(b) Labor Share: 5th Percentile

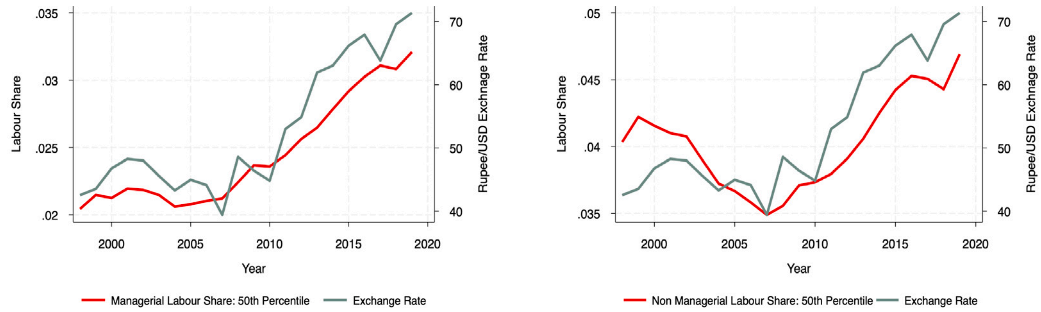


(c) Labor Share: 50th Percentile

Fig. 6. Exchange rate and labor share: The correlation between the 5th percentile, 50th percentile, and 95th percentile of the labor share and the exchange rate is 0.94, 0.95, and 0.83. These annual correlations are statistically significant.

that markdown, i.e., the labor market power and the exchange rate depreciation are negatively related. These correlations also emphasize the point that the exchange rate affects the labor market power across the entire distribution of plants.

Fig. 5 gives the time series plots of the 5th, 50th, and 95th percentile of the ratio of material and labor share (another dependent variable) and exchange rate. These ratios are obtained from the annual distribution of the plant level ratio and as mentioned above, we use this ratio to



(a) Managerial Labor Share: 50th Percentile (b) Non-Managerial Labor Share: : 50th Percentile

Fig. 7. Exchange rate and managerial and non-managerial labor share: The correlation between managerial labor share and the exchange rate is 0.96 whereas the correlation between non-managerial labor share and exchange rate is 0.82. Both these correlations are statistically significant.

estimate the effect of exchange rate changes on a plant's labor market power. As we can see, the post-2011 exchange rate depreciation has been associated with a significant decline in the ratio which is similar to the pattern in markdown. Indeed, we find a very high and negative correlation between these ratios and exchange rate, and the correlation between 5th percentile, 50th percentile, and 95th percentile of labor share/ material share and exchange rate is −0.85, −0.90, and −0.80. These annual correlations are statistically significant. These negative correlations suggest that markdown, i.e., labor market power declines due to exchange rate depreciation. These correlations also suggest that the variation in markdown is driven by the ratio of material and labor share as discussed above. Comparing the above correlations, it seems that the effect of exchange rate changes is much stronger on labor market power compared to the product market power.

Fig. 6 gives the time series plots of the 5th, 50th, and 95th percentile of labor share (one of the dependent variables) and exchange rate. As mentioned above, the temporal variation in labor share is used to estimate the effect of exchange rate changes on the combined market power of plants in the sample. These labor shares are obtained from the annual distribution of plant-level labor share. We find a positive correlation between labor share and exchange rate, which implies a decrease in combined market power due to exchange rate depreciation. The correlation between 5th percentile, 50th percentile, and 95th percentile of the labor share and exchange rate is 0.94, 0.95, and 0.83. These annual correlations are strong and statistically significant. These correlations emphasize the point that exchange rate depreciation decreases market power across the entire distribution of plants.

Fig. 7 gives the time series plots of the 50th percentile of managerial and non-managerial labor share (one of the dependent variables) and exchange rate. The correlation between managerial labor share and the exchange rate is 0.96 whereas the correlation between non-managerial labor share and exchange rate is 0.82. In the next section, we estimate the results from Eqs. (10), (11), (12), (13), (14), (15) and (16). Eq. (11) is estimated with two measures of estimated labor markdown. The first measure uses overall average material and labor share at two-digit industry level as elasticity of output with material and labor. The second measure uses annual average material and labor share at two digit level as elasticity of output with material and labor. Eqs. (13) and (14) are estimated with −log(Material Share$_{it}$), log(Markdown$_{it}$) and −log(labor Share$_{it}$) one at a time. We estimate models for both the measures of labor markdown. Eqs. (15) and (16) are estimated with −log(Material Share$_{it}$), log(Material Share/Labor Share$_{it}$), −log(labor Share$_{it}$), log(Material Share/Manufacturing Labor Share$_{it}$) and log(Material Share/ Managerial Labor Share$_{it}$) one at a time. We also estimate Eqs. (15) and (16) with petrol share instead of material share.

5. Exchange rate pass-through to markdown, markup, and overall market power

5.1. Baseline regressions

The widely used pass-through regression, estimated here using four and six-digit product-level data from India, suggests incomplete pass-through to traded goods prices. These results are given in Appendix A which remain similar to the results reported in the literature. As argued in Amiti et al. (2014), this incompleteness in pass-through gives rise to adjustment in product or input or in both markets. In this paper, we explore the adjustment through both input and output markets using labor markdown and markup. The strategy used in this paper also helps to understand the net effect of these adjustments through variation in overall market power.

Table 2 gives the baseline regression results. The markdown is based on the estimated output elasticity of material and labor at the two-digit industry levels. We use annual average of material and labor share as elasticities to estimate two measures of labor markdown. The sample period is from 1998 to 2019. We use log markdown, and hence the coefficient gives the % change in labor market power (markdown) due to a 1% change in the exchange rate. As mentioned above, the dependent variable for the third column is -log(material share) and -log(labor share) which gives the % change in markup and combined market power due to a 1% change in the exchange rate.

The result suggests that a 1% depreciation in exchange rate leads to a 0.62% decline in labor market power during 1998–2019, column (1). The effect on markdown remains negative but magnitude declines if we use annual average as elasticities, column (2). This is expected as we have more variation in elasticities compared to column (1). Further, we find that 1% depreciation in the exchange rate leads to a 0.08% increase in product market power during 2008–2019. Overall, the results suggest that a 1% depreciation in the exchange rate leads to 0.57% decrease in combined market power during 1998–2019.

