Chinese Import Competition and Prices: Evidence from India*

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Abstract

How do output prices respond to trade shocks? Using detailed firm-product level data on sales and quantity between 1996–2007, we study the causal effect of Chinese import competition on prices for Indian manufacturing firms. We find that Chinese import competition induces a significant decline in firm-product prices. A one percentage point increase in the Chinese import penetration ratio reduces firm-product prices by 3.5%. Further, this decline in prices is driven by a decline in markup, conditional on costs, as opposed to the passthrough of cost savings to prices – providing evidence for *pro-competitive effect*. This decline in prices and markup is less pronounced for firms owned by Business Groups compared to stand-alone, privately owned firms. We also document a large decrease in marginal costs and an increase in markup with no significant effect on prices for firms on account of increased access to imported Chinese inputs.

Keywords: Chinese Imports, Prices, Markup, Marginal Cost, Business Groups
JEL Codes: F14, F16, F66

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1 Introduction

China experienced rapid productivity growth in manufacturing during the 1990s and 2000s primarily due to its internal market reforms.[1] This productivity growth, combined with its accession to the WTO in 2001, fuelled an exponential growth in Chinese exports to countries across the world. A burgeoning literature subsequently emerged to document the impact of this large increase in Chinese exports on firms' performance and employment but focused mostly on developed economies with little attention to developing countries.[2] Among the few studies on developing economies, the effect of Chinese imports on the prices of domestic firms in those countries has largely been neglected. This is problematic as trade theory underlines several mechanisms through which consumers can benefit from lower prices of domestic goods in response to an increase in imports. Thus, understanding how prices of domestic firms change in response to an increase in Chinese imports is important to understand the gains to consumers from trade shocks.

Import competition, in our case from China, can lead to a decline in prices as domestic firms would be forced to lower markups and hence prices as they experience a reduction in their residual demand. Further, increased competition from China could, in theory, force domestic firms to lower their marginal costs by undertaking investments to improve productivity. However, the extent of the price reduction due to lower marginal costs would crucially depend on the rate of passthrough of costs to prices.

In this article, we study the effect of import competition from China on firm-product

[1] These reforms included, inter alia, mass rural-urban migration (Chen et al., 2010), permission to multinational enterprises to operate in China (Naughton, 2007), and access to foreign technology and inputs (Hsieh & Klenow, 2009).

[2] Autor et al. (2013), Autor et al. (2014), and Acemoglu et al. (2016) study the effect of Chinese import competition on the labor market outcomes in the US, while Utar (2014) documents the effect of Chinese import competition in the textile sector on the performance of Danish firms. Bloom et al. (2016) and Autor et al. (2020a) study the effect of Chinese import competition on innovation in European countries and the USA, respectively. Hombert & Matray (2018) find that R&D intensive firms in the US are more resilient to Chinese import competition.

prices using rich data on firm-product sales and quantity for Indian manufacturing firms from 1996 to 2007. Additionally, we disentangle the contributions of cost savings and the lowering of markup (*pro-competitive effect*) to the overall effect of Chinese import competition on prices. Finally, we also document considerable heterogeneity in firm responses based on ownership and initial marginal costs.

India provides an ideal setting for evaluating the effect of Chinese imports on domestic prices. Among the developing countries, the rise in Chinese imports was particularly severe for India, with the Chinese import share in manufacturing increasing dramatically from 3% in 1996 to 18% in 2007. By 2007, the share of Chinese imports in India's total imports was higher than that of both low-and-middle and high-income countries as shown in **Figure 1**. Further, Chinese imports are likely to intensify the competition in the import-competing sectors as India and China are technologically similar.[3] When there is head-to-head competition, the effect on prices is likely to be stronger both due to a larger decline in markup (Edmond et al., 2015) and investments to reduce marginal costs (Aghion et al., 2005). Thus, we are more likely to observe the competitive mechanisms in India. Further, registered firms in India are required by law under the Companies Act, 1956 to report sales and quantity for all their products, which is crucial for our empirical analysis. We use recent advancements in estimating marginal costs and markup from quantity based production functions, as in De Loecker et al. (2016), to analyze the effect of Chinese import competition on prices and its underlying components.

Our empirical strategy relies on comparing changes in prices for firms across industries with varying degrees of exposure to Chinese imports. While much of the increase in Chinese imports was due to an increase in its manufacturing productivity, unobserved demand and technology shocks may be correlated with both the Chinese imports and

[3]Comparing across countries, Di Giovanni et al. (2014) find that the correlation between the tradeable sectors' productivity of a country with China is highest for India at 0.928.

prices. To address these endogeneity concerns, we follow Autor et al. (2013) and Acemoglu et al. (2016) and instrument for India's imports from China with Chinese imports to a set of Latin American countries.[4] Our specifications include a rich set of fixed effects and a host of alternative trade channels to control for unobservables.[5] We also conduct several robustness checks and provide strong evidence that differential trends in prices and omitted variables do not drive our results.

We find that a one percentage point increase in the Chinese import penetration ratio reduces firm-product prices by 3.5%. To understand the mechanisms driving the reduction in prices, we examine the response of marginal cost and markup to Chinese imports. We find that Chinese import competition has a negative albeit insignificant effect on marginal costs. In contrast, there is a strong negative effect on markup, which increases in magnitude when we control for changes in marginal costs, consistent with an incomplete passthrough of costs to prices. Thus, the overall reduction in prices due to Chinese import competition is primarily driven by a direct reduction in markup. This result is consistent with the *pro-competitive effect* of trade – import competition leads to lower residual demand for domestic firms, which reduces markups.

We also find a considerable decline in marginal costs for Indian firms due to increased access to Chinese inputs. However, due to an incomplete passthrough of costs to prices, there is an increase in markup due to Chinese inputs. Combining the effects of Chinese import competition and access to Chinese inputs, our estimates imply a reduction in marginal costs by 43.8% and an increase in markup by 23.2%, leading to a decline in prices by 20.6%. Our findings suggest that Indian firms capture a significant part of the cost savings and are the main beneficiaries of increased imports from China.

[4]We choose Latin American countries as our set of instrument countries as these are not major trade partners of India (Chakraborty et al., 2021).

[5]In particular, our specifications control for Chinese import competition in foreign markets, import competition in India from the rest of the world, and import tariffs (output and input) faced by Indian firms in the domestic market.

Further, we test for heterogeneous effects based on firm characteristics to better understand the mechanisms driving our results on marginal cost, markup, and prices. We focus mainly on *Business Groups*. A 'business group' comprises several firms in diverse sectors having substantial common ownership. These firms dominate the private economic activity in India. Studies have argued that they have considerable market power and/or consumer appeal for their products and have access to internal pools of capital and managerial talent compared to other firms, such as stand-alone private firms (Khanna & Palepu, 1997, 2000).

We find that Business Group owned firms lower their prices much less than other stand-alone privately owned Indian firms. In particular, Business Group owned firms dropped their prices 30% less than other firms in response to Chinese import competition. This differential effect for Business Group firms is driven by a lower direct reduction in markup (conditional on marginal costs) as opposed to a differential change in marginal costs.

While we find no significant effect on marginal costs in response to Chinese import competition, the average effects may be masking considerable heterogeneity in firm responses based on initial marginal costs. We find that firms in the lowest quartile of marginal costs differentially lower marginal costs compared to other firms. However, there is no differential effect on markup and prices.

There are two key takeaways from our findings. First, our results highlight the important role that incomplete passthrough of costs to prices play in determining the distribution of the gains from import competition between producers and consumers. If the most efficient firms passed on their reduction in costs to prices in response to Chinese import competition, there would have been a much larger decline in prices. Secondly, our results suggest that privately owned firms are the most negatively affected by Chinese import competition. This has implications for better targeting of policies aimed at mitigating the negative consequences for firms due to import competition.

Related literature: Our study contributes to several strands of literature. First, we contribute to the literature documenting the deflationary consequences of import competition from low-wage countries, particularly from China, in developed economies (Chen et al., 2009; Auer & Fischer, 2010; Auer et al., 2013; Amiti et al., 2020; Bai & Stumpner, 2019). While these studies focus on aggregate price changes, our focus instead is narrower, and we provide micro-level evidence on how prices charged by domestic firms decline in response to Chinese import competition in a large developing country, India. Further, our data allows us to study the effect of Chinese imports on the underlying components of prices, enabling us to disentangle the various mechanisms driving the overall changes in prices.

Our paper is related to Bugamelli et al. (2015), who document a decline in prices of manufacturing firms in Italy in response to Chinese import competition driven by a decline in prices of low productivity firms. Our paper differs from theirs along several important dimensions. We find a much stronger decline in prices compared to their estimates: a one percentage point increase in Chinese import penetration reduces prices by 3.5% in India as compared to 1.7% in Italy. We are also able to estimate the effect of Chinese imports on marginal cost and markup, enabling us to disentangle the procompetitive effects from the changes in costs in response to imports. Finally, we focus on a novel dimension of firm heterogeneity, Business Group affiliation of firms, that affects the price responses to import competition. Given that Business Groups account for a large share of manufacturing output in developing countries, it is important to understand differences in how these firms respond to trade liberalization compared to others. Our results add to a growing literature documenting various dimensions of heterogeneity in firm responses to increased import competition (Pavcnik, 2002; Bernard et al., 2006; Bloom et al., 2016; Hombert & Matray, 2018; Autor et al., 2020a; Brandt et al., 2017; Chen & Steinwender, 2021).

Second, our paper is related to the empirical literature on the impact of trade on markups. Early studies on trade and firm-level markups focus on the reduction of tariffs on final goods (output tariffs) in Côte d'Ivoire (Harrison, 1994) and Turkey (Levinsohn, 1993) finding evidence of *pro-competitive* effects of trade. Extending the same line of research, De Loecker et al. (2016) studies the trade liberalization in India and find that while the reduction of output tariffs has exerted *pro-competitive effects* on firm-level markups, declining input tariffs have the opposite effect. We complement this literature by providing empirical evidence for the pro-competitive effects of Chinese import competition, which is relatively less explored.

Third, our paper also contributes to a burgeoning literature documenting the effect of Chinese import competition on firm performance in developing countries. Iacovone et al. (2013) find that market shares are reallocated toward larger firms in Mexico in response to Chinese import competition. Utar & Ruiz (2013) find that increased Chinese import competition in the US market has a negative impact on the employment and plant growth for Mexican exporters. Our study complements and extends these findings by documenting the effect of Chinese import competition on firm-product prices, which is absent in the literature. Given that firms in India would be in head-to-head competition with Chinese imports (as they are technologically similar), it is important to evaluate how domestic prices respond to increased Chinese competition.

Lastly, our paper is also related to a large literature that has examined the effect of trade on changes in firm productivity (Pavcnik, 2002; Amiti & Konings, 2007; Topalova & Khandelwal, 2011; Brandt et al., 2017). However, lack of data on firm-product level price data implies that most studies are unable to separately identify efficiency effects from that on markups. Our paper overcomes this deficiency by using firm-product level data to disentangle such effects.[6]

The rest of the paper is organized as follows. Section 2 outlines the data. We describe the construction of key variables in Section 3. We lay out the empirical strategy and discuss our benchmark and heterogeneity results in Section 4, while Section 5 concludes.

2 Data

The primary source for the data on firms is the PROWESS database from the Centre for Monitoring of the Indian Economy (CMIE). The dataset covers large firms, firms listed on the major stock exchanges, and many small enterprises. Data for large firms are collected from the income statements and balance sheets, while the CMIE periodically surveys the smaller firms. These firms account for a substantial fraction of output in the organized manufacturing sector. For example, Goldberg et al. (2010b) note that PROWESS has a relatively wide coverage, accounting for more than 70% of the economic activity in the organized industrial sector, and 75% (95%) of corporate (excise duty) taxes collected by the Indian Government.[7]

A unique feature of the PROWESS database is that it captures detailed information

[6]See De Loecker & Goldberg (2014) for a discussion of the main issues with estimation of productivity from a revenue based production function and the underlying components of revenue based total factor productivity estimates.

