ESSAYS IN INTERNATIONAL TRADE IN POST LIBERALIZATION INDIA

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This study is based on the doctoral dissertation titled "Essays in International Trade in Post Liberalization India," which is selected as the award-winning entry for the India Exim Bank BRICS Economic Research Annual Award (BRICS Award) 2021. The dissertation was written by Dr. Rahul Singh, currently Assistant Professor at the Amrut Mody School of Management, Ahmedabad University, under the supervision of Professor Rupa Chanda, Professor Souvik Dutta and Professor Vidhya Soundararajan. Dr. Singh received his doctoral degree in 2020 from Indian Institute of Management, Bangalore.

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EXECUTIVE SUMMARY

The post liberalization period in India saw some major changes in international trade. The focus of trade negotiations shifted from tariffs, which were at historically low levels, towards non-tariff measures (NTMs) which emerged as the main barriers to trade. This period also saw China becoming the world's largest exporter in 2009 and a drastic increase in its share in India's manufacturing imports from 5% in 2000 to 18% in 2010. Against this backdrop, it is natural to ask how these changes impacted the Indian economy. Are there consequences for firms in India if India introduces a non-tariff measure which reduces imports? How large are the competitive effects of the sudden rise in Chinese import competition? What are the labor market effects of Chinese import competition? This study takes a step in addressing these questions empirically with a focus on causal inference.

Since the early 2000s, there has been a substantial increase in the incidence of Technical Barriers to Trade (TBTs) maintained by India. While the proximate reasons for TBTs relate to addressing public policy objectives like health, consumer protection and the environment, countries can also use these regulatory measures to give unfair advantage to domestic firms. TBTs can negatively impact the import flows into the maintaining country by increasing the production costs. This can have a negative effect on domestic firm performance through reduced competition in the Indian market and reduced access to intermediate inputs for importers. The findings in this study suggest that TBTs have a negative impact on the performance of domestic firms driven by the reduced access to imported inputs for importers. Importers experience a reduction in their efficiency as well as profitability in response to introduction of TBTs on inputs. The findings highlight that maintaining TBTs may be costly, especially if they hinder access to imported inputs for importers.

The rise of China as an exporting hub is one of the salient economic events in the last two decades and almost all countries experienced an exponential increase in their share of Chinese imports. Understanding the impact of this sudden increase in imports from China on the performance of domestic firms is of relevance to both policymakers and researchers. While recent studies have examined the effect of Chinese imports on firm performance in developed economies, there is surprisingly little empirical evidence on its effect on firms in developing economies like India. This study makes progress on addressing this gap by analyzing the effect of Chinese imports on Indian manufacturing firms' efficiency, profitability, and prices. The findings of this study suggest that Chinese import competition induced Indian firms to increase their physical efficiency and reduce marginal costs. Further, firms experienced a large decrease in marginal costs due to access to imported inputs from China. However, firms only passed on these cost savings partially to prices leading to modest reduction in firms' prices. The findings of this study suggest that the primary beneficiaries of increased imports from China were producers who experienced a large reduction in marginal costs and an increase in markup.

There has been a structural shift in the composition of manufacturing employment in India since the 1990s, with firms drastically increasing the share of workers employed on contract in their workforce. While this phenomenon has been widely acknowledged by policymakers and researchers, the causal factors driving this shift remain poorly understood. This study combines firm level data from the Annual Survey of Industries with industry level changes in Chinese import competition between 1998 and 2007 and analyzes the effect of Chinese import competition on firm employment. The results suggest that there is significant increase in contract share in employment for formal firms in response to Chinese import competition. The within firm effects are driven by larger and productive firms that face stronger firm level unions, and this effect is further amplified in states with stronger unions. The study also provides evidence of a composition effect, where contract share in employment increases as more output and resources shift toward high productive high contract share firms in response to import competition. Taken together, these results suggest that rising import competition is an important determinant of firms' decision to hire more contract workers.

1. TECHNICAL STANDARDS, INTERMEDIATE INPUTS, AND PERFORMANCE OF DOMESTIC FIRMS

Progressive liberalization in preceding decades has resulted in a significant decline in tariffs worldwide.[1] Alongside this decline, however, there has been a significant rise in the use of NTMs. The growing incidence of NTMs has led to a burgeoning literature on their impact on trade flows between countries (WTO, 2012). While much of this literature has focused on how NTMs affect the volume of exports from source countries and the performance of exporting firms in these exporting countries (Fontagne et. al., 2015; Fontagne and Orefice, 2018), there is scant research on how NTMs affect the performance of firms in the maintaining countries by reducing import competition and access to imported inputs. This contrasts starkly with the voluminous literature on the impact of output and input tariff liberalization on the performance of firms.

This study addresses this gap in the literature by examining the effect of restrictive TBT measures on the performance of manufacturing firms in India. This issue is pertinent to research in the Indian context given the significant unilateral trade liberalization undertaken by the country in the early 1990s followed by the growing use of TBTs since the early 2000s. These liberalization measures resulted in greater import competition in the Indian market and enabled Indian manufacturing firms to gain access to previously unavailable foreign intermediate inputs, thus helping to remove their pre-liberalization constraints on production technology.[2]

[1] Average world tariffs for manufacturing almost halved from around 21% to 10.4% between 1994 and 2010.

[2]Previously unavailable imported inputs accounted for over two-thirds of total imported inputs (Goldberg et. al.,2010). Access to imported inputs is the salient channel by which Indian manufacturing firms benefited from trade liberalization and the effect of input tariffs is much larger as compared to output tariffs (Topalova and Khandelwal, 2011; De Loecker et. al., 2016).

This study examines the effect of restrictive TBTs introduced by India on its manufacturing firms by focusing on a specific channel, i.e., their effect on access to imported intermediate inputs and the consequent effects on the efficiency and profitability of domestic firms which are the end users of these inputs. The underlying rationale for investigating this channel is that TBTs have a negative effect on imports into the maintaining country as they are associated with increased variable costs (e.g. labeling requirements) or fixed costs (e.g. new production process) of production (Fontagne and Orefice, 2018). Hence, by reducing access to imported inputs that potentially embody better technology and decreasing input varieties available to firms, TBTs are likely to affect firm-level performance in the country maintaining these regulatory measures.

The study estimates the effect of introducing restrictive TBT measures on final goods and intermediate inputs on firm performance following a standard two step procedure followed in the literature on trade liberalization and firm performance. The study first estimates the coefficients of the production function at the industry level using the methodology of De Loecker et. al. (2016) to construct measures of firm level productivity and firm-product level marginal costs and markups. In addition to controlling for simultaneity bias from unobserved productivity shocks, this method controls for input price bias as well as bias from unobserved product wise allocation of inputs for a multi-product firm. The availability of detailed production data on sales and quantity produced at the product level is used to recover the underlying components of prices, i.e., marginal costs and markups, and firm level measure of physical efficiency. Next, the impact of the incidence of restrictive TBT measures in an industry and its intermediate inputs on the performance of manufacturing firms is studied. The performance measures focused on are- firm level physical efficiency (TFPQ) and firm-product level price-cost markups. The main hypothesis is that importers of intermediate inputs will suffer productivity and markup losses compared to non-importers due to the incidence of TBTs on inputs to an industry.

Some key challenges in evaluating the causal impact of TBTs on the performance of domestic firms are addressed. Firstly, not all TBTs are restrictive to trade flows. For the purpose of this analysis, the study focuses on TBTs which are restrictive to imports into the maintaining country. To address this concern, firm

level data from Prowess is combined with the database recording TBTs that have been raised as a concern by member countries against India in the dedicated committees of the WTO as these are likely to be restrictive to flow of imports.