These results are in line with earlier literature that suggests that exchange rate depreciation leads to an increase in markup. But, as it is obvious from these results, exchange rate depreciation leads to a decline in overall market power, which is predominantly driven by the decline in labor market power due to the exchange rate depreciation, which the earlier literature has ignored and assumed that markup is the source of market power. But, as argued in this paper, markup is market power only in the absence of input market power, and hence, with the widespread prevalence of input market power, markup is not sufficient to analyze the effect of exchange rate shock on market power. The results in Table 2 suggest that exchange rate depreciation leads to a decline in market power, mainly due to a decline in labor market power.

Table 2
Exchange rate pass-through to labor markdown, markup, and market power I.

	(1) Markdown: 2 Digit	(2) Markdown: 2 Digit	(3) Markup	(4) Market power
Log exchange rate	−0.618***	−0.236***	0.0810***	−0.572***
	(−39.38)	(−14.97)	(9.17)	(−46.97)
Log size (Sales)	0.632***	0.623***	−0.0288***	0.640***
	(254.10)	(250.76)	(−22.26)	(326.74)
Log size (Workers)	−0.549***	−0.544***	0.0349***	−0.567***
	(−77.14)	(−76.79)	(10.84)	(−93.25)
Plant fixed effects	Yes	Yes	Yes	Yes
Plant-level variables	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No
Observations	563 349	563 349	563 349	563 349
R-Squared	0.872	0.869	0.688	0.907

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels respectively. Macro variables include interest rate, consumer inflation, real GDP growth, log of money supply, log real broad effective exchange rate, log crude oil prices, net barter terms of trade index, merchandise trade to GDP, foreign direct investment as % of GDP and current account balance as % of GDP. Plant level variable includes labor concentration at two-digit industry, state, and state & two-digit industry level, square of log size(workers), log capital, and square of log capital. The markdown in column (1) is based on overall average of material and labor share at two-digit industry level as elasticity of output with material and labor. The markdown in column (2) is based on annual average of material and labor share at two-digit industry level as elasticity of output with material and labor. The sample period is from 1998 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

Table 3
Export share and exchange rate pass-through to labor markdown, markup, and market power II.

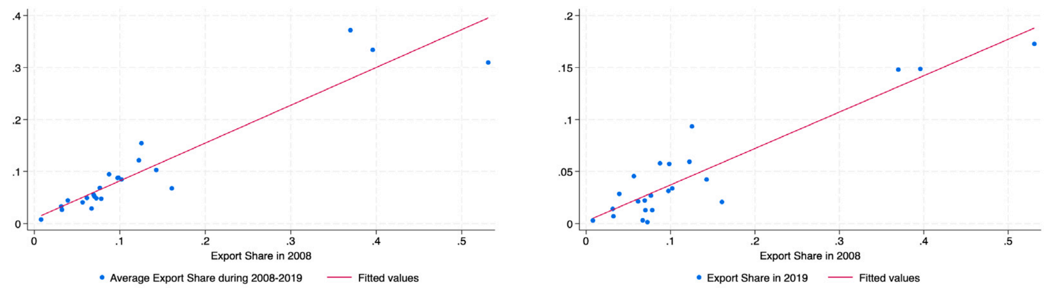
	(1) Markdown: 2 Digit	(2) Markdown: 2 Digit	(3) Markup	(4) Market power
Log exchange rate × Export share	−0.206***	−0.115***	0.0605***	−0.180***
	(−7.72)	(−4.31)	(4.58)	(−8.46)
Log exchange rate	−2.096***	−0.828***	0.568***	−1.487***
	(−15.97)	(−6.28)	(7.61)	(−14.69)
Log size (Sales)	0.664***	0.658***	−0.0120***	0.653***
	(207.72)	(205.25)	(−6.51)	(256.26)
Log size (Workers)	−0.536***	−0.535***	0.00124	−0.541***
	(−61.03)	(−61.21)	(0.33)	(−68.04)
Plant fixed effects	Yes	Yes	Yes	Yes
Plant-level variables	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No
Observations	354 247	354 247	354 247	354 247
R-Squared	0.892	0.889	0.719	0.921

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels respectively. Macro variables include interest rate, consumer inflation, real GDP growth, log of money supply, log real broad effective exchange rate, log crude oil prices, net barter terms of trade index, merchandise trade to GDP, foreign direct investment as % of GDP and current account balance as % of GDP. Plant level variable includes labor concentration at two-digit industry, state, and state & two-digit industry level, square of log size(workers), log capital, square of log capital, export share, and imported input share. The markdown in column (1) is based on overall average of material and labor share at two-digit industry level as elasticity of output with material and labor. The markdown in column (2) is based on annual average of material and labor share at two-digit industry level as elasticity of output with material and labor. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

Further, the coefficients of size (sales) and size (workers) suggest that when firms grow bigger by increasing sales, the labor markdown increases whereas more number of workers leads to a lower markdown. This is in line with Yeh et al. (2022), Brooks et al. (2021a,b).[13] These effects are opposite for markup; firms larger in size on sales have lower markup whereas firms larger in size on workers have higher markup. Further, these results suggest that firms larger in size in terms of sales have higher market power, whereas firms larger in size in terms of workers have lower market power, and again these effects are predominantly driven by the effect of size (sales) and size (workers) on labor market power, as these have an opposite but smaller effect on product market power.

Table 3 gives the results from the regression in which we include the interaction between export share and exchange rate to estimate the heterogeneous effect of exchange rate changes on domestic and exporting firms. The sample period covers 2008 to 2019, because the export share is only available after 2008. We use export and imported input share for plants as additional control variables in these regressions. Amiti et al. (2014) also suggest that exporters are also importers which affects the exchange rate pass-through and markup adjustment at these plants. These results confirm the previous results related to the exchange rate, size (sales), and size (workers). Interestingly, we find

[13] Increase in gross value added conditional on number of workers increases markdown, whereas increase in number of workers conditional on gross value added decreases markdown. These results suggest the functioning of the workers' bargaining hypothesis due to unionization argued earlier in the paper, although we do not have actual unionization data across these plants to test this hypothesis any further, and this effect is not the objective of this paper.