[7]A potential issue with the PROWESS database is that it does not include informal firms. Informal firms account for a large share of the total number of plants and employment in the manufacturing sector. However, they only account for a small share of overall production and value-added in manufacturing. Asturias et al. (2019) report that informal firms only account for around 20% of the value added in manufacturing in the year 2005-2006. We are unable to directly test for the effect of Chinese imports on the prices of informal firms as there is no panel dataset for these firms in India. However, we note that Chakraborty et al. (2024) document a substantial negative impact of Chinese import competition on the number of firms and employment in the informal sector, suggesting that they, too, experienced competitive pressure from Chinese imports.

on the production of each product manufactured by a firm. Firms must report detailed production data for all products they manufacture under the Companies Act, 1956. In particular, we use the information on firm-product quantity and sales to compute unit values (or prices).

The internal product classification of CMIE assigns a unique code to each product. The products in our data should be seen as narrowly defined categories within industries rather than a specific product variety like barcode scanner datasets.[8] These product codes were then mapped on to the National Industrial Classification (NIC) 2004 4-digit level industries, which is also the level of industry affiliation of firms.

We complement our firm-product data with firm characteristics like fixed assets, compensation, raw material expenditure, exporting status, and a host of other related indicators. In addition, we use information on the ownership structure of the firms. PROWESS divides firms into four different categories: Business Groups, Private-owned, Government, and Foreign. Both the firm-product and firm variables are sourced from the PROWESS database. There are over 4000 firms and 1,414 unique products in our sample. **Table B1 (Appendix B)** reports the number of firms by their product scope. Single-product firms form the largest group, while the median firm in our sample produces 2 products.

We use the UN-COMTRADE database for all variables related to industry trade flows between countries. The industry classification for the trade data is the ISIC revision 3.1, which is mapped to the 2004 NIC 4-digit, which is the industry classification of the firms.[9]

[8]Goldberg et al. (2010b) provide a detailed description of the product classification in PROWESS as well as quality checks on the data.

[9]The trade data is downloaded from the World Integrated Trade Solution (WITS) website. We note here that the original trade flow data is in the HS classification and the WITS software maps these to the ISIC revision 3.1 classification and directly provides data in the latter classification. There is no existing correspondence between the HS classification and PROWESS product codes. We follow Goldberg et al. (2010a,b) and map the PROWESS product codes to the NIC-4-digit industries.

There are 22 NIC 2-digit sectors, 48 NIC 3-digit industries, and 95 NIC 4-digit industries in our sample.

To construct the Chinese import penetration ratio and its instrument, we combine the trade data with industry production data from the Annual Survey of Industries (ASI) for the registered enterprises and the National Sample Survey Office (NSSO) unorganized enterprise surveys for the unregistered enterprises. In addition, we use the input-output transactions table for the year 1993–1994 to compute the measure of access to Chinese imported inputs.[10] The main reason to use 1993-1994 or out-of-sample input estimates is that using I-O tables for other years (such as for 1999-2000, which is within our sample period) could lead to biased estimates, as input coefficients might also change with large trade shocks, like the one from China, rendering them endogenous.

Our empirical strategy relies on cross-industry variation in exposure to Chinese imports for Indian manufacturing firms. **Table 1** reports sector-level (NIC 2-digit) shares of Chinese import for the years 1996 (column (1)), 2007 (column (2)), and percentage changes in import share between these two years (column (3)). All the sectors experienced a significant increase in Chinese import share during this period along with considerable heterogeneity across sectors. Increase in Chinese import share is very high for Wood and wood products (sector 20), Publishing and printing (sector 22), Paper and paper products (sector 21), Non-metallic mineral products (sector 26), Office, accounting, and computing machinery (sector 30), Electrical machinery (sector 31), and Communication equipment (sector 32).[11] Overall, Chinese import share increased in both consumer goods as well as basic and intermediate input industries and there is rich variation across industries in their exposure to Chinese imports.

[10]The input-output table is sourced from `https://www.mospi.gov.in/publication/input-output-transactions-table-1993--94`.

[11]We also report changes in Chinese import share across NIC 4-digit industries within two NIC 3-digit industries as examples in **Table B2**. We continue to find substantial heterogeneity in the increase in Chinese import share across industries within the broader NIC 3-digit industry as well.

3 Construction of Key Variables

3.1 Measuring Exposure to Chinese Import Competition

We follow the literature, such as, Acemoglu et al. (2016), Autor et al. (2014), Autor et al. (2020a), Autor et al. (2020b), and construct our measure of Chinese import penetration ratio for each industry in India as follows:

$$DComp_{jt-1}^{China} = \frac{M_{jt-1}^{China}}{(Y_{j,94} + M_{j,94} - X_{j,94})} \tag{1}$$

where M_{jt-1}^{China} is the total import of Chinese goods in an industry j at time $t-1$; $Y_{j,94}$, $M_{j,94}$, and $X_{j,94}$ are total domestic production, imports, and exports for industry j in 1994, respectively. Thus, the import penetration measure for an industry captures the changes in Chinese imports as a ratio of the initial domestic absorption and varies between 0 and 1.

However, changes to this import penetration ratio may be driven by technology or industry-level demand shocks that may influence both the demand for Chinese imports and firm prices. To isolate the supply driven component of Chinese imports by India and to allay any concerns regarding the correlation between domestic demand shocks and Chinese imports, we follow Autor et al. (2013) and Acemoglu et al. (2016) and instrument for Chinese imports in an industry in India with Chinese imports in a set of other developing economies (ODE). The instrument is calculated as:

$$IVDComp_{jt-1}^{China} = \frac{M_{j,t-1}^{China,ODE}}{(Y_{j,94} + M_{j,94} - X_{j,94})} \tag{2}$$

where $M_{j,t-1}^{China,ODE}$ is the lagged value of Chinese imports to an industry j in a set of

ODE. Following Chakraborty et al. (2024), we choose a set of Latin American countries, namely Argentina, Brazil, Costa Rica, Chile, Colombia, Mexico, Paraguay, Peru, Uruguay, and Venezuela, to create our instrument as they are not major trade partners with India and hence it is less likely that alternative trade channels are correlated with our instrument.

To study the effect of imported inputs from China on firm performance, we calculate the exposure of an industry j to Chinese imported inputs in year t as:

$$DInputs_{jt}^{China,IND} = \sum_{s} \alpha_{js} \cdot DComp_{st}^{China,IND} \tag{3}$$

where α_{js} is the share of input s in total output for industry j and $DComp_{st}^{China,IND}$ is the import penetration ratio for input s. The instrument for $DInputs_{jt}^{China,IND}$ is given by instrumenting for Chinese penetration ratio as given in equation (2), except the import penetration and its instrument is calculated for the input sector s instead of the industry j:

$$IVInputs_{jt}^{China,IND} = \sum_{s} \alpha_{js} \cdot IV_{st}^{China,IND} \tag{4}$$

The validity of our instruments rests on two key assumptions. First, the instrument should be strongly correlated with the Chinese import penetration measure. This assumption would be satisfied if the basket of goods exported by China to India and the countries in the instrument are similar and these countries experienced a rise in Chinese exports during our sample period. We report the first stage Sanderson-Windmeijer (SW) F-statistics to check for the strength of the correlation between the instrument and the import penetration ratio variable. Second, the exclusion restriction should be satisfied implying that the instrument only affects our outcome variables through its effect on the Chinese import penetration ratio. This rules out the presence of any common demand or technology shocks across India and the Latin American countries.

In order to control for the unobservables, our specifications include industry-year fixed effects (at the 3-digit level). We also control for the following trade channels that could be correlated with our instrument and the outcome variable: (1) Chinese import share in foreign markets (US, EU, and ASEAN), (2) import competition from rest of the world, (3) India's export share in the total exports of those countries we use to create our instrument, (4) India's export share in total exports to China, and (5) output and input tariffs.

3.2 Estimation of Prices, Marginal Costs, and Markup

We measure firm-product prices by calculating the unit values for each firm-product pair by dividing the value of sales (for each product) with the physical quantity. Next, we estimate the underlying components of prices, i.e., marginal costs and markup, for each firm-product following the methodology of De Loecker et al. (2016). The main advantages of using this method are that it: (1) allows for multi-product production function; (2) overcomes bias in revenue-based production function estimates by using information on quantities of products; (3) accounts for unobserved input allocations across products within a multi-product firm; and (4) addresses bias arising from unobserved firm-specific input prices. Below, we briefly describe the important steps involved in the estimation of marginal costs and markup.[12] Let the production function be given by:

$$Q_{ipt} = F_{pt}(R_{ipt}, K_{ipt}, L_{ipt})\Omega_{it} \tag{5}$$

where i denotes a firm, p denotes a product, t denotes year, Q is quantity of output,

[12] **Appendix A** provides the detailed explanation of the estimation procedure.

R is the quantity of raw material, K and L are quantities of physical capital and labor respectively, and Ω is firm-level total factor productivity (TFP). We assume that the firms' expenditure on all inputs is attributable to products and that firms minimize costs taking as given the output quantity and input prices in any time period. These assumptions imply that a firm's costs are separable across products as the firm's product mix is already determined at the time of choosing the variable inputs. The Lagrangian function is given by:

$$\mathcal{L}(R_{ipt}, K_{ipt}, L_{ipt}, \lambda_{ipt}) = W^R_{ipt}R_{ipt} + W^K_{ipt}K_{ipt} + W^L_{ipt}L_{ipt} + \lambda_{ipt}(Q_{ipt} - Q_{ipt}(R_{ipt}, K_{ipt}, L_{ipt}, \Omega_{it})) \tag{6}$$

where W^R_{ipt}, W^K_{ipt} and W^L_{ipt} denote the price of raw materials, the rental rate of capital, and wages respectively. The first order condition for the variable input, raw materials, is given by:

$$\frac{\partial \mathcal{L}_{ipt}}{\partial R_{ipt}} = W^R_{ipt} - \lambda_{ipt}\frac{\partial Q_{ipt}}{\partial R_{ipt}} = 0 \tag{7}$$

Defining markups as $\mu_{ipt} = \frac{P_{ipt}}{\lambda_{ipt}}$, where P_{ipt} is unit value of output and λ_{ipt} is the marginal cost at a given level of output, we can rearrange equation (7) and represent markup as:

$$\mu_{ipt} = (\frac{P_{ipt}Q_{ipt}}{W^R_{ipt}R_{ipt}})\frac{\partial Q_{ipt}}{\partial R_{ipt}}\frac{R_{ipt}}{Q_{ipt}} = \frac{\theta^R_{ipt}}{\alpha^R_{ipt}} \tag{8}$$

where μ_{ipt} denotes markup, P_{ipt} is the firm-product level price, W^R_{ipt} is the price of raw materials, α^R_{ipt} is the share of raw materials expenditure in total sales of product p, and θ^R_{ipt} is the output elasticity with respect to raw materials. With firm-product prices and markup in hand, we can calculate the marginal cost as follows:

$$cost_{ipt} = \frac{P_{ipt}}{\mu_{ipt}} \tag{9}$$

To compute markup, we need estimates of the production function coefficients. Taking natural logarithm of Equation (5), we estimate the following production function:

$$q_{ipt} = f_p(\mathbf{x}_{ipt}; \boldsymbol{\beta}) + \omega_{it} + \epsilon_{ipt} \tag{10}$$

where ϵ_{ipt} is an additive error term to capture measurement error and unanticipated shocks to output, and $\mathbf{x}_{ipt}$ is the vector of natural logarithm of physical inputs.[13] To estimate the production function coefficients, we use a sub-sample of single-product firms to address the bias arising from unobserved input allocation across products for multi-product firms.[14] Next, we use a control function approach to account for bias due to unobserved input prices. Finally, we control for unobserved productivity shocks following the control function approach standard in the literature (Levinsohn & Petrin, 2003).