Secondly, as TBT measures are behind-the-border measures, they apply to both domestic and foreign firms exporting to India. This raises a concern that the effects of these measures may be driven by their effect on domestic firms through channels other than imports of intermediate inputs. As domestic suppliers also have to conform to TBTs, the overall effect of the incidence of TBTs on intermediate inputs will reflect the combined effect on domestic as well as foreign suppliers. To address this concern, the differential effect of the incidence of TBTs is studied on inputs to an industry on importers compared to non-importers, which enables in isolating the impact of TBTs through the imported input channel.

Thirdly, there is a concern that industries and their inputs may have been selected for regulations based on past values of outcome variables or their correlates which would bias the results. For instance, there would be a spurious correlation between restrictive TBTs on inputs and productivity if low productivity industries were more likely to have restrictive TBTs on their inputs in the sample. This concern is addressed by a falsification test and it is shown that past changes in industry level productivity and markups are not a predictor of the current incidence of TBTs on the industry and its inputs. To provide further evidence against endogeneity concerns related to timing and selection of industries for TBTs, a placebo test is conducted where the actual distribution of incidence of TBTs is maintained over time but the allocation of industries for exposure to TBTs is randomized within any year. With the randomized allocation in hand, the incidence of TBTs is calculated on inputs to each industry. Strong evidence is found in support of the main results as the placebo runs fail to generate significant results in the majority of the cases for the coefficient of interest.

Finally, the results could be capturing the effect of some firm level characteristics along which importers and non-importers differ systematically. To address this, another placebo test is conducted where the data on importing channels for the importers is exploited. If the hypothesized relationship is true, importers of non-

intermediate inputs should be unaffected by the incidence of restrictive TBTs on inputs as compared to non-importers. The results suggest this is indeed the case with importers of finished goods and stores and spares showing no differential impact compared to non-importers.

It is found that higher TBT incidence on intermediate inputs to the industry leads to a decrease in physical efficiency and markups for importers relative to non-importers. For a 10% increase in the incidence of TBTs in input share of output, a firm with import share at the 75th percentile suffers an additional decrease in productivity and markup of 2% and 1%, respectively, compared to a firm with median import share. Analyzing the effects on marginal costs and prices provide additional insights. It is found that importing firms experience a differential increase in marginal costs compared to non-importers. However, there is no significant heterogeneity in price responses between importers and non-importers. Thus, faced with higher marginal costs, importers reduce markups with no significant increase in prices. This is suggestive of incomplete pass-through of costs to prices.

This study makes several contributions to the literature. First, the results provide estimates of efficiency and markups losses from the introduction of restrictive TBTs in the country maintaining these measures. This is in contrast to most studies in the literature that estimate the impact of restrictive regulations in destination markets on exporting firms in the source (exporting) country (Fontagne and Orefice, 2018). The results of this study suggest that using regulatory measures like restrictive TBTs as a trade barrier can be counterproductive, especially for developing economies that depend on technologically superior imported inputs. Second, this is one of the few studies estimating physical efficiency and markups separately whereas the bulk of the literature on the effect of trade on firm performance estimates a revenue-based production function and hence, is unable to separate the true efficiency effects from the effects on markups.

The rest of the chapter is organized as follows. Section 2.1 discusses the data sources and presents stylized facts about TBTs. Section 2.2 discusses the empirical strategy and results. Section 2.3 concludes.

1.1 Data Sources

In this study the WTO database on specific trade concerns (STCs) which records concerns raised in the dedicated committees of the WTO is used. Member countries of the WTO are expected to conform to the provisions of the Agreement on Technical Barriers to Trade. These provisions aim to achieve balance between member countries' ability to enact regulations on legitimate issues while ensuring that imported goods are not discriminated against compared to domestic goods by the maintaining country.[3] The dedicated committee on TBT measures was established as a forum for member countries to raise concerns with specific TBT measures introduced by other member countries.[4]

The unique feature of this data is that it systematically identifies the TBTs that are restrictive to trade flows. Countries are likely to raise a concern only if the TBT measure acts as a significant barrier to trade for exporters in these countries. Thus, the STC database overcomes the shortcomings of other databases on TBTs used in previous studies. The STC database spans from 1995-2011 and provides information on: (1) member countries raising the concern and the maintaining country, (2) year of concern, (3) Harmonized Classification (HS)-4 digit products covered by the TBT measure, (4) resolution status of the concern, (5) objectives of the TBT measure, and (6) issues that the countries raising the concern have with the TBT measure.

[3] The key provisions are Article 2.1, "Members shall ensure that in respect of technical regulations, products imported from the territory of any Member shall be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country." and Article 2.2, "Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. For this purpose, technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create. Such legitimate objectives are, inter alia: national security requirements; the prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment. In assessing such risks, relevant elements of consideration are, inter alia: available scientific and technical information, related processing technology or intended end-uses of products."

[4] The main functions of the TBT committee are to review concerns with specific TBT measures and strengthen the implementation of the TBT agreement. More details are available at https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm

Overall 257 concerns were raised in the TBT committee during 1995-2009. The study focuses on the 14 STCs raised against India for the analysis in this paper.[5] **Table 1.1** shows the yearly number of new STCs and the number of HS4 product lines covered by at least one concern in that year for all countries (columns 1-2) and India (columns 3-4). Considering all countries, columns 1 and 2 show that both the number of STCs and the HS4 product lines covered by them have been increasing over time. Columns 3 and 4 show that India introduced restrictive TBT measures covering a large number of products in the years 2001, 2002, 2007 and 2009. There were no STCs raised against India from 1995-2000.

The objectives for the TBT measures raised as STCs against India are shown in **Table 1.2**. A particular STC may have multiple objectives associated with it. Human health and safety, and consumer safety or protection are the most common objectives for the STCs against India with 9 and 8 measures, respectively, reporting these objectives. Environment protection and quality issues are reported as objectives of 3 and 1 STCs, respectively. The issues related to the concerns also vary considerably. Some concerns are raised to seek clarification regarding the regulation or to raise transparency issues with the regulation. Other issues raised in the concerns relate to the discriminatory nature of the regulation, question the legitimacy and rationale for the regulation, or deem the regulation as an unnecessary barrier to trade. **Table 1.3** reports the number of STCs associated with the different issues raised by member countries against India.[6]

The firm level data on manufacturing firms in India for the years 1996-2010 comes from the Prowess database provided by the Centre for Monitoring the Indian Economy (CMIE). The dataset reports firm level information from income statements and balance sheets for publicly listed firms and from yearly surveys of unlisted firms. The data on sales, capital stock, wagebill, exports, imports, and year of incorporation is collected for around 5900 manufacturing firms. In addition, Prowess reports data on sales, physical quantity, and capacity at the product level classified according to CMIE's internal product codes. There are

[5] Lagged values of these concerns are used as explanatory variables and can use the STC dataset for 1995-2009 as the firm-product data is available only till 2010. STCs reported in HS4 product lines are mapped to NIC2004 4 digit industries.

[6] One STC may be associated with more than one type of issues raised by countries raising the concern.

2088 products in the sample which is linked to the NIC2004 4-digit industries. Prowess also provides information on yearly imports by individual firms. The total imports are further classified into raw materials, capital goods, stores and spares, and final goods. The data on industry level imports to India from the World Integrated Trade Solutions (WITS) website is used.