(a) Average Export Share During 2008-2019 and Average Export Share in 2008: Two–Digit Industry

(b) Average Export Share in 2019 and Average Export Share in 2008: Two–Digit Industry

Fig. 8. The correlation between average export share during 2008–2019 and average export share in 2008 is 0.94. The correlation between the average export share in 2019 and average export share in 2008 is 0.92.

Table 4
Export share and exchange rate pass-through to labor markdown, markup, and market power III.

	(1) Markdown: 2 Digit	(2) Markdown: 2 Digit	(3) Markup	(4) Market power
Log exchange rate × Export share	−0.206***	−0.115***	0.0605***	−0.180***
	(−7.72)	(−4.31)	(4.58)	(−8.46)
Log size (Sales)	0.664***	0.658***	−0.0120***	0.653***
	(207.72)	(205.25)	(−6.51)	(256.26)
Log size (Workers)	−0.536***	−0.535***	0.00124	−0.541***
	(−61.03)	(−61.21)	(0.33)	(−68.04)
Plant fixed effects	Yes	Yes	Yes	Yes
Plant-level variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	354 247	354 247	354 247	354 247
R-Squared	0.892	0.889	0.719	0.921

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels respectively. Plant level variable includes labor concentration at two-digit industry, state, and state & two-digit industry level, square of log size(workers), log capital, square of log capital, export share, and imported input share. The markdown in column (1) is based on overall average of material and labor share at two-digit industry level as elasticity of output with material and labor. The markdown in column (2) is based on annual average of material and labor share at two-digit industry level as elasticity of output with material and labor. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

Table 5
Relevance of the instrument.

	(1) Export share	(2) Export share*Exchange rate
Industry export share in 2008	0.683***	
	(196.20)	
Industry export share in 2008 × Exchange rate shock		4.112***
		(44.59)
Observations	353 815	353 815
R-Squared	0.0981	0.00559
F Statistics	38 496.4	1987.9

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the export share at the plant level. The dependent variable in the second column is the export share at the plant level multiplied by the exchange rate. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

that 1% depreciation in the exchange rate leads to 0.12 and 0.21% additional decline in labor market power for exporters. Furthermore, we find that 1% depreciation in the exchange rate leads to a 0.06% additional increase in markup for exporters. Overall, the exchange rate depreciation of 1% leads to an additional 0.18% decline in combined market power for exporters. Hence, we conclude that although depreciation helps exporters gain product market power, the loss in labor market power is larger, and thus depreciation leads to a decline in combined market power for exporters.

Table 4 gives the regression results where we include the interaction between export share and exchange rate to estimate the heterogeneous effect of exchange rate changes on domestic and exporting firms. In these regressions, we include year-fixed effects instead of macro variables and the results are similar to the results reported in Table 2. This suggests that the macro variables in Table 2 are able to capture the time variation in the data. Tables C.1, C.2, and C.3 in the Appendix give the corresponding results from Census only plants. These are large plants and are surveyed every year as explained above. The results from Census only plants are similar to the results reported for all plants in Tables 1, 2, and 3 which give us confidence about the reliability of these estimates. As argued above, year-fixed effects help us mitigate concerns related to the endogeneity of the exchange rate, but endogeneity concerns related to export shares are still relevant. In the next section, we estimate the instrumental variable regression to address the endogeneity concerns related to the export share and the exchange rate. As mentioned above, we use the exchange rate shocks obtained from the SVAR model as an instrumental variable for the exchange rate.

5.2. Exchange rate pass-through to labor markdown, markup, and market power: Instrumental variable regressions

As discussed above, the endogeneity of export shares at the plant level and exchange rate are the two main concerns that could lead to biased estimates of the coefficient associated with the interaction

Table 6
Exchange rate pass-through to labor markdown, markup, and market power: Instrumental variable regression.

	(1) Markdown: All	(2) Markup	(3) Market power	(4) Markdown: Manufacturing	(5) Markdown: Managerial
Log exchange rate × Export share	−2.434***	1.162***	−1.273**	−1.373**	−2.967***
	(−3.53)	(3.44)	(−2.34)	(−2.37)	(−2.85)
Log size (Sales)	0.664***	−0.0114***	0.652***	0.823***	0.510***
	(193.02)	(−5.77)	(238.08)	(257.95)	(104.01)
Log size (Workers)	−0.542***	−0.0000208	−0.542***	−0.859***	−0.162***
	(−58.34)	(−0.01)	(−68.25)	(−104.47)	(−11.57)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	353 815	353 815	353 815	353 794	341 663
R-Squared	0.357	−0.0439	0.488	0.573	0.101
Kleibergen–Paap rk Wald F statistic	24.76	24.76	24.76	24.75	24.75

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the material share to the labor share. In the second column, the dependent variable is the negative logarithm of the material share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the material share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the export share and the exchange rate at the plant level is instrumented with the product of the exchange rate shock from the SVAR and the average export share of the corresponding two-digit industry in 2008. The export share itself is instrumented with the average export share of the two-digit industry in 2008. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, the square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

Table 7
Exchange rate pass-through to labor markdown, markup and market power: Instrumental variable regression with petrol as flexible input.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Export share	−3.172***	2.310**	−0.861*	−2.411**	−3.198**
	(−2.68)	(2.10)	(−1.77)	(−2.05)	(−2.39)
Log size (Sales)	0.248***	0.405***	0.653***	0.412***	0.0874***
	(36.94)	(63.03)	(208.88)	(61.44)	(11.43)
Log size (Workers)	−0.371***	−0.147***	−0.518***	−0.714***	−0.00897
	(−23.03)	(−9.99)	(−57.55)	(−42.13)	(−0.47)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	278 848	278 848	278 848	278 834	271 500
R-Squared	−0.00821	0.0197	0.480	0.0779	−0.0314
Kleibergen–Paap rk Wald F statistic	28.20	28.20	28.20	28.20	28.60

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the petrol share to the labor share. In the second column, the dependent variable is the negative logarithm of the petrol share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the petrol share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the export share and the exchange rate at the plant level is instrumented with the product of the exchange rate shock from the SVAR and the average export share of the corresponding two-digit industry in 2008. The export share itself is instrumented with the average export share of the two-digit industry in 2008. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, the square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

of exchange rate and export share. In this section, we argue that the historical average export share in the industry to which a plant belongs can be used as an instrument for the plant's export share (see Fig. 8).