We form moments based on the innovations in the productivity shocks, and use the GMM procedure in Wooldridge (2009) to estimate the model and get the parameters of the production function and the input price control function. Finally, given the fact that all input allocations sum to 1 and using the production function, we impute the firm-level TFP and the input allocations across products for multi-product firms. We then compute

[13]For the estimation, we use the translog production function given by:

$$\begin{aligned} q_{ipt} = {} & \beta_l l_{ipt} + \beta_r r_{ipt} + \beta_k k_{ipt} + \beta_{lr} l_{ipt} r_{ipt} + \beta_{rk} r_{ipt} k_{ipt} + \beta_{lk} l_{ipt} k_{ipt} + \beta_{ll} l_{ipt}^2 \\ & + \beta_{rr} r_{ipt}^2 + \beta_{kk} k_{ipt}^2 + \beta_{lrk} l_{ipt} r_{ipt} k_{ipt} + \omega_{it} + \epsilon_{ipt} \end{aligned}$$

where lowercase symbols denote variables in natural logarithms.

[14]We address the concerns related to selection bias by employing a correction procedure where the probability of a firm remaining a single-product firm is modeled as a function of previous period productivity and a productivity cutoff. We refer the reader to **Appendix A** for a detailed description of this procedure.

markup using output elasticity of materials and the cost share of materials in total sales for each firm-product pair using Equation (8) and marginal cost using Equation (9).

Figure 2 plots the distribution of firm-product level prices for a sub-sample of firm-product observations observed in 1996 and 2007. Following De Loecker et al. (2016), we plot the residuals from running a regression with price as the outcome variable on firm-product fixed effects. There is a leftward shift in the distribution of prices between 1996 and 2007. We also plot the distribution of marginal costs and markup in **Figures C1** and **C2 (Appendix C)**, respectively. The figures show that the leftward shift in prices is not driven by any shift in the distribution of marginal costs, but a leftward shift in the distribution of markup. This suggests that prices and markup were falling during a period when there was a substantial increase in the share of Chinese imports in India.

Table B3 reports the mean and standard deviation of key firm-product level outcomes by dividing them into different ownership categories. Business Group firms (column (2)) have higher sales and quantity produced compared to privately-owned firms (column (1)). They charge higher prices for their products, have higher marginal costs, and higher markup compared to privately-owned firms. Based on this preliminary evidence, we now turn to a more rigorous empirical analysis to examine the causal link between Chinese import competition and prices for Indian manufacturing firms.

4 Empirical Strategy and Results

4.1 Chinese Import Competition: Effect on Sales and Production

Before examining the effect of Chinese import competition on the prices of manufacturing firms, we check whether there was indeed an increase in competitive pressure from Chinese imports on these firms by studying the effect of Chinese import competition on firm-product sales and physical quantities. We estimate the following specification:

$$y_{ipt} = \alpha_{ip} + \alpha_{j(3)t} + \beta DComp^{China}_{jt-1} + \theta X_{jt-1} + \phi Z_{it-1} + \nu_{ipt} \tag{11}$$

where y_{ipt} is the natural logarithm of either sales or quantity sold by firm i for product p at time t. α_{ip} and $\alpha_{j(3)t}$ are firm-product and industry(NIC 3-digit)-year fixed effects to control for firm-product specific characteristics and time varying shocks to the industry, which may be correlated with both Chinese imports and the outcome variables. $DComp^{China}_{jt-1}$ is the measure of Chinese import competition in industry j corresponding to the product p. As described before, our measure of Chinese import competition in India is a ratio of imports from China to the initial domestic absorption in India. The ratio varies between 0 and 1. β is our coefficient of interest. X is a vector of alternative trade channels, described in Section 3.1, and Z is a vector of firm-level controls. We cluster heteroskedasticity robust standard errors at the industry-level (NIC 4-digit).

Results are reported in **Table 2**. Columns (1) – (2) use sales and columns (3) – (4) use quantities as the outcome variable, respectively. Column (1) regresses firm-product sales on the Chinese import penetration ratio, controlling for firm-product and industry-year fixed effects. Column (2), in addition, controls for a measure of access to Chinese inputs, $DInputs^{China}_{jt-1}$. We do the same for quantity sold in columns (3) and (4). Overall, our results show significant negative effect of Chinese import penetration ratio on both sales and quantity sold by an Indian manufacturing firm, thereby suggesting substantial competitive pressure on these firms due to Chinese imports. Our estimates show that, on average, a 1 percentage point increase in the Chinese import penetration ratio led to a reduction in sales and physical quantities by 6.6–6.8% and 3.1–3.5%, respectively.[15]

[15]We also report the OLS results in **Table B4**. The results are qualitatively similar for sales as the outcome

Our first-stage SW F-statistics suggest a strong first stage relationship between the IV and the Chinese import penetration to India.[16] Additionally, in **Table B6**, we report the results from industry-level regressions with industry sales as the outcome variable. Consistent with the firm-product level results, we find that aggregate sales declined in response to Chinese import competition.

4.2 Chinese Import Competition: Effect on Prices

Having established that Chinese imports induce substantial competitive pressure on Indian firms, we now proceed to study the effect of Chinese import competition on firm-product prices, estimating Equation (11) with the natural logarithm of firm-product prices as the outcome variable.

Import competition can affect prices through two main channels. First, an increase in competition can put downward pressure on the markup of firms, resulting in erosion of market power, and this could lead to a decline in prices, which is the so-called *pro-competitive effect*. Secondly, firms may reduce their marginal costs of production in response to increased competition and pass on some of the cost savings to prices. This will also induce a decline in prices, with the magnitude depending on the rate of passthrough of costs to prices and the strength of cost-savings. Thus, we expect the coefficient of Chinese import competition on prices to be negative ($\beta < 0$). **Table 3** report results from estimating Equation (11) and its variants.

Column (1) reports results from our baseline specification in Equation (11). The coefficient on $DComp^{China}_{jt-1}$ is negative and significant, implying a 1 percentage point increase

variable but lower in magnitude and imprecisely estimated. The effect on quantity is positive, small in magnitude, and not statistically significant. Overall, the OLS results underestimate the reduction in output due to Chinese import competition.

[16]We report the first stage results in **Table B5**.

in Chinese import penetration ratio, on average, reduces firm-product prices by 3.3%. Between 1996 and 2007, Chinese import penetration, on average, increased by 8.4 percentage points, implying an overall reduction in prices by 27.9%. This shows that Chinese import competition induced a substantial decline in factory-gate prices for Indian manufacturing goods.

Next, in column (2) we include $DInputs^{China}_{jt-1}$ to control for access to Chinese inputs. The effect of $DComp^{China}_{jt-1}$ on prices continues to be negative and significant, with little change in the magnitude of the coefficient. On the other hand, the coefficient on $DInputs^{China}_{jt-1}$ is positive but insignificant, suggesting that prices are insensitive to changes in access to Chinese inputs. This may seem surprising in light of existing empirical evidence documenting substantial productivity gains for firms from increased access to imported inputs in India (Topalova & Khandelwal, 2011; Goldberg et al., 2010a). However, Section 4.3 show that access to Chinese inputs indeed leads to a large reduction in marginal costs for Indian firms. But, prices do not reduce as there is incomplete passthrough of costs to prices and a weak positive effect on markup conditional on marginal costs due to Chinese inputs. To incorporate the weak positive effect of Chinese inputs on prices, we compute the combined effect of competition and access to inputs on prices during 1996–2007. Our aggregate estimates suggest that prices declined by 20% as a result of Chinese import penetration.[17]

A potential concern here is that the decline in prices may be driven by exporters due to changes in competitive environment in the destination markets. While we already control for overall effect of Chinese import share in foreign markets, there may still be heterogeneous effects across different types of exporters. In column (3), we additionally use the export share of a firm as one of the controls. The coefficient on $DComp^{China}_{jt-1}$ remains vir-

[17] Average change in access to Chinese inputs was 0.024. Therefore, the overall decline in prices is by 20% [=(0.084*(–3.5))+(0.024*3.6)].

tually unchanged and statistically significant, suggesting that the decline in prices is not driven by changes in the competitive environment facing exporters in foreign markets.

Another potential concern is that the average decline in prices is driven by selection bias. If Chinese import competition forces firms with higher prices (within an industry) to exit, this will drive down prices. To check for the severity of this issue, we re-run our specification in column (4) for a balanced panel of firm-products which are available for all the years from 1996 to 2007. Our coefficient remains negative and statistically significant, thereby highlighting that entry and exit of firm-products do not drive the decline in prices that we observe in the baseline specification.

We now address the concerns related to differential trends in firm-product prices across industries with varying exposure to Chinese import competition. Our identification strategy depends on the absence of any differential trend in prices in industries with varying exposure to Chinese imports. To control for firm-product specific trend in prices, we first run a regression of the natural logarithm of prices on a trend variable separately for each firm-product pair. We then estimate the predicted values of prices and use it as a control variable in our main specification, following Martin et al. (2017). Column (5) reports the results from this specification. Our primary coefficient of interest is robust and continues to be significant at 1% level, suggesting that the decline in prices is not driven by differential trends in prices.

Next, we test for the sensitivity of our key findings to the inclusion of different sets of controls in our baseline specification. We report these results in **Table B7**. We start by estimating a parsimonious specification with only firm and year fixed effects and sequentially introduce high dimensional fixed effects and different controls for alternative trade channels. Across all specifications, we continue to see a negative and statistically significant effect of Chinese import competition on prices. The magnitude of the coefficient on

$DComp_{jt-1}^{China}$ is also very similar across different specifications – from the parsimonious specification in column (1) to column (6) with the full set of controls.[18]

Finally, **Table B8** reports some additional robustness checks. In column (1), we include firm × year fixed effects to control for the time varying firm-level characteristics that may be correlated with both the instrument and prices. Even in this stringent specification, the coefficient on $DComp_{jt-1}^{China}$ remains negative and statistically significant, albeit with a lower magnitude. Column (2) runs a long difference specification. The coefficient on $DComp_{jt-1}^{China}$ increases in magnitude and remains statistically significant. In column (3), we run a weighted regression using firm sales as weights and find that the coefficient on $DComp_{jt-1}^{China}$ is negative and statistically significant, albeit with a lower magnitude. This suggests that prices of smaller firms are more responsive to Chinese import competition. Finally, in column (4), we cluster our standard errors two-way – at the industry- and year-level. Clustering two-way also does not affect the significance of our coefficient of interest – it continues to remain statistically significant at 1% level. Taken together, these results provide strong and robust evidence of Chinese import competition inducing Indian firms to reduce their prices and show that our finding is not driven by pre-existing trends and omitted variables.[19]

[18]We note two additional points related to the results reported in **Table B7**: (a) drop in input tariffs significantly increases prices of products; and (b) import competition from rest of the world leads to increase in prices. Our former finding is consistent with findings in Bas & Strauss-Kahn (2015) and Fan et al. (2015). They find that Chinese firms source high-quality imported inputs in order to upgrade the quality of their final goods leading to higher prices. Further, an increase in prices is consistent with quality upgrading in response to import competition, as documented by Amiti & Khandelwal (2013).

[19]**Table B9** presents the specifications reported in **Table 3** using OLS. The OLS results are also qualitatively similar and suggest a significant negative effect of Chinese import competition on prices. The estimates suggest that a 1 percentage point increase in the Chinese import penetration ratio reduced prices of Indian manufacturing firms by 1–1.5%. However, the magnitude of the OLS coefficients is substantially lower than our IV estimates. A potential explanation for this difference could be that unobserved demand side factors induce a downward bias in the OLS estimates. The IV estimates provide the local average treatment effect (LATE), and the effect of the supply side component of Chinese imports, which is isolated by the instrument, may be larger than the combined effect of the supply as well as demand side factors determining overall changes in Chinese imports in an industry.