1.2 Empirical Strategy and Results

Estimation of marginal cost and markup

TFPQ at firm level and markups and marginal costs at the firm-product level is estimated using the methodology of De Loecker et. al., 2016. Their method is well suited for analysis as it allows for multi-product firms, uses information on quantities to remove bias from unobserved output prices and accounts for bias arising from unobserved input prices. The method involves two key steps. First, the production function is estimated for a sub sample of single product firms to compute the output elasticity of material inputs. The second step involves imputing the product specific input allocations and firm level productivity using the production function for each product produced by the firm and the fact that the sum of input shares allocations sum to 1. Using the estimates of output elasticity and input allocations, firm product level markup and marginal costs are calculated.

To check if the estimates of firm-product level markups and marginal costs are consistent with increasing returns to scale and core-competency, the study examines how sales share and quantity produced varies with marginal costs and markups. Following De Loecker et. al. (2016), the study plots log of markups and marginal costs (demeaned) against sales share of firm-product in **Figure 1**, and against physical quantity produced by the firm-product in **Figure 2**. As expected, the figures show that high (low) markup (marginal cost) firm-products are associated with higher physical output as well as higher sales share in firm sales.

TBTs and Aggregate Imports

Before examining the firm level adjustments to restrictive TBTs, their effect on aggregate industry import flows into India are studied. **Table 1.4** reports results

from running a regression of the log of imports at the industry level on lagged values of incidence of restrictive TBTs on the industry. Columns 1-3 reports results for the period 1996-2010 while columns 4-6 restrict the sample to the period 1996- 2007. The results suggest that the reduction in import flows is driven primarily by reduced imports from OECD countries while there is no significant reduction in imports from non-OECD countries. This suggests that restrictive TBTs lower access to high quality intermediate inputs for Indian firms.

Endogeneity of TBTs

If industries were selected for the introduction of restrictive TBT measures based on their productivity and markups, it would lead to a spurious correlation between restrictive TBTs and outcome variables. Similarly, inputs to an industry may be selected for regulation based on the industry level productivity and markups or their correlates. To provide suggestive evidence against the issue of selection, a falsification test is undertaken and a regression of current measure of incidence of restrictive TBTs on an industry and its input on past changes in industry level measures of outcome variables is run. Industry level productivity is calculated as sales share weighted sum of firm level productivity. Industry level markup is calculated as sales share weighted sum of firm-product level markup.

Table 1.5 reports the results from the falsification test. Odd numbered columns include the full sample of all industry year observations. In the even numbered columns, the sample is restricted by excluding all years after the incidence of TBTs in an industry (columns 2 and 4) or its inputs (columns 6 and 8) to avoid picking up the effects of restrictive TBTs in an industry and its inputs, respectively. As expected, the coefficients on lagged changes in productivity and markups are insignificant in columns 5-8 suggesting that the incidence of restrictive TBTs on inputs to an industry was not based on past values of industry productivity and markups. Similar evidence is found for the incidence of TBTs in an industry except in column 3 where a positive and significant coefficient on lagged changes in markups is present. This suggests that industries with higher markups were more likely to be selected for the incidence of restrictive TBTs. However, once industry-year observations is excluded after incidence of TBTs in an industry,

the coefficient is no longer significant suggesting that the effect of restrictive TBTs in column 3 may be getting captured. Taken together, these results suggest that incidence of restrictive TBTs in an industry and its inputs were not based on past changes in productivity and markups of industries.

TBTs and Firm Level Productivity

With measures of firm level productivity in hand, the below equation is estimated to study the effect of incidence of restrictive TBT measures on firm level productivity:

$$\begin{aligned}\log(TFP)_{ijt} = {} & \alpha_0 + \alpha_i + \alpha_{j(2),t} + \beta_1 concern_{i,t-1}^{output} + \beta_2 concern_{i,t-1}^{input} \\ & + \beta_3 concern_{i,t-1}^{input} \times importer_{it} \\ & + \varepsilon_{ijt}\end{aligned} \tag{1}$$

where $concern_{i,t-1}^{output}$ is the measure of the incidence of concerns for firm i, calculated as the sales weighted average of the incidence of concerns on all products produced by the firm. Similarly, $concern_{i,t-1}^{input}$ is the lagged measure of the incidence of concern on intermediate inputs for firm *i*, calculated as the sales weighted average of the incidence of concerns on inputs to all products produced by the firm *importer*$_{it}$. is an indicator of importing status of a firm i equal to 1 if the firm imports raw materials or capital goods in time t.[7] In some specifications, the importer dummy is replaced with import share of output for a firm. All specifications include firm level fixed effects and sector-year fixed effects. Firm fixed effects control for unobserved heterogeneity in the determinants of productivity that are firm specific. The sector-year fixed effects control for shocks over time that affect productivity which may vary across the 2 digit industries.

[7] Each firm is assigned an industry based on its product with the highest sales share and its corresponding industry. Each product is mapped to a NIC2004 4 digit industry. For single product firms, their firm-product industry and firm industry are the same.

Firm level measures on incidence of concerns for the output good and intermediate inputs, $concern_{i,t-1}^{output}$ and $concern_{i,t-1}^{output}$, respectively, are calculated as:

$$concern_{i,t-1}^{output} = \sum_{ipt} m_{ipt} \cdot \ concern_{j(p),t-1}^{output} \quad (2)$$

$$concern_{i,t-1}^{input} = \sum_{ipt} m_{ipt} \cdot \ concern_{j(p),t-1}^{input} \quad (3)$$

where m_{ipt} is the sales share of firm-product, ip, in total firm sales. The $concern_{j(p),t-1}^{input}$ is computed as the weighted average of incidence of concerns on the intermediate inputs for an industry given by:

$$concern_{j(p),t-1}^{input} = \sum_{s} \alpha_{j(p)s} \cdot \ concern_{s,t-1}^{output} \quad (4)$$

where $\alpha_{j(p)s}$ is the share of input s in total output for industry j(p), $concern_{s,t-1}^{output}$ is equal to 1 if input s for industry j(p) is covered by a concern in year t-1.[8]

There is evidence that firm level productivity increased substantially following trade liberalization in the 1990s in India. The productivity increase was mainly due to reduction in input tariffs which led to greater access to imported inputs (Topalova and Khandelwal, 2011). If firms had adjusted their production technology to use more of higher quality imported inputs, the incidence of restrictive TBT measures could lead to losses in productivity, at least in the short term. Further, the losses would be higher for importing firms than non-importers. Thus the specifications include a measure of incidence of restrictive TBTs and its interaction with a firm level indicator of importing firms. The effects on domestic suppliers are also separately identified from that on foreign exporters to India as these measures apply to both domestic as well as foreign suppliers. The coefficient of interest is β_3 and it is hypothesized that it is negative suggesting that importing firms are differentially negatively affected by the introduction of restrictive TBT measures on inputs to the industry ($\beta_3 < 0$).

[8] The IO table for the Indian economy for 1993-1994 are used to get. There are 66 manufacturing sectors in the IO matrix and NIC2004 industry for each product is mapped to a particular IO sector.

The incidence of restrictive TBTs in an industry could lower the import competition and the channels by which import competition improves productivity - reduced X-inefficiencies and reallocation of resources toward high productivity firms - may not materialize. Thus the productivity of firms could stagnate or even decrease due to the introduction of restrictive TBT measures in an industry ($\beta_1 \leq 0$). The coefficient on $concern_{i,t-1}^{input}$, β_2 will depend on the direct effect of the TBT measure on domestic suppliers to the firms and the indirect effects of reduced access to imported inputs on these firms.