These historical averages are likely to influence exports through higher exports at the plant level, and hence the exogeneity of these instruments seems reasonable. Fig. 6 shows the correlation between the average export share during 2008–2019 and the average export share in 2008, which is 0.94 and is statistically significant. The correlation between the average export share in 2019 and the average export share in 2008 is 0.92 and is statistically significant. These two correlations suggest that export shares are highly persistent, and hence past export shares can be useful in predicting current exports share at the industry level and hence at the plant level. We exploit cross-industry variation in historical average industry shares measured in 2008. While this variation could, in principle, reflect either time-invariant industry characteristics or transitory shocks affecting industries differentially in 2008, the high persistence of industry export shares over time indicates that time-invariant factors are likely the primary drivers of the cross-sectional variation. We further argue that time-invariant factors that explain the variation in export shares in 2008 across industries will be absorbed by industry/plant fixed effects. Since we have two endogenous variables, exports share and export share interacted with exchange rate, we have to test the relevance of the instrumental variable strategy with both endogenous variables and the corresponding instrument. Intuitively, it must be the case that these historical industry averages are able to predict the current export share at the plant level. Second, the ability of these historical industry average interacted with exchange rate shocks to predict the interaction of current export share and exchange rate is also required.

Hence we estimate two regression models. The first is to estimate the strength of the relationship between plant-level export share and the average export share of the relevant industry in 2008 (instrumental variable), and the second is to estimate the relationship between plant-level export share multiplied by the exchange rate (endogenous variable) with the average export share of the relevant industry in 2008 multiplied with the exchange rate shock (instrumental variable). Table 5 gives these regression results, and both these regressions give significant coefficients and very high F values. Since these F values are

Table 8
Relevance of the instrument.

	(1) Export share	(2) Historical export share × Exchange rate
Historical export share	0.522***	
	(280.65)	
Historical export share × Exchange rate shock		16.62***
		(237.61)
Observations	174 574	174 574
R-Squared	0.311	0.244
F Statistics	78 763.9	56 457.6

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the export share at the plant level. The dependent variable in the second column is the historical export share at the plant level multiplied by the exchange rate. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

relatively higher compared to the rule of thumb F values, we argue that the instrument satisfies relevance criterion.[14] Further, we argue that the historical nature of the industry average makes them plausibly exogenous. Also, the exchange rate shocks obtained from the SVAR is likely to be exogenous. Using these instrumental variables, we estimate five models which capture the effect on labor markdown, markup, combined market power, markdown for manufacturing workers, and markdown for managerial workers.

Table 6 gives the first set of instrumental variable regressions. The dependent variable for the first column is the log of the ratio of material share and labor share, and that gives the effect on labor markdown. The dependent variables in the second and third columns are -log(material share) and - log(labor share) which show the % change in markup and market power. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of material share to manufacturing labor share and to managerial labor share, respectively. These results are with a slightly smaller number of observations because we kept only at four-digit industry with at least 100 plants in 2008 to obtain the average.

These regressions are estimated with plant and year-fixed effects and hence we cannot estimate the effect of exchange rate but can only estimate the incremental effect on exporting firms. Results in Table 6 suggest that 1% depreciation in the exchange rate leads to a 2.4% additional decline in labor market power for exporters. Furthermore, we find that 1% depreciation in the exchange rate leads to 1.2% additional increase in markup for exporters. But, overall the exchange rate depreciation of 1% leads to an additional 1.3% decline in combined market power for exporters. The coefficients associated with size (sales) and size(workers) are similar in magnitude and direction. Further, comparing the effect of labor market power with respect to manufacturing and managerial labor, we find that exchange rate depreciation of 1% leads to an additional 1.4% decline in manufacturing labor market power compared to 3% decline in managerial labor market power. These instrumental variable regressions suggest that the effect of exchange rate changes on the different market power of exporting firms is higher in magnitude. These estimates are larger compared to regressions without instrumental variables presented in Table 3. Further, these estimates effectively imply that output elasticities are plant specific and vary over time due to a range of controls in the estimation as explained above.

[14] The significantly higher F values are driven by the temporal nature of the data. If we estimate the F values for one year alone, then it is not very high; these results are available upon request. Furthermore, the R^2 from the first stage regression presented here is lower or comparable to the existing studies using such estimation strategy (see Autor et al., 2013).

As already mentioned, the framework used in this paper is useful for estimating the effect of exchange rate changes on market power using different flexible inputs. Table 7 presents the instrumental variables regression in which we use petrol (fuel) as a flexible input. The dependent variable for Table 7 is same as in Table 6. These estimates are with a slightly smaller number of observations, as we exclude plants having zero or missing petrol share, which is required to obtain the ratio of labor share and petrol share. With petrol as a flexible input, we find that exchange rate depreciation leads to a higher decline in labor market power for exporters but the gain in the product market is also bigger in terms of a larger increase in markup. Overall, the effect on combined market power is similar but quantitatively smaller compared to Table 6. These results also suggest that the decline in market power with respect to managerial labor is higher compared to manufacturing labor.

This suggests that different types of flexible input may give rise to different effects on markdown and markup which make these effects more volatile, and we compare these effects in the later section.

5.3. Plant level historical exports share: Shift-share design

As mentioned above, the regression results presented in previous sections help in mitigating the endogeneity concerns related to the plant's export share. In this section, we estimate regression models which alleviate these concerns in a different way. We use historical plant share, instead of plant share at time t to estimate these models. Hence in these models, we have only one endogenous variable, i.e., exchange rate. We use historical export share at plant and argue that this is not driven by subsequent exchange rate changes. Column (2) of Table 8 presents the first stage regression. The first column shows that the current export shares are related to the historical export share. As we can see, the instrumental variable is significantly correlated with the endogenous variable and the first stage F is higher than the rule of thumb F. The identification relies on plausible exogeneity of historical export share and exogeneity of exchange rate shocks obtained from SVAR.