4.3 Chinese Import Competition: Effect on Marginal Costs and Markup

To examine the mechanisms driving the decline in prices in response to Chinese import competition, we now study its impact on the underlying components of prices, i.e., marginal costs and markup, and report the results in **Table 4**. Import competition from China can induce firms to save costs by reducing X-inefficiencies within firms. Under incomplete passthrough of costs to prices, cost-savings will lead to an increase in markup.[20] Further, Chinese import competition can force firm-products with higher market power to lower their markups and hence prices; the result of so called *pro-competitive effect*. However, in order to isolate the *pro-competitive effect*, we need to examine the changes in markup conditional on any changes in marginal costs.

Column (1) borrows our estimate on prices from column (2) of **Table 3** for comparison of coefficients. We replace price in Equation (11) by marginal costs in column (2) and markups in columns (3), (4), and (5). In columns (4) and (5), we additionally control for marginal costs to estimate the direct effect of Chinese import competition on markups conditional on marginal costs. The coefficient of $DComp_{jt-1}^{China}$ in column (2) is negative but imprecisely estimated, suggesting that the reduction in marginal costs is not the primary mechanism driving a reduction in prices in response to Chinese import competition. The coefficient is negative and significant for markup in column (3) implying an overall reduction in markups by 21% for Indian manufacturing firms between 1996–2007 due to Chinese import competition. In column (4), we additionally control for marginal costs and find that the coefficient on $DComp_{jt-1}^{China}$ continues to remain significant and increases in magnitude.

[20] The rate of passthrough would depend on the market structure and consumer demand and is likely to vary across industries and firms. The methodology employed by us to recover marginal cost and markup does not impose any parametric assumptions on market structure, demand, or the nature of competition (De Loecker et al., 2016). Thus, our results would reflect the average effect across all firms and we infer the presence of incomplete passthrough by comparing the coefficients in the regressions with prices, marginal costs, and markup (conditional on costs) as the outcome variables.

All of these suggest that the average direct reduction in markups during the sample period due to Chinese import competition was even larger than 21%. The difference in magnitudes between columns (3) and (4) can be attributed to the incomplete passthrough of cost-savings to prices which increases markup of firms. Thus, if cost-savings were fully passed on to prices there would have been a larger reduction in prices and markups of firm-products in response to Chinese import competition. Finally, in column (5), we address concerns related to endogeneity of marginal costs by instrumenting marginal costs by its lagged value. The coefficient remains negative and statistically significant, confirming the strong *pro-competitive effect* of Chinese import competition.

We also find a significant reduction in marginal costs from increased access to Chinese intermediate inputs. The coefficient on $DInputs^{China}_{jt-1}$ is negative and statistically significant in column (2), implying a substantial cost reduction of 35.4% due to access to Chinese inputs.[21] However, due to incomplete passthrough of costs to prices, there is a large increase in markup. The coefficient on $DInputs^{China}_{jt-1}$ in case of markups is large in magnitude, positive and statistically significant in column (3) implying a substantial increase in markup by 44%. In column (4), the effect of Chinese inputs is positive but imprecisely estimated suggesting that access to Chinese inputs may have had a positive impact on markup of firms. The weak passthrough of costs to prices combined with a direct positive effect on markup explains the weak positive effect on prices due to access to Chinese inputs.

Our findings on the incomplete passthrough of cost-savings from access to imported inputs are qualitatively consistent with the literature. De Loecker et al. (2016) find that during the tariff liberalization, input tariff reduction led to a decrease in marginal costs by 28% and an increase in markups by around 19%. Brandt et al. (2017) find that Chi-

[21] In our sample, raw materials account for around 80% of the variable cost as measured by the sum of intermediate inputs and labor costs. Further, anecdotal evidence during the sample period points to Chinese products being 20–50% cheaper than Indian products (Karthik & Suresh, 2002)

nese manufacturing firms only pass on half of the cost-savings from lower input tariffs to prices.[22]

Combining the effects of Chinese import competition and access to Chinese inputs, our results imply a cost-savings of 43.8% and a markup increase of 23.2%, leading to an overall price decline of 20.6%. These findings suggest that an incomplete passthrough of costs to prices has significant implications for the distribution of gains between consumers and producers from increased trade with China. With variable markups, the main beneficiary of increased Chinese imports appears to be the producers who are able to capture the cost savings by increasing markups. On the other hand, consumers only see a moderate decline in prices.

4.4 Heterogeneous Effects

The overall effect of Chinese imports on prices, marginal costs, and markups may be masking considerable heterogeneity in firm responses, especially based on firm characteristics.

We focus on two important characteristics: (a) ownership and (b) initial efficiency. Coase (1937) and Williamson (1985) among others, argue that the structure of a firm is central to the study of organizations. The theoretical lens through which we would like to investigate the response of different types of ownership of firms in India to increased competition from Chinese imports is based on the transaction cost economics as proposed by them.[23] In a recent survey article on how different types of distortions modify the impact of international trade in developing countries heterogeneous Atkin & Khandelwal

[22] **Table B10** presents the specification reported in **Table 4** using OLS and the results remain qualitatively similar.

[23] The transaction cost approach to the study of economic organisation regards the transaction as the basic unit of analysis and asserts that an understanding of transaction cost economising is central to the study of organisations (Williamson (2010); see also Commons (1932).

(2020) point out that there is not much of evidence on how trade interacts with conglomerate organizational structures.

Hay & Liu (1997) posit that the efficiency of a firm relative to others plays a crucial role in determining its market share. And, it becomes more important in markets where competition is intensified. This is similar to what Vickers (1995) and Nickell (1996) propose. They point two ways in which competition, in our case import competition, can influence firm behaviour. One of the ways is the ranking of the firms in terms of initial relative costs.

The exact distribution of these firm characteristics, highlighted above, can play a substantial role in firm responses to the deflationary impact of Chinese import competition. In the following subsections, we develop our hypotheses for the heterogeneous responses based on ownership and efficiency of firms from the related theoretical and empirical literature, followed by the empirical strategy we use, and the discussion of the heterogeneity results.

4.4.1 Heterogeneity Based on Ownership

We start by testing for heterogeneity in firms' responses based on their ownership. PROWESS categorizes firms into Business Groups (BG), other Privately Owned (PO), Foreign Owned (FO), and Government Owned (GO). We are particularly interested in examining the differential response in prices between Business Group (BG) firms and other standalone or privately owned (PO) firms.

BG firms are common in many developing economies, such as India and accounts for a large share of the private sector activity. They are generally comprised of several firms, often publicly traded, operating in a variety of sectors with substantial common ownership (Khanna & Palepu, 2000; Khanna & Yafeh, 2007). However, it is uncertain whether BG firms are better able to cope with an increase in competition relative to the PO firms.

There are at least three reasons why we expect a differential effect on prices for BG firms compared to PO firms in response to an increase in import competition. First, BG firms can overcome market imperfections in developing countries and are able to build a quality brand image (Khanna & Palepu, 1997, 2000). Thus, these firms have higher consumer appeal for their products, and hence, we expect a lower reduction in markups (and prices) for these firms in response to an increase in import competition. Second, emerging economies do not have well-developed financial institutions and labor markets, and BG firms can utilize the internal pool of capital and managers to reduce their transaction costs and better cope with competition (Khanna & Palepu, 1997, 2000; Khanna & Yafeh, 2007).[24] Thus, the availability of an internal pool of capital and managers may help these firms undertake investments to cut costs and lower output prices. BG firms may also serve to mitigate contracting issues between suppliers (Atkin & Khandelwal, 2020).

Third, agency issues among division managers in BG firms could lead to inefficient allocation of resources across the various divisions within these firms (Rajan et al., 2000), leading to a larger or smaller drop in output prices. Bertrand et al. (2002) also suggest that BG firms have weak governance structures. As these channels have opposing effects on prices, BG firms can have a lower or higher reduction in prices compared to other firms depending on the channel that dominates.[25]

To test for the differential effect of Chinese import competition on firm-product out-

[24] Management practices have been shown to be an important determinant of firm efficiency (Bloom et al., 2013). In addition, import competition can also increase the cost of bank debt for firms (Valta, 2012).

[25] Khanna & Palepu (1999) study large BGs in Chile and India and find an improvement in their affiliate's accounting and stock market performance in response to deregulation and international competition.

comes based on the ownership category, we estimate the specification below:

$$
\begin{aligned}
y_{ipt} = \alpha_{ip} + \alpha_{j(3)t} + \beta_1 DComp_{jt-1}^{China} + \beta_2(DComp_{jt-1}^{China} \times BG_i) \\
+ \beta_3(DComp_{jt-1}^{China} \times FO_i) + \beta_4(DComp_{jt-1}^{China} \times GO_i) \\
+ \theta X_{jt-1} + \phi_{it} + \nu_{ipt} \quad (12)
\end{aligned}
$$

where y is the natural logarithm of either price or marginal costs or markups. PO firms form the base group. ϕ_{it} includes ownership category interacted with year fixed effects to flexibly capture unobserved time varying shocks to firms with different ownership categories. **Table 5** reports the results from estimating Equation (12) with prices (column (1)), marginal costs (column (2)), and markup (columns (3) - (4)) as the outcome variable.

β_2, the coefficient on the interaction term between BG firms and Chinese import penetration is positive and significant, suggesting that BG firms reduce prices by much less than the PO firms. This effect is predominantly driven by a lower reduction in markup (column (4)).[26] In terms of marginal costs (column (2)), the coefficient is negative, small in magnitude, and insignificant, suggesting no differential reduction in marginal costs for BG firms compared to PO firms. The coefficients on the interaction terms with FO and GO firms are not statistically significant across all columns.

A potential concern with these results is that they may be driven by the correlation between firm ownership and other firm characteristics that may also show heterogeneous responses to Chinese imports. To address these concerns, we include interactions of $DComp_{jt-1}^{China}$ with other firm characteristics. Bernard et al. (2006) document significant

[26]These results provide suggestive evidence consistent with the hypothesis that products produced by BG firms enjoy greater customer appeal. However, we note that testing for this channel is not feasible due to a lack of measures of customer appeal for products in our data.

heterogeneity in firm response to import competition in the US based on capital intensity of firms. On the other hand, Chen & Steinwender (2021) find heterogeneous response to import competition based on family ownership. Finally, firms' pricing decisions are also likely to be influenced by liquidity constraints (Gilchrist et al., 2017). Results controlling for such characteristics are reported in **Table 6**.[27] We include interactions of $DComp_{jt-1}^{China}$ with capital intensity (measured by (natural logarithm) capital to compensation ratio), share of family ownership (measured by the proportion of shares owned by Hindu Undivided Family), and liquidity ratio (measured by the ratio of current assets to total assets). Our key results remain robust to including these interactions.[28]

4.4.2 Based on Initial Marginal Cost

We now examine heterogeneity in firms' responses based on their initial efficiency. A common argument in favor of trade liberalization is that import competition would induce domestic incumbents to improve their efficiency. This could be achieved, for instance, from a reduction in X-inefficiencies at the firm-level due to improved managerial practices (Schmidt, 1997). Our aggregate results, however, suggest that there is no significant decline in marginal costs in response to Chinese import competition. Several studies have developed theoretical frameworks to examine the heterogeneous responses to competition based on the efficiency of firms.

On the one hand, Aghion et al. (2005, 2009) argues that the relationship between competition and firm efficiency can be moderated by the distance from the technology frontier. In particular, import competition would induce the more efficient incumbents

[27] **Table B11** presents the specification reported in **Tables 5** and **6** using OLS and the results are qualitatively similar.