Table 1.6 reports the results. The specifications in columns 1-3 include firm and year fixed effects. In column 1, looks at the overall effect of incidence of restrictive TBTs. The coefficient is negative but insignificant. In column 2, incidence of restrictive TBTs on inputs is added. The coefficient on $concern_{i,t-1}^{output}$ is positive but insignificant while the coefficient on $concern_{i,t-1}^{input}$ remains negative and insignificant. However, the overall effect of restrictive TBTs on inputs to the firm may be masking considerable heterogeneity among importers and non-importers. To check for this, the interaction between $concern_{i,t-1}^{input}$ and $importer_{it}$ is added in column (3). The coefficient on the interaction term is negative and statistically significant. However, the overall effect on importers is insignificant.

In column (4) sector-year fixed effects are introduced to account for sector specific yearly shocks. The coefficient on the interaction term is similar in magnitude to that in column (3), however, it is only significant at the 10% level. While the interaction term is negative and significant, the overall effect of $concern_{i,t-1}^{input}$, on importers as well as non-importers is insignificant. One possible explanation is that firms with very small import shares may not be significantly affected by these regulations. To check for this the importer dummy is replaced with the import share of output for a firm in columns 5 and 6. Column 5 has year fixed effects while column 6 introduces sector-year fixed effects. The interaction term is negative and significant at the 1% level. To check if the results are not driven by the effects of the financial crisis, observations after 2007 are excluded in column 7. The interaction term is negative and highly significant with a slightly higher magnitude. For a 10% increase in $concern_{i,t-1}^{input}$, a firm with import share at the 75th percentile suffers an additional decrease in productivity of 2% compared

to a firm with the median import share. Thus, firms that are more reliant on imported inputs experience higher productivity losses.

To further alleviate concerns regarding the selection of industries for the introduction of restrictive TBTs, an event-time variable is included as in Martin et. al. (2017), to control for any pre-existing linear trend in outcome variables before the incidence of restrictive TBTs in an industry and its inputs. Two industry specific event-time variables: $trend_{j,t}^{output}$ are defined which equals the difference between year of observation and the year of incidence of restrictive TBTs in the industry, and $trend_{j,t}^{input}$ which equals the difference between the year of observation and the first year when there is incidence of restrictive TBTs on inputs to the industry. These variables take a value zero for industries and their inputs which do not have an incidence of restrictive TBTs throughout the sample period. These event-time variables are included to check for the robustness of the results in column 8. The coefficient on the interaction term remains highly significant and negative albeit with a slightly lower magnitude. In column 9, a dummy variable is included for exporting status of firms and the coefficient on the interaction term remains negative and statistically significant. Finally, to provide suggestive evidence to rule out the concern that the entry and exit of firms is driving the results, it is checked if the results hold in a balanced sample consisting of firms for which data for all years is available in column (10). The coefficient on the interaction term is negative and significant and larger in magnitude. This suggests that the results are primarily driven by within firm changes in productivity rather than entry and exit of firms.

TBTs and Markup

A similar specification at the firm-product level is estimated to study the effect of incidence of restrictive TBTs on firm-product level markups:

$$\begin{aligned}\log\left(markup\right)_{ipt} &= \alpha_0 + \alpha_i + \alpha_{j(p)(2),t} + \beta_1 concern_{j(p),t-1}^{output} + \beta_2 concern_{j(p),t-1}^{input} \\ &\quad + \beta_3 concern_{j(p),t-1}^{input} \times importer_{it} + \varepsilon_{ijt}\end{aligned} \tag{5}$$

where p denotes product and j(p) denotes the industry (NIC 2004) associated with product p. It is hypothesized that reduced competition from imported

goods would increase firm-product markups ($\beta_1 > 0$). Also, it is expected that importers of intermediate inputs will differentially lose market power and hence, a reduction in markups in response to the incidence of restrictive TBTs on inputs to the industry ($\beta_3 < 0$). As with productivity, the overall effect on markups for non-importers is ambiguous.

Table 1.7 reports results from estimating equation (5) and its variants. The specifications follow a similar pattern to **Table 1.6**. The coefficient, , is positive and significant in columns 1,2 and 5, suggesting increased markup due to reduced competitiveness. However, the coefficient loses significance in specifications including sector-year fixed effects. The coefficient of interest on the interaction term, β_3, is negative and significant in all specifications suggesting that importers differentially lose markup as compared to non-importers. Further, importers with higher import shares suffer higher losses. In the preferred specification (column (7)), a 10% increase in $concern_{j(p),t-1}^{input}$ leads to an additional decrease in markups of 1% for firms with import share at the 75th percentile compared to firms with median import share. The coefficient on $concern_{j(p),t-1}^{input}$ is insignificant suggesting that there was no significant impact on markups of non-importers. Similar to the results on productivity, it is found that the effects are not driven by effects of the financial crisis (column 7), pre-existing linear trend in outcome variables (column 8), export status (column 9) and entry and exit of firm-products (column 10).

Prices, Marginal Costs and Markups

To further explore the mechanism at work, equation (1.5) is estimated with firm-product level prices and marginal costs as the outcome variables. **Table 1.8** reports the results. Results for markups from **Table 1.7** are carried over in columns 7-9. Columns 1, 4 and 7 use importer dummy as a measure of importing status while the rest of the columns use import share instead. Columns 3,6 and 9 exclude observations after 2007 to check if the results are not driven by the effects of the financial crisis. The coefficient on $concern_{j(p),t-1}^{output}$ is insignificant for prices, marginal costs and markups suggesting no significant effects of reduced competitiveness from the incidence of restrictive TBTs. There is no significant effect of $concern_{j(p),t-1}^{input}$ on prices, marginal costs and markups of non-importers. The coefficient on the interaction term between $concern_{j(p),t-1}^{input}$

and importing status of a firm for prices, marginal costs and markups suggest that when faced with an increase in marginal costs, importers do not transfer cost increases to prices but reduce markups. This incomplete pass-through of costs to prices for Indian manufacturing firms is consistent with the literature. In the context of the Indian tariff liberalization, De Loecker et. al. (2016) find that cost savings are only imperfectly passed through to prices leading to an increase in markups. Thus, at least in the short run importing firms absorb the increase in marginal costs and consumers are not worse off.

Heterogeneity Based on Industry and Firm Characteristics

In this section, the heterogeneity in firm response to the incidence of restrictive TBTs on their input industries is explored. First, it is studied if the effect of these measures on inputs differentially impacted importers based on contract intensity of industries. Contract intensity is defined following (Nunn, 2007) based on data on whether the inputs are sold on an organized exchange or not as classified by Rauch (1999).

It is hypothesized that the import of intermediate inputs would be more severely affected in industries that are less contract intensive. Lower contract intensity would imply that a higher share of inputs to the industry are sold on an exchange. Alternatively, lower contract intensity implies a lower proportion of inputs are relationship-specific. These inputs would have relatively higher value outside of the buyer-seller relationship. Hence, the cost of exporting to an alternate destination would be lower and more exporters may choose not to incur the cost of complying with the restrictive TBTs and sell these inputs in alternate destinations. Thus, importers in less contract intensive industries would be more likely to see disruption in access to imported inputs and have a negative impact on productivity and markups. Industries above the median value of contract intensity are defined as high contract intensive industries. Second, the heterogeneity based on exporting status of a firm. Recent studies find a link between import of intermediate inputs and exports (Bas and Strauss-Kahn, 2014; Feng et al., 2016). In this sample more than three-fourths of importers also export. Thus, it is expected that exporters who import to experience greater decline in physical efficiency and markups.