It is important to emphasize that we do not use instrumental variable for export share and use historical values of the same. We only use exchange rate shock from the SVAR model as instrumental variable for exchange rate. The design is similar to the widely used shift-share design where the historical export share is 'share' and the exchange rate is a 'shift' variable. Autor et al. (2013) use similar design to estimate the effect of China shock on US manufacturing employment. But unlike traditional Bartik shift-share design, this design is not based on an explicit accounting approach (Ferri, 2022). The effect of the exchange rate is thus driven by variation in historical export shares, which helps mitigate concerns about reverse causality. This also resolves time-invariant omitted variables that may drive variation in historical export shares as we control for plant-fixed effects. Finally, since we control for plant fixed effects, effectively this implies output elasticity to vary at plant level and over time due to wide-range of controls. We only keep plants with more than 5 years of observations to estimate the within effect. We do robustness with smaller number of plants where we keep plants having more than 10 years of observations, and these results are given in Appendix.

Results in Table 9 suggest that 1% depreciation in the exchange rate leads to a 0.56% additional decline in labor market power for exporters. Furthermore, we find that 1% depreciation in the exchange rate leads to a 0.22% additional increase in the markup for exporters. Overall, the exchange rate depreciation of 1% leads to an additional 0.34% decline in combined market power for exporters. We also find that exchange rate depreciation of 1% leads to an additional 0.48% decline in manufacturing labor market power compared to 0.58% decline in managerial labor market power. These effects are very close to the effects obtained with plant-level regression reported using simple fixed-effect regressions before, but lower than the instrumental

Table 9
Exchange rate pass-through to markdown, markup, and market power: Shift-share regression.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Export share	−0.558***	0.218***	−0.340***	−0.480***	−0.576***
	(−6.99)	(5.08)	(−5.27)	(−6.63)	(−3.95)
Log size (Sales)	0.651***	0.00793***	0.658***	0.809***	0.497***
	(136.25)	(2.88)	(167.74)	(178.39)	(74.79)
Log size (Workers)	−0.482***	−0.0227***	−0.505***	−0.858***	−0.138***
	(−28.30)	(−3.28)	(−34.66)	(−46.86)	(−6.78)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	174 574	174 574	174 574	174 569	172 433
R-Squared	0.385	0.0111	0.499	0.576	0.129
Kleibergen–Paap rk Wald F statistic	734.6	734.6	734.6	734.6	731.4

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the material share to the labor share. In the second column, the dependent variable is the negative logarithm of the material share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the material share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the historical export share (first year in the sample) and the exchange rate at the plant level is instrumented with the product of the historical export share and exchange rate shock from the SVAR. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, the square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

Table 10
Exchange rate pass-through to markdown, markup, and market power: Shift-share regression with petrol as flexible input.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Export share	−1.053***	0.741***	−0.312***	−1.021***	−1.081***
	(−4.77)	(3.42)	(−4.76)	(−4.60)	(−4.49)
Log size (Sales)	0.167***	0.495***	0.662***	0.325***	0.0143
	(17.06)	(51.33)	(164.14)	(32.84)	(1.34)
Log size (Workers)	−0.322***	−0.152***	−0.474***	−0.724***	−0.000129
	(−10.64)	(−5.34)	(−30.54)	(−22.66)	(−0.00)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	167 444	167 444	167 444	167 437	166 019
R-Squared	0.0146	0.0333	0.502	0.0600	0.00209
Kleibergen–Paap rk Wald F statistic	6697.0	6697.0	6697.0	6697.6	6682.0

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the petrol share to the labor share. In the second column, the dependent variable is the negative logarithm of the petrol share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the petrol share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the historical export share (first year in the sample) and the exchange rate at the plant level is instrumented with the product of the historical export share and exchange rate shock from the SVAR. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, the square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

variable regression estimated above using historical industry average export share as instrumental variable for export share. Apart from the differences in instrumental variable, the other difference between these two tables is that in Tables 6 and 7, export share is used as control for elasticity, but not in Table 9. Since these historical exports shares do not vary overtime, this is absorbed by plant fixed effects. Hence, these results are likely driven by the difference in instrumental variables as well as differences in control for elasticities. Despite these differences, the results are qualitatively similar.

With petrol as a flexible input (Table 10), we find that 1% exchange rate depreciation leads to a higher decline (1.05%) in labor market power for exporters, but the gain in the product market is bigger (0.19%) due to a larger increase in markup and the overall effect on combined market power is similar to the effect obtained using material as flexible input reported in Table 9. These regressions are estimated with very different samples as we do not have information related to petrol inputs for all the plants. We also find that exchange rate depreciation of 1% leads to an additional 1.02% decline in manufacturing labor market power compared to 1.08% decline in managerial labor market power. We further estimate these models with two-digit industry-year fixed effects, and these results are given in Table D.1. These results are also qualitatively similar to the results reported here. The inclusion of two-digit industry year controls for sector specific year fixed effects and hence controls for common sector level variables. This also allows a very flexible control for elasticities and suggests that even within a sector in a year, exchange rate depreciation reduces labor markdown or market power for plants with higher export share. Appendix E presents all these results with a smaller number of observations where we keep plants with more than 10 years of observations. These results are qualitatively similar to the results reported with a smaller set of plants with at least 10 years of observations reported here. Since the effect of exchange rate shock on markdown, markup, and overall market power of exporters remains similar across different flexible inputs and samples, this gives confidence about the direction of relationship and the effect of exchange rate on exporter's market power.

5.4. Discussion

The above results suggest that labor market adjustments dominate the effect of exchange rate depreciation, implying that plants experience a decline in overall market power primarily due to an increase in the elasticity of labor supply. Moreover, the increase in labor supply elasticity is more pronounced for managerial labor than for non-managerial labor. This heterogeneity likely reflects segmentation in the labor market arising from differences in skill requirements. Intuitively, these results indicate that exchange rate depreciation enhances the bargaining power of managerial workers to a greater extent than that of non-managerial workers.

We use two categories of flexible inputs: raw materials and petrol. Although the samples differ due to data limitations, the findings consistently suggest that the effects on both product and labor market power are stronger using the petrol share. Raval (2023) also reports substantial differences in markup estimated using energy and non-energy raw materials, which they attribute to non-neutral productivity. Assuming that plants possess some market power in the materials market, our estimates based on material share may partially reflect this influence. By contrast, it is implausible that plants exercise market power in the petroleum products; hence, the results based on the petrol share are likely to provide a more accurate measure of the true effect of exchange rate changes on different components of market power.