[28] We also find that the coefficient on the interaction term with liquidity ratio is positive and significant for marginal costs as the outcome variable. The coefficient is also positive for prices and markup in columns (1) and (4), although imprecisely estimated. These results are consistent with quality improvements by firms that have better liquidity ratio.

to improve their efficiency. The key insight from these models is that firms closer to the technology frontier innovate to escape competition as their pre-innovation rents reduce by more than post-innovation rents inducing investments in innovation. On the other hand, firms away from the technology frontier are discouraged from innovating as the post-innovation rents are not sufficient to induce costly investments in innovation. In addition, the least efficient firms who face higher bankruptcy risk would improve their efficiency in response to higher import competition (Chen, 2019).[29]

Thus, the relationship between import competition and efficiency depends on the initial efficiency, with firms above an efficiency level innovating while firms below this cut-off are discouraged from innovating rendering it to be an empirical question. We test for the heterogeneous effect of initial efficiency, using initial marginal cost of firm-product pairs as the indicator, in response to Chinese import competition by estimating the following equation:

$$y_{ipt} \ = \ \alpha_{ip} + \alpha_{j(3)t} + \beta_1 DComp^{China}_{jt-1} + \sum_{i=2}^{i=4} \beta_i (DComp^{China}_{jt-1} \times Qr_{ip}) + \theta X_{jt-1} + \nu_{ipt} \quad (13)$$

where y is the natural logarithm of either price, marginal costs, or markups, and Qr_{ip} is the quartile of a firm-product within an industry, based on the inverse of the initial marginal cost when the firm-product first enters our sample. **Table 7** reports result from estimating Equation (13).[30]

We start by looking at the effect on prices in column (1). We do not find any heterogeneous effects on prices. In column (2), we find that firms with the lowest initial marginal costs (fourth quartile) differentially reduce marginal costs compared to the firms with

[29] It could also be possible that falling profitability, due to increased competition, may make increasing effort to be less attractive, so efficiency will fall further.

[30] We also control for the interaction terms of $DInputs^{China}_{jt-1}$ with Qr_{ip} in our regressions.

the highest initial marginal costs (first quartile). The overall effect on firm-products in the fourth quartile is negative and statistically significant with the estimates implying a significant reduction in marginal costs of around 37% during 1996–2007 for these firm-products.

Contrary to the predictions from the proximity to frontier models, the coefficient on $DComp_{jt-1}^{China}$ is negative in column (2) suggesting that firm-products with initially high marginal costs do not exhibit the discouragement effect. We hypothesize two reasons for these finding: first, the PROWESS dataset comprises primarily of medium- and large-sized firms and hence our sample may consist of firms which have lower initial marginal costs compared to the cutoff point at which the effect of competition on innovation becomes positive. Secondly, Chinese import competition can help alleviate agency issues within firms and thereby inducing increased managerial effort, especially for high marginal cost firms who are faced with bankruptcy risk (Chen, 2019).

Using markup as the outcome variable in columns (3) and (4), we find that the coefficient on the interaction term with the fourth quartile is positive and significant in column (3), i.e., firm-products with initially lowest marginal costs differentially increased markups compared to those in the first quartile. But, the effect vanishes while controlling for marginal costs in column (4). The coefficient on $DComp_{jt-1}^{China}$ is negative and significant, in both the cases, indicating that it is the initially high cost firms who reduce markups as a response to Chinese import competition.[31]

The magnitudes on the interaction terms imply that the firm-products in the fourth quartile experience no differential reduction in markups with the coefficient being very close to zero and statistically insignificant. Therefore, the overall decline in markups

[31] **Table B12** presents the specification reported in **Table 7** using OLS. The results remain very similar for the high cost firms in the first quartile. The coefficient on the interaction term with the fourth quartile, however, is imprecisely estimated for marginal cost (column 2) and markup (column 3).

is driven by the firm-products in the first three quartiles. Taken together, these results imply that firm-products with initially lowest marginal costs significantly reduce their marginal costs but only partially pass on these savings to prices. The passthrough rate is low enough such that these firm-products experience no decline in markups.[32]

5 Concluding Remarks

We estimate the causal effect of the rise in Chinese imports to India on the prices, marginal costs, and markups of Indian manufacturing firms between 1996–2007. We find that increase in import penetration from China led to significant drop in prices for Indian manufacturing firms, indicating *pro-competitive* effect of trade.

Further, we find that firms affiliated to Business Groups reduce prices by much less than other privately-owned firms due to a relatively lower decline in markup as opposed to differential changes in costs. Our results suggest that policies aimed at mitigating the negative consequences of import competition may be targeted toward stand-alone, privately owned firms.

Finally, we find that the most efficient firms differentially reduce their marginal costs relative to other firms and are able to maintain their markup due to incomplete passthrough of costs to prices. These results highlight the crucial role of passthrough rates in determining the distribution of gains between producers and consumers from increased import competition. The gains to consumers from lowering of prices for domestically produced

[32] We also test for the heterogeneity based on the end-use categories of products. We classify industries into intermediate goods, capital goods, and consumer goods based on the classification by Nouroz (2001). We interact $DComp^{China}_{jt-1}$ with indicator variables (which are equal to 1) for capital good and consumer goods in our baseline specifications. Results reported in **Table B13** show that there are no statistically significant differential effect on prices and markup for capital goods and consumer goods relative to intermediate goods. While using marginal costs as the outcome variable, we find that there is a significant differential reduction in marginal cost for capital goods relative to intermediate goods. However, the overall effect on marginal costs for intermediate, capital, and consumer goods are imprecisely estimated.

goods would have been substantially higher if the cost-savings by efficient firms were completely passed on to prices in response to increased Chinese import competition.

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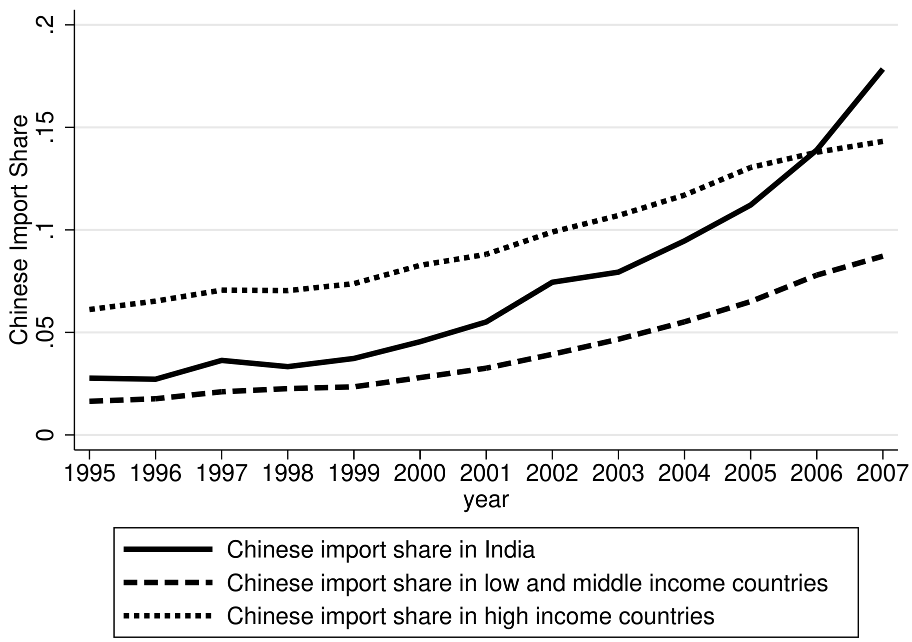

Figure 1: Chinese Import Share: India and Other Country Groups

Notes: Chinese import share for a particular country is the ratio of imports from China to that country to all imports to that country. For example, India's share of imports from China is the Chinese imports to India divided by the total imports to India. Data are sourced from the UN-COMTRADE database.

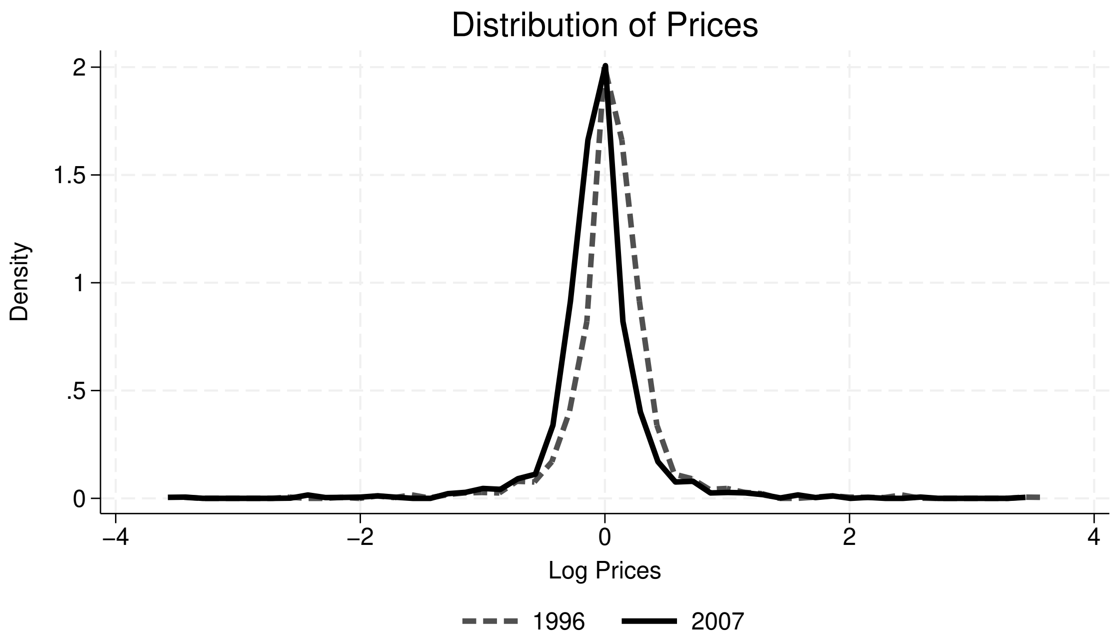

Figure 2: Distribution of Prices: 1996-2007

Notes: The figure plots the distribution of prices in 1996 and 2007. The plot includes all the firm-products present in our sample for both years.

Table 1: Sector-wise (NIC 2-digit) Chinese Import Share in India

Sector Code (NIC 2-digit)	Sector Description	Chinese Import Share 1996 (1)	Chinese Import Share 2007 (2)	% Change (3)
15	Foods Products and Beverages	0.005	0.016	220
16	Tobacco Products	0	0.052	–
17	Textiles	0.185	0.524	183.24
18	Wearing Apparel	0.092	0.296	221.74
19	Leather Products	0.046	0.25	443.48
20	Wood and Wood Products	0	0.193	–
21	Paper and Paper Products	0.006	0.129	2,050
22	Publishing and Printing	0.002	0.1	4,900
23	Coke, Refined Petroleum, Nuclear Fuel	0.018	0.092	411.11
24	Chemical and Chemical Products	0.048	0.198	312.5
25	Rubber and Plastics	0.018	0.25	1,288.89
26	Non-metallic Mineral Products	0.026	0.397	1,426.92
27	Basic Metals	0.024	0.097	304.17
28	Fabricated Metal Products	0.043	0.284	560.47
29	Machinery and Equipment	0.011	0.148	1,245.45
30	Office, Accounting and Computing Machinery	0.021	0.341	1,523.81
31	Electrical Machinery and Apparatus	0.024	0.289	1,104.17
32	Communication Equipment	0.053	0.460	767.92
33	Medical, Precision and Optical Instruments	0.015	0.082	446.67
34	Motor vehicles, Trailers and Semi-Trailers	0.001	0.059	5,800
35	Other transport equipment	0.01	0.078	680
36	Furniture; Manufacturing N.e.c	0.044	0.121	175

Notes: In columns (1) and (2), numbers are the share of Chinese imports (in total imports) for India at NIC 2004 2-digit level for the beginning and end years of our sample. Column (3) reports the percentage change between these two numbers.