Table 1.9 reports results from running the baseline regressions with log of TFPQ as the dependent variable for a sub-sample of high (columns 1-2) and low (columns 3-4) contract intensity industries, exporters (columns 5 and 6) and non-exporters (columns 7 and 8). **Table 1.10** reports the results with log of markups as the dependent variable. The results suggest that effect of restrictive TBTs was driven by their effect on importers in low contract intensity industries. The coefficient on the interaction term is negative, larger in magnitude and statistically significant for low contract intensive industries. It is also find that the effects of restrictive TBTs on inputs are primarily driven by exporters. The coefficient on the interaction term is negative and statistically significant for exporting firms while it is statistically insignificant for non-exporters for both productivity and markups.

Placebo tests

Further additional evidence is provided against endogeneity of incidence of restrictive TBTs on inputs to an industry and endogeneity of importing status of a firm. The main concern is that the analysis might be capturing effects of some unobservable industry or firm level correlates of outcome variables which are correlated with $concern^{input}_{j(p),t-1}$ and importing status of the firm, respectively. The analysis start by providing compelling evidence through placebo tests that: (1) the timing of incidence of restrictive TBTs on inputs to an industry is indeed important, and (2) the effect of restrictive TBTs on inputs works through the import of intermediate inputs.

The analysis undertakes a placebo test similar to Aghion et al. (2008) and Martin et. al. (2017) to provide evidence for the importance of the timing of actual incidence of TBT measures on inputs to an industry. The distribution of actual incidence of restrictive TBTs is mirrored while randomizing the occurrence of restrictive TBTs in an industry in any given year. Thus, the probability that an industry-year observation has a restrictive TBT is same in the placebo test as in the actual dataset but the identity of the industry selected for placebo treatment is randomized. With the randomized allocation of restrictive TBTs in hand, the placebo measure of occurrence of restrictive TBTs is constructed on inputs to the industry. As all industries are included in the randomization

process for the placebo test, industries that saw the incidence of restrictive TBTs could be selected for the placebo assignment. To isolate the placebo effect from the actual treatment effect, true incidence of restrictive TBTs in an industry are controlled for and its inputs and the interaction term as in the baseline specifications.

Table 1.11 summarizes the results from 100 iterations of the placebo test. Panel A summarizes results with import share as a measure of importing status while panel B uses importer dummy instead. Columns 1-3 report summary of results with 5% significance level while columns 4-6 summarize results with 10% significance. In panel A, columns 1-3 show that for productivity, the coefficient on the interaction term was insignificant in 98 out of 100 runs while for markups the interaction term was insignificant in 96 runs. The number of significant cases increases to 3 and 9 in columns 4-6. Thus, even at the 10% significance level, there is an insignificant coefficient in the majority of the cases. Similar results with importer dummy as a measure of importing status of firms in panel B with the coefficient being insignificant in the majority of the cases are arrived at.

Another concern is that the coefficient of interest in the baseline specifications is biased due to unobserved firm level characteristics which differ systematically based on the importing status of a firm. Fortunately, Prowess provides data on value of imports by a firm categorized into four broad categories, namely raw materials, capital goods, stores and spares and finished goods. This allows us to conduct another placebo test. If the hypothesized channel is true, incidence of restrictive TBTs on inputs to an industry should affect productivity of importers of intermediate inputs (raw materials and capital goods) while importers of non-intermediate inputs (stores and spares and finished goods) should show no negative effect on productivity as compared to non-importers. Thus, while importers of non-intermediate inputs differ from non-importers in the unobservable characteristics inducing bias in the coefficient of interest, they should not be affected by the incidence of restrictive TBTs on inputs to the industry as they do not import inputs.

Table 1.12 reports the results. Specifications in columns 1, 2 and 3 include the interaction between $concern^{input}_{j(p),t-1}$ and the importing share of output for the particular category of imported goods, either raw materials (column 1), capital

goods (column 2), and non-intermediate inputs (column 3). Column 4 runs the full specification including all the interaction terms together. The top panel reports results for firm level productivity while the bottom panel reports results with firm product markups as dependent variable.

For productivity, it is found that the coefficient on the interaction term is significant and negative for columns 1 and 2 (intermediate inputs) while the coefficient is insignificant in column 3 (non-intermediate inputs). Finally, in column 4 again there are significant coefficients on interactions with only raw materials and capital goods import shares while the interaction term with the import share of non-intermediate inputs is positive and insignificant, as would be expected from a successful placebo test.

The bottom panel results for markups have similar results with the coefficient on the interaction between import share of non-intermediate inputs and $concern^{input}_{j(p),t-1}$ being insignificant in columns 3 and 4. One important difference from the results on productivity is that the results for markups seem to be driven largely by import share of capital goods with the interaction term with the import share of raw materials being marginally significant and lower in magnitude in column 1 and insignificant in column 4.

Robustness Checks

To check if the results are robust to alternative methods for estimation of production functions and consequently markups and productivity, firm level measure of markups and productivity are calculated using a revenue based production function following the estimation procedure of De Loecker and Warzynski (2012). A larger set of firms can be analysed using this methodology as some firms do not report product level data. **Table A1** reports the results from estimating the baseline specifications and their variants for productivity and markups in columns 1-4 and columns 5-8 respectively. Even numbered columns restrict the sample to the pre-financial crisis period. Columns 1,2,5 and 6 consider importer dummy while columns 3,4,7 and 8 use import share as a measure of importing status of a firm. The results for productivity confirm the main results albeit with a lower magnitude of coefficient on the interaction term. The interaction term is negative and significant in all specifications.

For markups, the coefficient on the interaction term is negative and statistically significant in all columns except column 7 which is attributed to the effect of the financial crisis and/or unobserved sector-specific year shocks as significant results are received when the sample is limited to pre-crisis years in column 8. Thus, the analysis finds broad support for the results on markups although with lower magnitudes.

Finally, for robustness of main results is checked in the face of more stringent specifications, explicitly including interactions between $concern_{j(p),t-1}^{input}$ and firm level characteristics and performing other robustness exercises. **Tables A2** and **A3** report the results for productivity and markups, respectively. In column 1, industry-year (NIC 3 digit) fixed effects are introduced to check if results are not driven by unobservable yearly shocks to the industry at a more disaggregated level than sectors (NIC 2 digit). The results for both productivity and markups are robust to inclusion of industry year fixed effects.

In column 2, multi-product firms are excluded and baseline specification is estimated on a sub-sample of single-product firms. Recall that product level input shares are not observed but are needed to be estimated. Thus, it is required to be check if productivity and markups effects are similar for single product firms for which input data is available. The coefficient on productivity is slightly higher in magnitude but significant only at the 10% level while that on markups reduces significantly. This is expected since the majority of importers are multi-product firms and the purpose of using a sample of single product firms is to check if the results are qualitatively similar to the main results.

In column 3, interactions between $concern_{j(p),t-1}^{input}$ and input tariffs are added. Results for both productivity and markups are robust to the inclusion of interaction terms. In columns 4-7, interaction between import share of output and firm characteristics are included. The firm characteristics considered are capital intensity, size, age and exports. The results for both productivity and markups are robust to the inclusion of these interaction terms. Finally, in column 8 all interactions from columns 3-9 are included together and it is found that the coefficient on the interaction terms for both productivity and markups remain negative and statistically significant with a slight reduction in magnitudes.