Furthermore, the two instrumental-variable strategies yield quantitatively different effects of exchange rate changes on market power. Although the same instrument is used for the exchange rate variation in both specifications, the variation in export share differs. In the first approach, we employ industry-level export shares as an instrumental variable for exports, whereas we use historical export share directly in the second case. Although the individual first-stage F-statistics in the two regressions (reported in Table 5) are strong, the Kleibergen–Paap rk Wald F-statistics in Tables 6 and 7 (first case) are relatively smaller than those in Tables 9 and 10 (second case). This indicates that the combined instruments used in Tables 6 and 7 are comparatively weaker than the single instrument employed in Tables 9 and 10. Nevertheless, both strategies pass the weak-instrument test, with F-statistics exceeding the conventional threshold of 10. Assuming that historical export shares are plausibly exogenous, the results reported in Tables 9 and 10 can be considered relatively more reliable than those in Tables 6 and 7 given the strength of the instrumental variable.

6. Concluding remarks

In this paper, we explore how exchange rate depreciation affects markdown, markup, and overall market power for exporters using plant-level data from India. We argue that variations in markup and markdown are driven by changes in the material share and the ratio of material to labor share, which can be used to estimate the effects of exchange rate shocks on these variables. Our results show that exchange rate depreciation reduces labor markdown, bringing wages closer to competitive levels and benefiting labor, particularly so in exporting plants. Although exchange rate depreciation leads to gains in product market power for exporters, these gains are insufficient compared to losses in labor market power. As a result, there is an overall decline in combined market power for exporters due to exchange rate depreciation. We emphasize the importance of considering the market power that exporters retain in the input market to accurately assess the overall impact of exchange rate depreciation on their market power.

To address endogeneity concerns related to export shares at the plant level, we use two strategies. First, we employ the historical average of export share at the industry level interacted with exchange rate shocks from a SVAR model as an instrumental variable for interaction of export share and exchange rate. In this model, we also make use of the historical average of the export share at the industry level as an instrumental variable for the plant-level export share. Second, we also adopt historical plant-specific export shares interacted with exchange rate shocks as an instrumental variable for historical plant-specific export shares interacted with exchange rate in a shift-share design. Both strategies validate our findings that exporters experience a greater reduction in markdown and a larger increase in markup due to exchange rate depreciation, but their overall market power still declines due to losses in labor market power. We also conduct robustness checks using alternative flexible inputs and distinguish between managerial and non-managerial labor. Our findings suggest that managerial workers benefit more from exchange rate depreciation compared to non-managerial workers, and treating managerial labor as an input with market power results in a higher loss of market power for exporters. These results suggest that adjustments in the labor market are key to understanding the effect of exchange rate changes on exporters' market power.

CRediT authorship contribution statement

Abhishek Kumar: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sushanta Mallick:** Writing – review & editing, Writing – original draft, Visualization, Validation, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Pass-through to prices

We estimate the simple pass-through regression given by

$$\Delta \text{Log Price}_{it} = \beta_0 + \beta_1 \Delta \text{Log Exchange Rate}_t + \beta_2 \text{Inflation}_t + \beta_3 \text{Time Trend} + \theta_i + \theta_t + \epsilon_{it}$$

where $\beta_1 = -1$ in case of complete pass-through. Suppose the dollar price is given by p^{usd}, the price in the home country is p, and the exchange rate is e (Rupee/USD). Hence we have:

$$p = e * p^{usd}$$

$$log p = log e + log p^{usd}.$$

Differentiating both sides, we can write

$$\frac{dp}{p} = \frac{de}{e} + \frac{dp^{usd}}{p^{usd}}$$

% Change in Domestic Price=

% Change in Exchange Rate+% Change in Dollar Price

If we want % change in Domestic Price to be zero, then that implies:

% Change in Dollar Price = –% Change in Exchange Rate

We control for product fixed effects θ_i, time fixed effects θ_t and time trend. We also control for domestic inflation in India to ensure that price changes are orthogonal to domestic inflation. Table A.1 gives the pass-through to export prices. The results indicate higher pass-through

Table A.1
Pass-through to export prices.

	(1) ΔLog Price	(2) ΔLog Price
Rupee/USD exchange rate	−0.337***	−0.514***
	(−4.13)	(−3.49)
Consumer inflation	0.00253	0.000725
	(1.60)	(0.25)
Product fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Time trend	Yes	Yes
Observations	234 303	61 245

Notes: *, **, and *** denote 10%, 5%, and 1% significance levels respectively. Column 1 and 2 are at 6 and 4 digit product code respectively.

Table A.2
Pass-through to imports prices.

	(1) ΔLog Price	(2) ΔLog Price
Rupee/USD exchange rate	−0.581***	−0.669***
	(−9.33)	(−6.10)
Consumer inflation	−0.00475***	−0.00727***
	(−5.72)	(−5.47)
Product fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Time trend	Yes	Yes
Observations	283 182	75 362

Notes: *, **, and *** denote 10%, 5%, and 1% significance levels respectively. Column 1 and 2 are at 6 and 4 digit product code respectively.

at 4-digit compared to the 6-digit products. In general the incomplete pass-through implies that domestic sellers gain due to exchange rate depreciation and hence we argue that there is a windfall gain due to exchange rate depreciation to the exporting plants which do not occur to non-exporting plants.

Table A.2 gives the pass-through to import prices. Again, the results indicate higher pass-through at 4-digit compared to the 6-digit products. The incomplete pass-through to import prices implies that plants using imported input face higher input prices in Rupee due to exchange rate depreciation and hence the plants using imported inputs are worse off due to depreciation compared to plants not using imported inputs. Also the pass-through to the imports prices are higher compared to the export prices. This pattern has been documented in the literature. Using both regression- and VAR-based estimates, Choudhri and Hakura (2015) argue that the exchange rate pass-through to import prices for a large number of countries, although incomplete, is in general higher than the pass-through to export prices. This implies that a plant that both exports and uses imported inputs is still likely to gain from exchange rate depreciation due to differential exchange rate pass-through.