Table 2: Chinese Import Competition and Production: Effect on Sales and Quantity

	Sales		Quantity	
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–6.824***	–6.569***	–3.496**	–3.066*
	(2.305)	(2.463)	(1.597)	(1.679)
$\text{DInputs}_{jt-1}^{China}$		–5.398		–9.069
		(12.58)		(7.718)
Observations	41,075	41,075	41,075	41,075
Estimation Method	IV	IV	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	21.32	21.95	21.32	21.95
SW F-statistic ($\text{DInputs}_{jt-1}^{China}$)	-	58.31	-	58.31
Alternative Trade Channels	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit)×Year FE	Yes	Yes	Yes	Yes

Notes: Columns (1) – (2) use natural logarithm of firm-product sales, and columns (3) – (4) use natural logarithm of firm-product quantity as the outcome variables of interest, respectively. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table 3: Chinese Import Competition and Prices: Benchmark Results

	Price				
				Balanced Panel	Trend in Prices
	(1)	(2)	(3)	(4)	(5)
$\text{DComp}_{jt-1}^{China}$	–3.328***	–3.502***	–3.503***	–2.940**	–3.380***
	(0.887)	(1.000)	(0.998)	(1.436)	(0.982)
$\text{DInputs}_{jt-1}^{China}$		3.671	3.713	7.091	3.201
		(5.145)	(5.116)	(4.467)	(4.634)
Export Share			0.083	0.137*	0.075
			(0.050)	(0.077)	(0.050)
Observations	41,075	41,075	41,075	10,605	41,075
Estimation Method	IV	IV	IV	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	21.32	21.95	21.96	23.00	21.97
SW F-statistic ($\text{DInputs}_{jt-1}^{China}$)	-	58.31	58.30	76.86	58.07
Alternative Trade Channels	Yes	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes	Yes
Industry (3-digit) $\times$ Year FE	Yes	Yes	Yes	Yes	Yes

Notes: The outcome variable is natural logarithm of firm-product prices (unit values). $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Export Share denotes the firm-level share of exports in total sales. Entry and Exit are indicator variables equal to 1 if the firm enters a product line or exits from an existing product line, respectively. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table 4: Chinese Import Competition, Marginal Costs, and Markups

	Prices	Marginal Cost	Markups		
	(1)	(2)	(3)	(4)	(5)
$\text{DComp}^{China}_{jt-1}$	–3.502***	–1.003	–2.499**	–3.279***	–2.593***
	(1.000)	(0.886)	(1.136)	(0.961)	(0.867)
$\text{DInputs}^{China}_{jt-1}$	3.671	–14.75***	18.42***	6.947	9.568**
	(5.145)	(5.311)	(6.462)	(5.057)	(4.402)
Observations	41,075	41,075	41,075	41,075	22,683
Estimation Method	IV	IV	IV	IV	IV
SW F-statistic ($\text{DComp}^{China}_{jt-1}$)	21.95	21.95	21.95	21.95	16.67
SW F-statistic ($\text{DInputs}^{China}_{jt-1}$)	58.31	58.31	58.31	58.34	70.21
Alternative Trade Channels	Yes	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes	Yes
Instrument for Marginal Cost	-	-	-	-	Yes

Notes: Column (1), Column (2) and Columns (3) – (5) use the natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp^{China}_{jt-1}$ and $DInputs^{China}_{jt-1}$ denote the Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp^{China}_{jt-1}$ and $DInputs^{China}_{jt-1}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from the rest of the world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table 5: Chinese Competition, Prices, Marginal Costs, and Markups: Heterogeneity based on Ownership

	Price	Marginal Cost	Markup	
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–3.866***	–1.262	–2.604**	–3.587***
	(1.010)	(0.983)	(1.222)	(0.976)
$\text{DComp}_{jt-1}^{China} \times \text{BG}_i$	1.132**	0.016	1.116	1.128*
	(0.511)	(0.827)	(1.060)	(0.578)
$\text{DComp}_{jt-1}^{China} \times \text{FO}_i$	1.066	0.626	0.441	0.928
	(0.789)	(1.039)	(1.339)	(0.835)
$\text{DComp}_{jt-1}^{China} \times \text{GO}_i$	1.365	–0.215	1.580	1.413
	(1.568)	(3.477)	(3.200)	(1.449)
Observations	41,075	41,075	41,075	41,075
Estimation Method	IV	IV	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	56.87	56.87	56.87	56.90
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times \text{BG}_i$)	44.14	44.14	44.14	44.24
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times \text{FO}_i$)	21.98	21.98	21.98	21.98
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times \text{GO}_i$)	57.35	57.35	57.35	57.11
Alternative Trade Channels	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes
Ownership Category × Year FE	Yes	Yes	Yes	Yes

Notes: Column (1), Column (2) and Columns (3) – (4) use natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp_{jt-1}^{China}$ denotes Chinese import penetration ratio and is instrumented. Alternative trade channels include Chinese imported intermediate inputs ratio, Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. *BG*, *FO*, and *GO* are indicator variables, which take a value 1 for business-group, foreign-owned, and government-owned firms, respectively. Robust standard errors are clustered at the 4-digit industry level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table 6: Heterogeneity based on Ownership, Robustness Checks

	Price	Marginal Cost	Markup	
	(1)	(2)	(3)	(4)
$\text{DComp}^{China}_{jt-1}$	–4.926***	–0.163	–4.763**	–4.889***
	(1.361)	(1.237)	(2.055)	(1.453)
$\text{DComp}^{China}_{jt-1} \times \text{BG}_i$	1.084**	–0.043	1.127	1.094*
	(0.519)	(0.886)	(1.213)	(0.633)
$\text{DComp}^{China}_{jt-1} \times \text{FO}_i$	1.323	–0.344	1.666	1.399
	(0.936)	(1.113)	(1.682)	(1.047)
$\text{DComp}^{China}_{jt-1} \times \text{GO}_i$	1.111	–0.976	2.088	1.328
	(1.609)	(3.520)	(3.314)	(1.523)
$\text{DComp}^{China}_{jt-1} \times \ln(\text{K/L})_i$	0.405	–0.270	0.675	0.465
	(0.367)	(0.422)	(0.714)	(0.434)
$\text{DComp}^{China}_{jt-1} \times \text{HUF}_i$	0.689	–2.711	3.400	1.291
	(0.631)	(1.875)	(2.347)	(0.969)
$\text{DComp}^{China}_{jt-1} \times \text{Liquidity ratio}_i$	15.184	13.436***	1.748	12.201
	(17.170)	(4.884)	(17.274)	(17.050)
Observations	41,075	41,075	41,075	41,075
Estimation Method	IV	IV	IV	IV
SW F-statistic ($\text{DComp}^{China}_{jt-1}$)	204.14	204.14	204.14	203.77
SW F-statistic ($\text{DComp}^{China}_{jt-1} \times \text{BG}_i$)	132.75	132.75	132.75	132.78
SW F-statistic ($\text{DComp}^{China}_{jt-1} \times \text{FO}_i$)	80.16	80.16	80.16	79.87
SW F-statistic ($\text{DComp}^{China}_{jt-1} \times \text{GO}_i$)	66.46	66.46	66.46	65.97
Alternative Trade Channels	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes
Ownership Category × Year FE	Yes	Yes	Yes	Yes

Notes: Column (1), Column (2) and Columns (3) – (4) use natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp^{China}_{jt-1}$ denotes Chinese import penetration ratio and is instrumented. Alternative trade channels include Chinese imported intermediate inputs ratio, Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. *BG*, *FO*, and *GO* are indicator variables, which take a value 1 for business-group, foreign-owned, and government-owned firms, respectively. $log(K/L)$ denotes natural logarithm of capital to compensation ratio, *HUF* denotes share of family ownership in the firm, and *Liquidityratio* is measured as the ratio of current assets to total assets of the firm. All three variables are measured for the first year the firm enters the sample. Robust standard errors are clustered at the 4-digit industry level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table 7: Chinese Import Competition, Prices, Marginal Costs, and Markups: Heterogeneity Based on Initial Marginal Cost

	Prices	Marginal Cost	Markups	
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–3.336***	–0.189	–3.146***	–3.293***
	(1.077)	(1.096)	(1.174)	(1.000)
$\text{DComp}_{jt-1}^{China} \times \text{Qr}_2$	–0.486	–1.525	1.038	–0.147
	(0.699)	(0.936)	(0.842)	(0.619)
$\text{DComp}_{jt-1}^{China} \times \text{Qr}_3$	0.0956	–0.728	0.823	0.258
	(0.466)	(1.554)	(1.620)	(0.578)
$\text{DComp}_{jt-1}^{China} \times \text{Qr}_4$	–0.803	–4.302**	3.499**	0.155
	(0.929)	(2.010)	(1.518)	(0.688)
Observations	41,075	41,075	41,075	41,075
Estimation Method	IV	IV	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	64.00	64.00	64.00	64.37
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times \text{Qr}_2$)	50.17	50.17	50.17	38.56
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times \text{Qr}_3$)	52.76	52.76	52.76	51.28
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times \text{Qr}_4$)	39.71	39.71	39.71	39.31
Alternative Trade Channels	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes

Notes: Column (1), Column (2) and Columns (3) – (4) use natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Online Appendix for

Chinese Import Competition and Prices: Evidence from India

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A Marginal Costs and Markups Estimation

We closely follow the methodology proposed by De Loecker et al. (2016) to estimate the coefficients of the production function. Below, we describe the methodology to estimate markups and marginal costs.

As within firm allocation of inputs across products and physical quantities for inputs are unobserved by us,[33] we substitute $x_{ipt} = \rho_{ipt} + \tilde{x}_{ipt} - w_{ipt}$ in Equation (10) to obtain:

$$q_{ipt} = f_p(\tilde{\mathbf{x}}_{ipt}; \boldsymbol{\beta}) + A(\rho_{ipt}, \tilde{\mathbf{x}}_{ipt}, \boldsymbol{\beta}) + B(\mathbf{w}_{ipt}, \rho_{ipt}, \tilde{\mathbf{x}}_{ipt}, \boldsymbol{\beta}) + \omega_{it} + \epsilon_{ipt} \tag{A1}$$

where ρ_{ipt} is the natural logarithm of input share of product p, $\tilde{x}_{ipt}$ is the deflated input expenditure, w_{ipt} captures the log difference of firm-product specific input price and the industry-level input price index. $A(.)$ denotes the bias arising from unobserved product-level input allocation while $B(.)$ denotes the bias due to unobserved input prices specific to a firm-product. We now need to estimate the production function coefficients , β, and the unobserved input allocation, ρ_{ipt}.

[33] We only observe deflated (using industry-level deflators) expenditures on each input used by a firm.