1.3 Conclusion

Extant literature on the effect of restrictive regulatory measures like TBTs finds that these measures negatively affect exports to the maintaining country. Building on these findings and borrowing insights from the voluminous literature which highlights the importance of access to intermediate inputs for developing country firms, it is examined if restrictive TBTs had negative consequences for importing firms in the maintaining country due to reduced access to intermediate inputs. Using rich firm-product level data from Prowess, matched with specific concerns data from WTO, a causal link is found between restrictive TBTs maintained by India and the performance of its manufacturing firms. The results indicate that these measures had a negative impact on physical efficiency and markups of importers relative to non-importers and that this effect was increasing in the import share of a firm. Interestingly, importers absorbed the increased costs by reducing markups, without any significant increase in prices. It is also found that the results are driven by importers in less contract-intensive industries and by importers who export.

The results of this analysis have broader implications for trade policy, especially in developing countries. It is found that regulatory measures aimed at addressing legitimate public policy objectives can have unintended consequences for firm performance in developing countries if they negatively affect the import flows of intermediate inputs. Given the increasingly integrated world of global value chains, supply chain disruptions caused by such measures can have spillover effects on firm performance. Hence, the impact on trade flows and such spillovers should be taken into account to ensure that these measures do not impose excessive increases in trade costs than is necessary to achieve the public policy objective.

Figure 1: Markups, Marginal Costs, and Sales Share

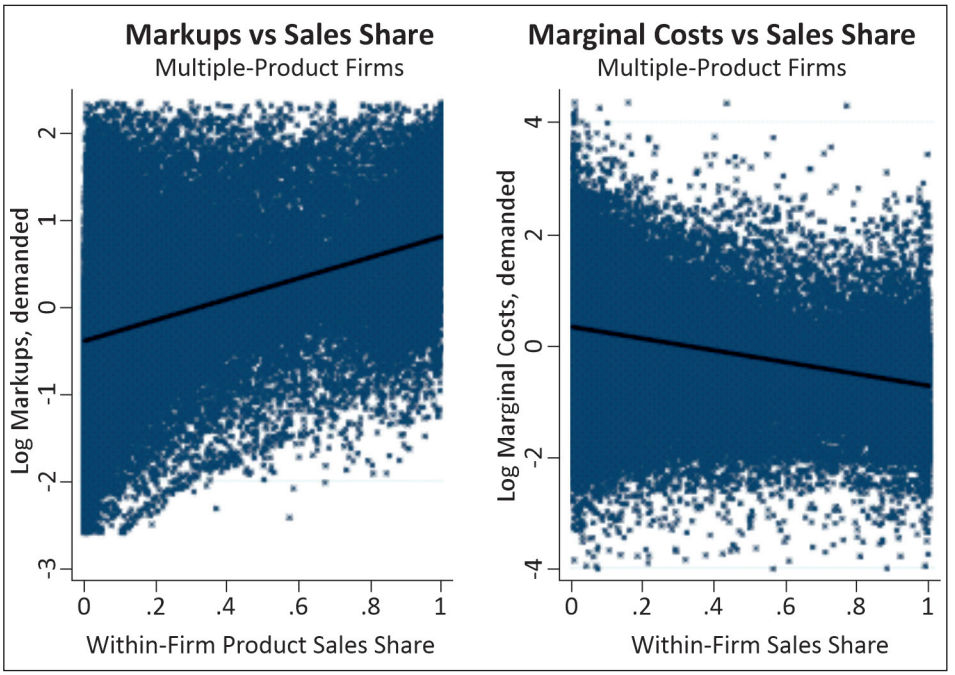


Figure 2: Markups, Marginal Costs, and Quantity Produced

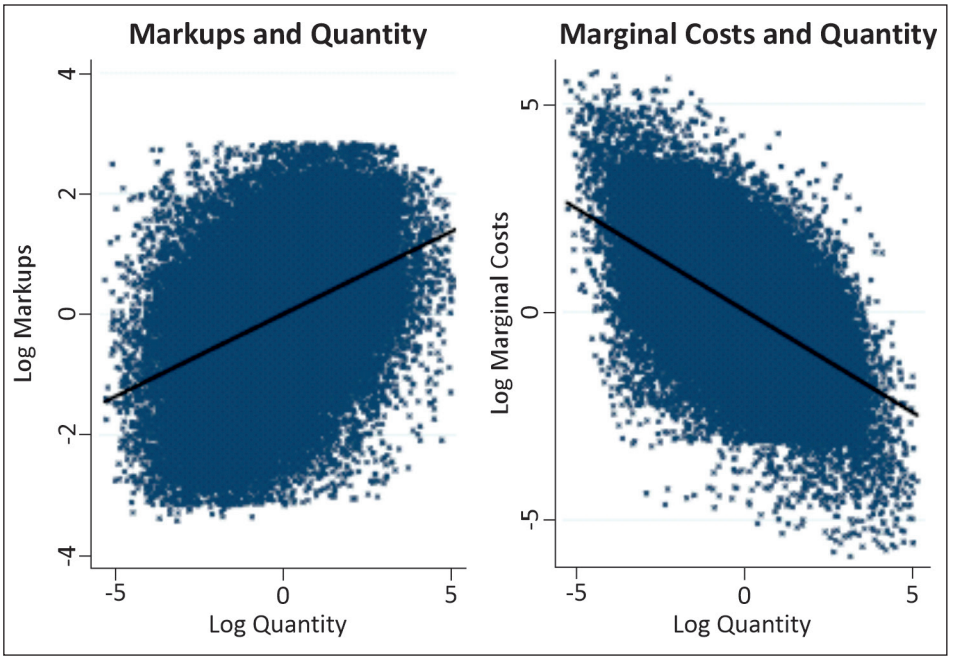


Table 1.1: Yearly Incidence of STCs

Year	All Countries		India	
	concerns	products	concerns	products
	(1)	(2)	(3)	(4)
1995-2000	52	578	0	0
2001	15	317	2	125
2002	20	436	2	171
2003	15	471	0	0
2004	14	29	1	14
2005	12	337	0	0
2006	24	459	2	7
2007	27	329	4	142
2008	32	333	0	0
2009	46	363	3	193

Source: Author's calculation based on STC dataset.

Table 1.2: Objectives of STCs

Objectives	Concerns
Human Health and Safety	9
Consumer Safety or protection	8
Environment	3
Quality	1

Source: Author's calculation based on STC dataset.

Table 1.3: Issues Raised in STCs

Objectives	Concerns
Unnecessary barrier to trade	10
Transparency	8
Clarification	5
Standards	4
Discrimination	3
Legitimacy and Rationale	3

Source: Author's calculation based on STC dataset.