Appendix B. Data

Quarterly Data

- Inflation, GDP and Interest Rate from Reserve Bank of India Database on Indian Economy
- NAEXKP07INQ652S National Accounts: GDP by Expenditure: Constant Prices: Less: Imports of Goods and Services for India, Indian Rupee, Quarterly, Seasonally Adjusted
- INDIMPORTQDSMEI National Accounts: GDP by Expenditure: Current Prices: Less: Imports of Goods and Services for India, Indian Rupee, Quarterly, Seasonally Adjusted
- DCOILBRENTEU Crude Oil Prices: Brent - Europe, Dollars per Barrel, Quarterly, Not Seasonally Adjusted
- DEXINUS Indian Rupees to U.S. Dollar Spot Exchange Rate, Indian Rupees to One U.S. Dollar, Quarterly, Not Seasonally Adjusted

Annual Data

- Inflation and Interest Rate from Reserve Bank of India Database on Indian Economy
- DEXINUS Indian Rupees to U.S. Dollar Spot Exchange Rate, Indian Rupees to One U.S. Dollar, Annual, Not Seasonally Adjusted
- RBINBIS Real Broad Effective Exchange Rate for India, Index 2020 = 100, Annual, Not Seasonally Adjusted
- DCOILBRENTEU Crude Oil Prices: Brent - Europe, Dollars per Barrel, Annual, Not Seasonally Adjusted
- MANMM101INM189S Monetary Aggregates and Their Components: Narrow Money and Components: M1 and Components: M1 for India, Indian Rupee, Annual, Seasonally Adjusted
- TT.PRI.MRCH.XD.WD Net barter terms of trade index (2015 = 100)
- TG.VAL.TOTL.GD.ZS Merchandise trade (% of GDP)
- BX.KLT.DINV.WD.GD.ZS Foreign direct investment, net inflows (% of GDP)
- BN.CAB.XOKA.GD.ZS Current account balance (% of GDP)
- NY.GDP.MKTP.KD.ZG GDP growth (annual

Appendix C. Results with only Census plants

See Tables C.1–C.3.

Table C.1
Exchange rate pass-through to labor markdown, markup, and market power I: Census plants only.

	(1) Markdown: 2 Digit	(2) Markdown: 2 Digit	(3) Markup	(4) Market power
Log exchange rate	−0.614***	−0.274***	0.0453***	−0.583***
	(−33.45)	(−14.81)	(3.89)	(−42.33)
Log size (Sales)	0.633***	0.624***	−0.00352*	0.645***
	(167.27)	(164.74)	(−1.66)	(218.36)
Log size (Workers)	−0.519***	−0.516***	−0.00733	−0.544***
	(−39.98)	(−39.79)	(−1.22)	(−52.96)
Plant fixed effects	Yes	Yes	Yes	Yes
Plant-level variables	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No
Observations	324 693	324 693	324 693	324 693
R-Squared	0.888	0.886	0.701	0.923

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels respectively. Macro variables include interest rate, consumer inflation, real GDP growth, log of money supply, log real broad effective exchange rate, log crude oil prices, net barter terms of trade index, merchandise trade to GDP, foreign direct investment as % of GDP and current account balance as % of GDP. Plant level variable includes labor concentration at two-digit industry, state, and state & two-digit industry level, square of log size(workers), log capital, and the square of log capital. The markdown in column (1) is based on overall average of material and labor share at two-digit industry level as elasticity of output with material and labor. The markdown in column (2) is based on annual average of material and labor share at two-digit industry level as elasticity of output with material and labor. The sample period is from 1998 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

Table C.2
Export share and exchange rate pass-through to labor markdown, markup, and market power II: Census plants only.

	(1) Markdown: 2 Digit	(2) Markdown: 2 Digit	(3) Markup	(4) Market power
Log exchange rate × Export share	−0.204***	−0.107***	0.0730***	−0.166***
	(−6.77)	(−3.54)	(4.95)	(−7.02)
Log exchange rate	−2.482***	−0.929***	0.714***	−1.688***
	(−15.71)	(−5.86)	(7.50)	(−13.97)
Log size (Sales)	0.658***	0.650***	0.00170	0.660***
	(157.91)	(156.01)	(0.70)	(198.58)
Log size (Workers)	−0.516***	−0.516***	−0.0127**	−0.537***
	(−36.97)	(−37.01)	(−2.08)	(−46.13)
Plant fixed effects	Yes	Yes	Yes	Yes
Plant-level variables	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No
Observations	233 691	233 691	233 691	233 691
R-Squared	0.894	0.891	0.719	0.925

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels respectively. Macro variables include interest rate, consumer inflation, real GDP growth, log of money supply, log real broad effective exchange rate, log crude oil prices, net barter terms of trade index, merchandise trade to GDP, foreign direct investment as % of GDP and current account balance as % of GDP. Plant level variable includes labor concentration at two-digit industry, state, and state & two-digit industry level, square of log size(workers), log capital, square of log capital, export share, and imported input share. The markdown in column (1) is based on overall average of material and labor share at two-digit industry level as elasticity of output with material and labor. The markdown in column (2) is based on annual average of material and labor share at two-digit industry level as elasticity of output with material and labor. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

Table C.3
Export share and exchange rate pass-through to labor markdown, markup, and market power III: Census plants only.

	(1) Markdown: 2 Digit	(2) Markdown: 2 Digit	(3) Markup	(4) Market power
Log exchange rate × Exports share	−0.204***	−0.107***	0.0730***	−0.166***
	(−6.77)	(−3.54)	(4.95)	(−7.02)
Log size (Sales)	0.658***	0.650***	0.00170	0.660***
	(157.91)	(156.01)	(0.70)	(198.58)
Log size (Workers)	−0.516***	−0.516***	−0.0127**	−0.537***
	(−36.97)	(−37.01)	(−2.08)	(−46.13)
Plant fixed effects	Yes	Yes	Yes	Yes
Plant-level variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	233 691	233 691	233 691	233 691
R-Squared	0.894	0.891	0.719	0.925

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels respectively. Plant level variable includes labor concentration at two-digit industry, state, and state & two-digit industry level, square of log size(workers), log capital, square of log capital, export share, and imported input share. The markdown in column (1) is based on overall average of material and labor share at two-digit industry level as elasticity of output with material and labor. The markdown in column (2) is based on annual average of material and labor share at two-digit industry level as elasticity of output with material and labor. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate.