Assuming that a multi-product firm and single-product firm producing the same product use the same production technology, observations on single-product firms for each industry can be used to estimate the production function in Equation (A1). For single-product firms, $A(.) = 0$; hence, we do not need to address the bias due to unobserved shares of inputs allocated to products within a firm. As we only use single firm-product sample for production function estimation, subscript p can be dropped. To account for input price bias, unobserved firm specific prices, w_{it}, is approximated by output prices (p_{it}), product dummies (D_p), market shares (s_{it}) and exporting status (exp_{it}). The input price control function is given by:

$$w_{it}^{x} = w_t(p_{it}, D_p, s_{it}, exp_{it}) \tag{A2}$$

On the other hand, a static input demand function is used to control for unobserved productivity shocks following Olley & Pakes (1996) and Levinsohn & Petrin (2003). The demand for raw materials is assumed to be a function of productivity, fixed inputs (capital and labor), and all other variables, such as output prices (p_{it}), product dummies (D_p), market shares (s_{it}), exporting status (exp_{it}), output tariffs (τ_{it}^{output}), input tariffs (τ_{it}^{input}) and Chinese import penetration ratio ($DComp_{jt}^{China}$). The material demand function is given by

$$\tilde{r}_{it} = r_t(\omega_{it}, \tilde{k}_{it}, \tilde{l}_{it}, p_{it}, D_p, s_{it}, exp_{it}, \tau_{it}^{output}, \tau_{it}^{input}, DComp_{jt}^{China}) \tag{A3}$$

Inverting the material demand function gives the control function for productivity:

$$\omega_{it} = h_t(\tilde{r}_{it}, \tilde{k}_{it}, \tilde{l}_{it}, p_{it}, D_p, s_{it}, exp_{it}, \tau_{it}^{output}, \tau_{it}^{input}, DComp_{jt}^{China}) = h_t(\mathbf{x}_{it}, \mathbf{z}_{it}) \tag{A4}$$

where $\mathbf{z}_{it}$ consists of all variables affecting input demand except other inputs and unobserved productivity.

The use of single-product firm to estimate the production function raises a few concerns regarding selection bias. This would be the case if the number of products produced by a firm is a function of the unobserved productivity or the inputs. Similar to the correction for the exit of firms proposed as by Olley & Pakes (1996), the probability of a firm remaining a single-product firm (sp_{it}) is modeled as a function of previous period productivity and a productivity cutoff.

The law of motion for productivity is given by:

$$\omega_{it} = g_t(\omega_{it-1}, \tau_{it-1}^{output}, \tau_{it-1}^{input}, DComp_{jt-1}^{China}, exp_{it}, sp_{it}) + \xi_{it} \tag{A5}$$

We now express output as a function of observable variables and the error term by combining $f(.)$ and $B(.)$ into a function $\phi(.)$. Output can then be expressed as:

$$q_{it} = \phi_t(\tilde{\mathbf{x}}_{it}, \mathbf{z}_{it}) + \epsilon_{it} \tag{A6}$$

where $\phi_t(.)$ identifies output net of measurement error, ϵ_{it}. Estimation of equation (A6) yields $\widehat{\phi}$ (predicted values of output). Productivity can now be expressed as a function of observables and parameters and is given by:

$$\omega_{it} = \widehat{\phi}_{it} - f(\tilde{\mathbf{x}}_{it}; \boldsymbol{\beta}) - B((p_{it}, D_p, s_{it}, exp_{it}), (p_{it}, D_p, s_{it}, exp_{it}) \times \tilde{\mathbf{x}}_{it}; \delta) \tag{A7}$$

where δ denotes the parameters of the input price control function.

To estimate the parameters, β and δ, we use equation (A5) to construct moments based on the innovation in the productivity shock, ξ_{it}. The moments identifying the parameters are given by:

$$E(\xi_{it}(\boldsymbol{\beta}, \delta)\mathbf{Z}_{it}) = 0 \tag{A8}$$

where $\mathbf{Z}_{it}$ consists of lagged material expenditure, current capital and labor expenditure (in higher orders and interaction terms), lagged output prices, lagged Chinese import penetration ratio, lagged market shares, lagged tariffs (output and input) and their interaction with inputs. The estimation procedure employed is the GMM procedure suggested by Wooldridge (2009). The estimation procedure yields true estimates for β and δ and hence all parameters of the production function as well as input price functions are identified. Input allocation between products within a multi-product firm can be recovered by dividing the production function into two separate functions, f_1 and f_2, with f_2 depending on the input allocation across products. Predicted output can be expressed as:

$$\hat{q}_{ipt} = f(\tilde{\mathbf{x}}_{it}, \hat{\boldsymbol{\beta}}, \hat{w}_{ipt}, \rho_{ipt}) + \omega_{it} \tag{A9}$$

The system of equations below can now be used to recover firm-level productivity and input allocation between products within a firm.

$$\hat{q}_{ipt} = f_1(\tilde{\mathbf{x}}_{it}, \hat{\boldsymbol{\beta}}, \hat{w}_{ipt}) + f_2(\tilde{\mathbf{x}}_{it}, \hat{w}_{ipt}, \rho_{ipt}) + \omega_{it} \tag{A10}$$

$$\sum_{j(p)} exp(\rho_{ipt}) = 1 \tag{A11}$$

Once we estimate the input allocation across products within a firm, we can use equations (8) and (9) to calculate firm-product level markups and marginal costs, respectively.

B Tables

Table B1: Product Scope of Firms

Number of Firms (1)	Number of Products (2)
10153	1
5308	2
2587	3
1365	4
1503	$>= 5$

Notes: Author's calculations based on the data from PROWESS database. The table represents the number of firms (column (1)) engaged in producing the number of products (column (2)). For example, the data in the second row suggests that 5308 firms in our sample produce 2 products.

Table B2: Industry-level Changes in Chinese Import Share in India: Some Examples

NIC 3-digit Industry Code	NIC 4-digit Industry Name	Chinese Import Share 1996 (1)	Chinese Import Share 2007 (2)
241			
	Manufacture of basic chemicals except fertilizers and nitrogen compounds	0.022	0.175
	Manufacture of fertilizers and nitrogen compounds	0	0.016
	Manufacture of plastics in primary forms and of synthetic rubber	0.002	0.063
291			
	Manufacture of engines and turbines	0	0.017
	Manufacture of pumps, compressors, taps and valves	0.001	0.065
	Manufacture of bearings, gears, gearing and driving elements	0.004	0.083
	Manufacture of ovens, furnaces and furnace burners	0.007	0.431
	Manufacture of other general purpose machinery	0.002	0.347

Notes: Table reports NIC 4-digit industry wise changes in Chinese import share (Chinese imports to India divided by the total imports to India) between 1996 and 2007 within two NIC 3-digit industries, 241 and 291.

Table B3: Summary Statistics: Divided by Ownership Categories

	Ownership Category			
	Private owned	Business Groups	Foreign owned	Government owned
	(1)	(2)	(3)	(4)
Sales_{ipt}	–0.471	0.561	1.638	0.120
	(2.193)	(2.320)	(2.138)	(2.488)
Quantity_{ipt}	–0.418	0.431	2.302	0.093
	(3.734)	(3.699)	(4.279)	(3.693)
Price_{ipt}	–0.053	0.130	–0.663	0.028
	(3.320)	(3.318)	(3.918)	(3.299)
$\text{Marginal cost}_{ipt}$	–0.037	0.131	–1.243	0.174
	(3.481)	(3.365)	(4.131)	(3.557)
Markup_{ipt}	–0.016	–0.002	0.579	–0.147
	(1.668)	(1.867)	(1.763)	(2.147)
Observations	24,088	15,949	1,292	2,286

Notes: All the variables (in natural logarithms) are at the firm-product level and are demeaned by product-year. Standard deviations are reported in parentheses.

Table B4: Chinese Import Competition and Production: Sales and Quantity

	Sales		Quantity	
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–0.920*	–0.767	0.077	0.364
	(0.503)	(0.551)	(0.304)	(0.391)
$\text{DInputs}_{jt-1}^{China}$		–5.045		–9.517*
		(5.744)		(5.063)
Observations	41,075	41,075	41,075	41,075
Estimation Method	OLS	OLS	OLS	OLS
Alternative Trade Channels	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes

Notes: Columns (1) – (2) use natural logarithm of firm-product level sales, and columns (3) – (4) use natural logarithm of firm-product level quantity as the outcome variables of interest, respectively. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B5: First Stage Estimates of Table 2

	$\text{DComp}_{jt-1}^{China}$	$\text{DComp}_{jt-1}^{China}$	$\text{DInputs}_{jt-1}^{China}$
	(1)	(2)	(3)
$\text{IVDComp}_{jt}^{China}$	0.154***	0.154***	0.006*
	(0.033)	(0.034)	(0.003)
$\text{IVInputs}_{jt-1}^{China}$		0.019	0.183***
		(0.325)	(0.025)
Observations	41,075	41,075	41,075
Alternative Trade Channels	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes
Industry (3-digit) $\times$ Year FE	Yes	Yes	Yes

Notes: Table reports first stage regressions corresponding to the IV specifications of Table 2. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. $IVDComp_{jt-1}^{China}$ and $IVInputs_{jt-1}^{China}$ are their respective instruments. Column (1) reports first stage regressions corresponding to Equation (11). The coefficient would refer to the first-stage regressions of columns (1) and (3) of **Table 2**. Columns (2) and (3) report first stage results corresponding to a specification that adds Chinese intermediate inputs ratio to Equation (11). This would mean that it represents the first stage of columns (2) and (4) of **Table 2**. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B6: Chinese Import Competition and Aggregate Sales

	Sales	
	(1)	(2)
$\text{DComp}_{jt-1}^{China}$	–5.626***	–5.832***
	(1.308)	(1.324)
$\text{DInputs}_{jt-1}^{China}$		7.741
		(11.249)
Observations	565	565
Estimation Method	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	21.32	21.95
SW F-statistic ($\text{DInputs}_{jt-1}^{China}$)	-	58.31
Alternative Trade Channels	Yes	Yes
Firm-Product FE	Yes	Yes
Industry (3-digit) $\times$ Year FE	Yes	Yes

Notes: Columns (1) – (2) use natural logarithm of industry-level sales as the outcome variables of interest, respectively. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B7: Chinese Import Competition and Prices

	Price					
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{DComp}^{China}_{jt-1}$	–3.690**	–2.077**	–1.220***	–3.325***	–3.223***	–3.328***
	(1.782)	(0.987)	(0.324)	(1.069)	(1.096)	(0.887)
$\text{DComp}^{World}_{jt-1}$				0.498**	0.470*	0.524**
				(0.237)	(0.248)	(0.259)
Output Tariff_{jt-1}					–0.199	–0.216
					(0.358)	(0.366)
Input Tariff_{jt-1}					–0.412*	–0.423*
					(0.208)	(0.214)
$\text{FComp}^{US-EU-ASEAN}_{jt-1}$						1.090*
						(0.577)
Observations	41,075	41,075	41,075	41,075	41,075	41,075
Estimation Method	IV	IV	IV	IV	IV	IV
SW F-statistic ($\text{DComp}^{China}_{jt-1}$)	12.24	46.59	44	20.37	20.28	21.22
Firm FE	Yes	Yes	No	No	No	No
Firm-product FE	No	No	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No
Industry (3-digit) × Year FE	No	Yes	Yes	Yes	Yes	Yes

Notes: The outcome variable is natural logarithm of firm-product level prices (unit values). $DComp^{China}_{jt-1}$ and $DInputs^{China}_{jt-1}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp^{China}_{jt-1}$ and $DInputs^{China}_{jt-1}$ are instrumented. $DComp^{World}_{jt-1}$ denotes import penetration from rest of world in India. $OutputTariff_{jt-1}$ and $InputTariff_{jt-1}$ denote output and input tariffs, respectively. $FComp^{US-EU-ASEAN}_{jt-1}$ denotes Chinese import share in foreign markets (US, EU and ASEAN). Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B8: Chinese Import Competition and Prices: Robustness Checks

	Price			
	Firm-Year Fixed Effects	Long Difference	Weighted	Two-way Clustering
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–2.503**	–4.840***	–2.345**	–3.502***
	(1.049)	(1.223)	(1.167)	(1.267)
$\text{DInputs}_{jt-1}^{China}$	9.390	14.157	5.456	3.671
	(9.733)	(11.323)	(9.125)	(2.879)
Observations	31,068	1,251	41,075	41,075
Estimation Method	IV	IV	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	29.71	13.83	12.63	27.00
SW F-statistic ($\text{DInputs}_{jt-1}^{China}$)	82.39	55.56	27.10	68.05
Alternative Trade Channels	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes

Notes: The outcome variable is natural logarithm of firm-product level prices (unit values). $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses except in column (4) where standard errors are two way clustered at the 4-digit industry- and year-level. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B9: Chinese Competition and Prices – OLS Results

	Price					
					Balanced Panel	Trend in Prices
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{DComp}_{jt-1}^{China}$	–0.996***	–1.132***	–1.141***	–1.150***	–1.451***	–1.124***
	(0.311)	(0.377)	(0.378)	(0.376)	(0.265)	(0.358)
$\text{DInputs}_{jt-1}^{China}$		4.472*	4.479*	4.510*	9.409***	4.058
		(2.593)	(2.585)	(2.579)	(2.634)	(2.750)
Export Share			0.079	0.078	0.134*	0.071
			(0.050)	(0.050)	(0.077)	(0.050)
Entry				0.011		
				(0.014)		
Exit				–0.027*		
				(0.015)		
Observations	41,075	41,075	41,075	41,075	10,065	41,075
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS
Alternative Trade Channels	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The outcome variable is natural logarithm of firm-product level prices (unit values). $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Both $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ are instrumented. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. $ExportShare$ denotes the firm-level share of exports in total sales. $Entry$ and $Exit$ are indicator variables equal to 1 if the firm enters a product line or exits from an existing product line, respectively. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B10: Chinese Import Competition, Marginal Costs, and Markups – OLS Results

	Prices	Marginal Cost	Markups		
	(1)	(2)	(3)	(4)	(5)
$\text{DComp}_{jt-1}^{China}$	–1.132***	–0.197	–0.935**	–1.088***	–0.975***
	(0.377)	(0.351)	(0.402)	(0.354)	(0.351)
$\text{DInputs}_{jt-1}^{China}$	4.472*	–3.265	7.737	5.198*	7.767*
	(2.593)	(4.800)	(5.774)	(2.967)	(4.423)
Observations	41,075	41,075	41,075	41,075	22,683
Estimation Method	OLS	OLS	OLS	OLS	OLS
Alternative Trade Channels	Yes	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes	Yes
Industry (3-digit)×Year FE	Yes	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes	Yes

Notes: Column (1), Column (2) and Columns (3) – (5) use natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from the rest of the world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B11: Heterogeneity based on Ownership – OLS Results

	Price	Marginal Cost	Markup		Price	Marginal Cost	Markup	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{DComp}^{China}_{jt-1}$	–1.911***	–0.042	–1.868***	–1.901***	–2.223***	0.627	–2.850**	–2.362***
	(0.496)	(0.553)	(0.598)	(0.467)	(0.668)	(0.906)	(1.247)	(0.743)
$\text{DComp}^{China}_{jt-1} \times \text{BG}_i$	1.401***	–0.431	1.832**	1.497***	1.425***	–0.489	1.914**	1.534***
	(0.445)	(0.618)	(0.719)	(0.451)	(0.454)	(0.627)	(0.781)	(0.479)
$\text{DComp}^{China}_{jt-1} \times \text{FO}_i$	0.983**	–0.940	1.922*	1.191***	1.261**	–1.506	2.767**	1.595**
	(0.405)	(0.909)	(0.965)	(0.436)	(0.526)	(0.991)	(1.201)	(0.603)
$\text{DComp}^{China}_{jt-1} \times \text{GO}_i$	0.720	–0.192	0.911	0.762	0.897	–0.523	1.419	1.013
	(0.887)	(1.916)	(1.586)	(0.732)	(0.921)	(2.023)	(1.647)	(0.747)
$\text{DComp}^{China}_{jt-1} \times \ln(\text{K/L})_i$					0.064	–0.134	0.199	0.094
					(0.205)	(0.405)	(0.545)	(0.265)
$\text{DComp}^{China}_{jt-1} \times \text{HUF}_i$					1.027	–2.120	3.147**	1.498**
					(0.867)	(1.708)	(1.262)	(0.661)
$\text{DComp}^{China}_{jt-1} \times \text{Liquidity ratio}_i$					–0.292	–1.171	0.880	–0.032
					(2.791)	(4.785)	(6.330)	(3.317)
Observations	41,075	41,075	41,075	41,075	41,075	41,075	41,075	41,075
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Alternative Trade Channels	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes	-	-	-	Yes
Firm-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Category × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1) and (5), Columns (2) and (6), and Columns (3), (4), (7), and (8) use the natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp^{China}_{jt-1}$ denotes Chinese import penetration ratio and is instrumented. Alternative trade channels include Chinese imported intermediate inputs ratio, Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. BG, FO, and GO are indicator variables, which takes a value 1 for business-group, foreign-owned, and government-owned firms, respectively. $ln(K/L)$ denotes natural logarithm of capital to compensation ratio, HUF denotes share of family ownership in the firm, and $Liquidityratio$ is measured as the ratio of current assets to the firm's total assets. All three variables are measured for the first year the firm enters the sample. Robust standard errors are clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B12: Chinese Import Competition, Prices, Marginal Costs, and Markups: Heterogeneity Based on Initial Marginal Cost – OLS Results

	Prices	Marginal Cost	Markups	
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–1.247***	0.127	–1.375***	–1.276***
	(0.379)	(0.394)	(0.467)	(0.365)
$\text{DComp}_{jt-1}^{China} \times \text{Qr}_2$	–0.031	–0.883***	0.852***	0.166
	(0.156)	(0.269)	(0.164)	(0.113)
$\text{DComp}_{jt-1}^{China} \times \text{Qr}_3$	0.312***	0.042	0.269	0.302***
	(0.113)	(0.215)	(0.174)	(0.093)
$\text{DComp}_{jt-1}^{China} \times \text{Qr}_4$	0.171	–1.141	1.312	0.425***
	(0.200)	(0.928)	(0.802)	(0.148)
Observations	41,075	41,075	41,075	41,075
Estimation Method	OLS	OLS	OLS	OLS
Alternative Trade Channels	Yes	Yes	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) × Year FE	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes

Notes: Column (1), Column (2) and Columns (3) – (4) use natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp_{jt-1}^{China}$ and $DInputs_{jt-1}^{China}$ denotes Chinese import penetration ratio and Chinese imported intermediate inputs ratio, respectively. Alternative trade channels include Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. Robust standard errors clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

Table B13: Chinese Competition, Prices, Marginal Costs, and Markups: Heterogeneity based on End-Use

	Price	Marginal Cost	Markup	
	(1)	(2)	(3)	(4)
$\text{DComp}_{jt-1}^{China}$	–2.427***	0.804	–3.231***	–2.606***
	(0.893)	(0.579)	(1.208)	(0.943)
$\text{DComp}_{jt-1}^{China} \times$ Capital Goods_j	–1.335	–2.279**	0.944	–0.829
	(1.232)	(1.130)	(1.595)	(1.231)
$\text{DComp}_{jt-1}^{China} \times$ Consumer Goods_j	–2.217	–3.238	1.021	–1.498
	(4.449)	(2.014)	(3.340)	(4.147)
Observations	41,075	41,075	41,075	41,075
Estimation Method	IV	IV	IV	IV
SW F-statistic ($\text{DComp}_{jt-1}^{China}$)	66.19	66.19	66.19	66.20
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times$ Capital Goods_j)	90.19	90.19	90.19	90.19
SW F-statistic ($\text{DComp}_{jt-1}^{China} \times$ Consumer Goods_j)	71.34	71.34	71.34	71.35
Alternative Trade Channels	Yes	Yes	Yes	Yes
Marginal Cost as a Control	-	-	-	Yes
Firm-Product FE	Yes	Yes	Yes	Yes
Industry (3-digit) $\times$ Year FE	Yes	Yes	Yes	Yes

Notes: Column (1), Column (2) and Columns (3) – (4) use natural logarithm of price, marginal cost, and markups as the dependent variable, respectively. $DComp_{jt-1}^{China}$ denotes Chinese import penetration ratio and is instrumented. Alternative trade channels include Chinese imported intermediate inputs ratio, Chinese import share in foreign markets (US, EU and ASEAN), import penetration from rest of world in India, and output and input tariffs at NIC 4-digit level. *CapitalGoods* and *ConsumerGoods* are indicator variables, which takes a value 1 for products that are classified as capital goods and consumer goods, respectively, based on the classification by Nouroz (2001). Robust standard errors are clustered at the 4-digit industry-level in parentheses. ***, **, * denotes statistical significance at 1%, 5%, and 10%, respectively.

C Figures

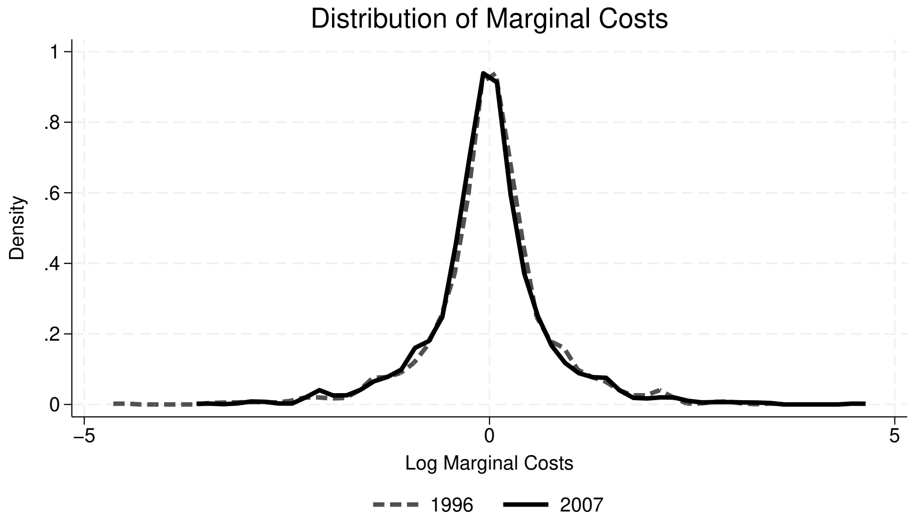

Figure C1: Distribution of Marginal Cost: 1996–2007

Notes: Figure plots the distribution of marginal costs in 1996 and 2007. The plot includes all the firm-products present in our sample for both years.

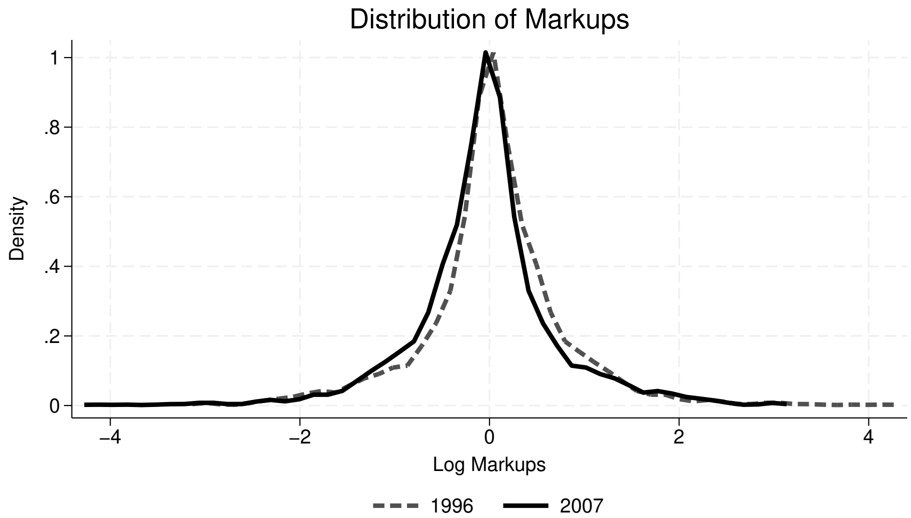

Figure C2: Distribution of Markup: 1996–2007

Notes: The figure plots the distribution of markup in 1996 and 2007. The plot includes all the firm-products present in our sample for both years.