Table 1.4: TBT Concerns and Imports to India

Dependent Variable	log(imports)_(j,t)					
	1996-2010			1996-2007		
	All countries	OECD	non-OECD	All countries	OECD	non-OECD
	(1)	(2)	(3)	(4)	(5)	(6)
$concern^{output}_{j(p),t-1}$	-0.180*	-0.301**	-0.148	-0.150	-0.294**	-0.105
	(0.0977)	(0.134)	(0.135)	(0.0924)	(0.147)	(0.126)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,350	1,350	1,350	1,080	1,080	1,080

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.5: Endogeneity of TBT Concerns

	$concern^{output}_{j,t}$		$concern^{output}_{j(p),t}$		$concern^{input}_{j,t}$		$concern^{input}_{j(p)}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFPQ	-0.000028	-0.000004			-0.000001	-0.000000		
	(0.000021)	(0.000019)			(0.000001)	(0.000003)		
markup			0.001775***	0.000897			-0.000156	0.000171
			(0.000578)	(0.001013)			(0.000128)	(0.000261)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,083	711	1,090	718	1,083	405	1,090	408

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.6: Impact of TBT Concerns on Firm Level Productivity

Outcome variable:	log (TFPQ)									
							Year <2008			Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$concern^{input}_{j(p),t-1} \times \text{importer}_{it}$	-0.0458	-0.0496	-0.0541	-0.0318	-0.0621	-0.0331	-0.0474	-0.0375	-0.0380	-0.169
	(0.0587)	(0.0613)	(0.0615)	(0.0824)	(0.0621)	(0.0848)	(0.0912)	(0.0667)	(0.0666)	(0.106)
importer_{it}		0.132	0.317	0.463	0.306	0.442	0.169	0.452	0.445	-0.240
		(0.266)	(0.305)	(0.431)	(0.265)	(0.421)	(0.493)	(0.382)	(0.383)	(0.558)
$concern^{input}_{j(p),t-1} \times \text{import share}_{it}$			-0.276*	-0.293*						
			(0.149)	(0.157)						
importer_{it}			-0.0424	-0.0490						
			(0.0348)	(0.0357)						
$concern^{input}_{i,t-1} \times \text{importshare}_{it}$					-1.675***	-1.558***	-1.867***	-1.550***	-1.496***	-1.822***
					(0.463)	(0.434)	(0.696)	(0.436)	(0.438)	(0.422)
import share_{it}					-0.00706***	-0.00880***	-0.00982***	-0.00879***	-0.00922***	0.0354***
					(0.00194)	(0.00184)	(0.00187)	(0.00184)	(0.00180)	(0.0121)

Outcome variable:	log (TFPQ)									
							Year <2008			Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\text{trend}_{jt}^{output}$								0.00588	0.00610	-0.0492***
								(0.0495)	(0.0496)	(0.0115)
$\text{trend}_{jt}^{input}$								0.0605	0.0600	-0.351
								(0.0397)	(0.0397)	(2.792)
exporter_{it}									-0.0786***	-0.0612
									(0.0198)	(0.0393)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	Yes	No	No	No	No	No
Sector-Year FE	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32,818	32,818	32,818	32,814	32,818	32,814	24,808	32,814	32,814	6,680

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.7: Impact of TBT Concerns on Firm-Product Level Markups

Outcome variable:	log (markups)									
							Year <2008			Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$concern_{j(p),t-1}^{output}$	0.0527*	0.0691**	0.0659**	0.0499	0.0661**	0.0500	0.0273	0.0500	0.0495	0.0120
	(0.0300)	(0.0303)	(0.0305)	(0.0387)	(0.0298)	(0.0383)	(0.0369)	(0.0383)	(0.0382)	(0.0496)
$concern_{j(p),t-1}^{input}$		-0.370**	-0.204	0.0248	-0.298*	-0.0295	0.0333	-0.0295	-0.0232	-0.682*
		(0.168)	(0.166)	(0.388)	(0.165)	(0.394)	(0.320)	(0.394)	(0.393)	(0.387)
$concern_{j(p),t-1}^{input} \times$ importer_{it}			-0.229**	-0.217**						
			(0.0991)	(0.0993)						
importer_{it}			0.0255	0.0230						
			(0.0244)	(0.0243)						
$concern_{j(p),t-1}^{input} \times$ import share_{it}					-0.987***	-0.977***	-0.931**	-0.977***	-0.986***	-1.372**
					(0.326)	(0.331)	(0.404)	(0.331)	(0.332)	(0.650)
import share_{i}					-0.00995	-0.00956	-0.0109	-0.00956	-0.00941	-0.0873*
					(0.00794)	(0.00776)	(0.00719)	(0.00776)	(0.00778)	(0.0495)

Outcome variable:	log (markups)									
							Year <2008			Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\text{trend}_{j(p),t}^{output}$								0.283	0.282	131.6
								(0.498)	(0.498)	(2.258e+07)
$\text{trend}_{j(p),t}^{input}$								-0.156	-0.153	
								(0.356)	(0.354)	
exporter_{it}									0.0286	0.0245
									(0.0175)	(0.0363)
Firm - Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	Yes	No	No	No	No	No
Product Sector-Year FE	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	77,549	77,549	77,549	77,548	77,549	77,548	58,983	77,548	77,548	13,380

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.8: Impact of TBT Concerns on Firm-Product Level Prices, Marginal Costs and Markups

Outcome variable:	log (unit value)			log (marginal cost)			log (markups)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$concern^{output}_{j(p),t-1}$	0.0242	0.0245	0.00191	-0.0252	-0.0250	-0.0252	0.0494	0.0495	0.0271
	(0.0295)	(0.0294)	(0.0357)	(0.0328)	(0.0327)	(0.0407)	(0.0386)	(0.0382)	(0.0368)
$concern^{input}_{j(p),t-1}$	0.0677	0.0102	-0.116	0.0362	0.0334	-0.152	0.0315	-0.0232	0.0363
	(0.281)	(0.272)	(0.328)	(0.283)	(0.285)	(0.293)	(0.387)	(0.393)	(0.320)
$concern^{input}_{j(p),t-1} \times$ importer$_{it}$	-0.0923			0.127			-0.219**		
	(0.0577)			(0.129)			(0.0990)		
importer$_{it}$	0.0497***			0.0300			0.0197		
	(0.0166)			(0.0303)			(0.0249)		
$concern^{input}_{j(p),t-1} \times$ import share$_{it}$		0.0103	0.0533		0.997**	0.991**		-0.986***	-0.938**
		(0.247)	(0.298)		(0.381)	(0.466)		(0.332)	(0.404)
import share$_{i_i}$		0.000879	0.000465		0.0103	0.0113		-0.00941	-0.0108
		(0.00119)	(0.000898)		(0.00872)	(0.00775)		(0.00778)	(0.00717)
trend$^{output}_{j(p),t}$	0.0450	0.0553	1.061	-0.511	-0.489	-1.652	0.344	0.355	-0.0365
	(0.473)	(0.452)	(1.012)	(0.754)	(0.736)	(1.549)	(0.602)	(0.583)	(1.022)

Outcome variable:	log (unit value)			log (marginal cost)			log (markups)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\text{trend}_{j(p),t}^{input}$	0.415	0.380	0.285	0.469	0.421	0.797	-0.179	-0.179	0.140
	(0.432)	(0.383)	(1.255)	(0.409)	(0.429)	(1.571)	(0.368)	(0.363)	(1.186)
exporter_{it}	0.0389***	0.0422***	0.0424***	0.0110	0.0136	0.0282	0.0279	0.0286	0.0142
	(0.0135)	(0.0140)	(0.0160)	(0.0234)	(0.0231)	(0.0255)	(0.0183)	(0.0175)	(0.0190)
Firm - Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product Sector - Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	77,548	77,548	58,983	77,548	77,548	58,983	77,548	77,548	58,983

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.9: Heterogeneity based on Contract Intensity and Exports: Productivity