Table D.1
Exchange rate pass-through to markdown, markup and market power: Shift-share regression with two-digit industry year fixed effects.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Exports share	−0.293***	0.0560	−0.237***	−0.254***	−0.286*
	(−3.41)	(1.23)	(−3.37)	(−3.27)	(−1.81)
Log size (Sales)	0.649***	0.00875***	0.658***	0.809***	0.495***
	(135.61)	(3.16)	(166.73)	(177.29)	(74.07)
Log size (Workers)	−0.485***	−0.0226***	−0.508***	−0.858***	−0.148***
	(−28.69)	(−3.30)	(−34.99)	(−47.05)	(−7.23)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	174 574	174 574	174 574	174 569	172 432
R-Squared	0.383	0.0118	0.497	0.574	0.127
Kleibergen–Paap rk Wald F statistic	672.8	672.8	672.8	672.8	668.7

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the material share to the labor share. In the second column, the dependent variable is the negative logarithm of the material share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the material share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the historical export share (first year in the sample) and the exchange rate at the plant level is instrumented with the product of the historical export share and exchange rate shock from the SVAR. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, the square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

Appendix D. Plant level historical exports share: Shift share design with additional fixed effects

See Table D.1.

Appendix E. Plant level historical exports share: Shift share design robustness

See Tables E.1–E.4.

Table E.1
Relevance of the instrument.

	(1) Export share	(2) Historical export share × Exchange rate
Historical export share	0.480***	
	(169.27)	
Historical export share × Exchange rate shock		15.56***
		(143.76)
Observations	78 505	78 505
R-Squared	0.267	0.208
F Statistics	28 651.9	20 667.5

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the export share at plant level. The dependent variable in the second column is the historical export share at plant level multiplied by the exchange rate. The sample period is from 2008 to 2019. The exchange rate refers to the nominal Rupee/USD bilateral exchange rate. Historical plant share refers to the export share in the first year from the sample.

Table E.2
Exchange rate pass-through to markdown, markup and market power: Shift-share regression.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Export share	−0.567***	0.168***	−0.400***	−0.488***	−0.660***
	(−6.60)	(3.82)	(−5.50)	(−6.06)	(−3.91)
Log size (Sales)	0.624***	0.0250***	0.649***	0.787***	0.466***
	(81.78)	(5.78)	(100.92)	(103.16)	(44.06)
Log size (Workers)	−0.347***	−0.0199	−0.367***	−0.813***	−0.0650
	(−8.27)	(−1.29)	(−10.11)	(−15.05)	(−1.49)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	78 505	78 505	78 505	78 501	78 315
R-Squared	0.352	0.0161	0.467	0.555	0.110
Kleibergen–Paap rk Wald F statistic	222.5	222.5	222.5	222.5	222.4

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the material share to the labor share. In the second column, the dependent variable is the negative logarithm of the material share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the material share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the historical export share (first year in the sample) and the exchange rate at the plant level is instrumented with the product of the historical export share and exchange rate shock from the SVAR. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

Table E.3
Exchange rate pass-through to markdown, markup and market power: Shift-share regression with two-digit industry year fixed effects.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Export share	−0.341***	0.0520	−0.289***	−0.312***	−0.355*
	(−3.63)	(1.08)	(−3.61)	(−3.58)	(−1.94)
Log size (Sales)	0.623***	0.0266***	0.650***	0.785***	0.464***
	(81.20)	(6.14)	(100.02)	(101.81)	(43.39)
Log size (Workers)	−0.348***	−0.0199	−0.368***	−0.812***	−0.0820*
	(−8.37)	(−1.28)	(−10.24)	(−15.05)	(−1.86)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	78 502	78 502	78 502	78 498	78 312
R-Squared	0.351	0.0169	0.465	0.553	0.109
Kleibergen–Paap rk Wald F statistic	187.2	187.2	187.2	187.2	187.0

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the material share to the labor share. In the second column, the dependent variable is the negative logarithm of the material share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the material share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the historical export share (first year in the sample) and the exchange rate at the plant level is instrumented with the product of the historical export share and exchange rate shock from the SVAR. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

Table E.4
Exchange rate pass-through to markdown, markup and market power: Shift-share regression with petrol as flexible input.

	(1) Log markdown	(2) Markup	(3) Market power	(4) Markdown manufacturing	(5) Markdown managerial
Log exchange rate × Export share	−0.730***	0.300	−0.431***	−0.660**	−0.905***
	(−2.80)	(1.18)	(−5.67)	(−2.51)	(−3.16)
Log size (Sales)	0.165***	0.490***	0.655***	0.330***	0.00328
	(9.27)	(28.30)	(99.52)	(18.57)	(0.17)
Log size (Workers)	−0.401***	0.0688	−0.332***	−0.897***	−0.128
	(−5.21)	(1.02)	(−8.19)	(−10.27)	(−1.61)
Plant fixed effects	Yes	Yes	Yes	Yes	Yes
Plant-level controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	65 307	65 307	65 307	65 304	65 248
R-Squared	0.0122	0.0259	0.467	0.0539	0.00233
Kleibergen–Paap rk Wald F statistic	23 712.6	23 712.6	23 712.6	23 716.5	23 671.9

Notes: *, **, and *** denote significance at 10%, 5%, and 1% significance levels respectively. The dependent variable in the first column is the logarithm of the ratio of the petrol share to the labor share. In the second column, the dependent variable is the negative logarithm of the petrol share, while in the third column, it is the negative logarithm of the labor (wage) share. The dependent variables in the fourth and fifth columns are the logarithm of the ratio of the petrol share to the manufacturing labor share and to the managerial labor share, respectively. All shares are computed relative to total sales. The product of the historical export share (first year in the sample) and the exchange rate at the plant level is instrumented with the product of the historical export share and exchange rate shock from the SVAR. The plant-level controls include labor concentration at the two-digit industry, state, and state-industry levels, the squared logarithm of plant size (number of workers), log capital, the square of log capital, and the imported input share. The sample period covers 2008–2019. The exchange rate refers to the nominal bilateral Rupee/USD exchange rate.

Data availability

The authors do not have permission to share data.

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