	Contract Intensity				Exporting Status			
	High		Low		Exporter		Non-exporter	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern_{i,t-1}^{output}$	-0.184**	-0.192**	0.0122	0.0118	-0.0418	-0.0476	-0.00912	-0.00945
	(0.0733)	(0.0731)	(0.0861)	(0.0910)	(0.0668)	(0.0678)	(0.0882)	(0.0884)
$concern_{i,t-1}^{input}$	0.441	0.475	0.0140	-0.0652	0.687	0.587	-0.0683	-0.101
	(0.468)	(0.430)	(0.623)	(0.596)	(0.454)	(0.447)	(0.493)	(0.488)
$concern_{i,t-1}^{input} \times \text{importer}_{it}$	-0.136		-0.386*		-0.461**		-0.164	
	(0.233)		(0.205)		(0.228)		(0.194)	
importer_{it}	-0.0332		-0.0213		0.0143		-0.0722	
	(0.0601)		(0.0398)		(0.0419)		(0.0481)	
$concern_{i,t-1}^{inpu} \times \text{import share}$		-1.071*		-1.801***		-1.817***		-0.654
		(0.551)		(0.640)		(0.630)		(0.515)
import share_{it}		-0.0103***		0.0509		-0.0104***		0.0972
		(0.000631)		(0.0846)		(0.00256)		(0.0817)

	Contract Intensity				Exporting Status			
	High		Low		Exporter		Non-exporter	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm - Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector - Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,406	13,406	19,305	19,305	16,670	16,670	15,476	15,476

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.10: Heterogeneity based on Contract Intensity and Exports: Markup

	Contract intensity				Exporting status			
	High		Low		Exporter		Non-exporter	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern^{output}_{j(p),t-1}$	-0.0322	-0.0330	0.0705	0.0728*	0.0835*	0.0836*	0.0166	0.0149
	(0.0730)	(0.0725)	(0.0444)	(0.0432)	(0.0446)	(0.0445)	(0.0590)	(0.0590)
$concern^{input}_{j(p),t-1}$	0.436	0.463	-0.737*	-0.872**	0.0492	-0.0614	0.0337	0.0180
	(0.573)	(0.576)	(0.386)	(0.385)	(0.464)	(0.458)	(0.508)	(0.510)
$concern^{input}_{j(p),t-1} \times \text{importer}_{it}$	-0.0424		-0.322**		-0.274		-0.0548	
	(0.164)		(0.123)		(0.171)		(0.147)	
importer_{it}	0.0244		0.0180		0.0118		0.0172	
	(0.0510)		(0.0227)		(0.0370)		(0.0294)	
$concern^{input}_{j(p),t-1} \times \text{import share}_{it}$		-0.535		-0.938**		-0.930**		-0.698
		(0.506)		(0.432)		(0.378)		(0.744)
$\text{import share}_{i_i}$		-0.00647		-0.108***				-0.0789*
		(0.00616)		(0.0327)		(0.0116)		(0.0409)

	Contract intensity				Exporting status			
	High		Low		Exporter		Non-exporter	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm - Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector - Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,868	29,868	47,680	47,680	45,121	45,121	30,794	30,794

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 1.11: Placebo Test: Summary of Results

Confidence Interval around 0:	5%			10%		
	Significant		Insignificant	Significant		Insignificant
	Coefficient>0	Coefficient<0		Coefficient>0	Coefficient<0	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A : Import share						
log (RFPQ)	2	0	98	3	0	97
log (markups)	1	3	96	5	4	91
Panel B : Importer dummy						
log (TFPQ)	0	0	100	1	2	97
log (markups)	1	3	96	3	7	90

Table 1.12: Importing Channel

	Import channel			Placebo
	Intermediate inputs		Non-inputs	
	Raw material	Capital goods		
	(1)	(2)	(3)	(4)
Outcome variable: TFPQ_{ijt}				
$concern_{i,t-1}^{output}$	-0.0356	-0.0337	-0.0308	-0.0378
	(0.0665)	(0.0659)	(0.0653)	(0.0662)
$concern_{i,t-1}^{input}$	0.406	0.350	0.308	0.432
	(0.376)	(0.371)	(0.368)	(0.380)
$concern_{i,t-1}^{input} \times \text{import share RM}_{it}$	-1.691***			-1.685***
	(0.560)			(0.542)
$\text{import share RM}_{it}$	-0.0298			-0.00524
	(0.0365)			(0.0377)
$concern_{i,t-1}^{input} \times \text{import share CG}_{it}$		-1.383**		-1.176**
		(0.541)		(0.454)

	Import channel			Placebo
	Intermediate inputs		Non-inputs	
	Raw material	Capital goods		
	(1)	(2)	(3)	(4)
import share CG_{it}		-0.00974***		-0.00949***
		(0.00157)		(0.00172)
$concern_{i,t-1}^{input}$ × import share NI_{it}			1.401	1.851
			(1.720)	(1.666)
import share NI_{it}			0.456	0.319
			(0.438)	(0.421)
Firm FE	Yes	Yes	Yes	Yes
Sector - Year FE	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes
Observations	32,814	32,814	32,814	32,814
Outcome variable: $markups_{ijt}$				
$concern_{j(p),t-1}^{output}$	0.0502	0.0502	0.0495	0.0472
	(0.0383)	(0.0386)	(0.0382)	(0.0378)
$concern_{j(p),t-1}^{input}$	-0.0635	-0.0754	-0.118	-0.0542
	(0.393)	(0.398)	(0.397)	(0.392)
$concern_{j(p),t-1}^{input}$ × import share RM_{it}	-0.737**			-0.642*
	(0.368)			(0.376)
import share RM_{it}	-0.140**			-0.141**
	(0.0575)			(0.0597)
$concern_{j(p),t-1}^{input}$ × import share CG_{it}		-1.239***		-1.144**
		(0.415)		(0.437)
import share CG_{it}		-0.00529		0.00289
		(0.00639)		(0.00398)

	Import channel			Placebo
	Intermediate inputs		Non-inputs	
	Raw material	Capital goods		
	(1)	(2)	(3)	(4)
$concern^{input}_{j(p),t-1} \times$ import share NI_{it}			0.0533	0.278
			(1.258)	(1.265)
import share NI_{it}			0.729***	0.619**
			(0.248)	(0.249)
Firm - Product FE	Yes	Yes	Yes	Yes
Product Sector - Year FE	Yes	Yes	Yes	Yes
Industry time-trend	Yes	Yes	Yes	Yes
Observations	77,548	77,548	77,548	77,548

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

2. CHINESE IMPORT COMPETITION AND FIRM PERFORMANCE

The division of the gains from international trade between producers and consumers is a key question in international trade research. A voluminous literature has documented the gains to producers from increased productivity due to increased import competition (Pavcnik, 2002; Topalova and Khandelwal, 2011) and also access to imported inputs (Amiti and Konings, 2007; Topalova and Khandelwal, 2011) . In the Indian trade liberalization context, De Loecker et. al. (2016) find that trade liberalization resulted in lower marginal costs which translated into higher markups due to incomplete pass-through leading to only a modest reduction in prices. Interestingly, they do not find decrease in marginal costs from increased competition. These findings raise important questions regarding the benefits to consumers from increased trade. How does import competition affect markups, marginal costs and prices for domestic firms? Do gains from trade accrue disproportionately to producers as compared to consumers? In this chapter this gap is addressed.

China experienced rapid productivity growth in the 1990s and 2000s leading to substantial rise in Chinese import share in most economies across the world. This has led researchers to examine the consequences of this major economic event on performance of manufacturing firms in importing countries. However, the primary focus of this literature has been on advanced economies while the effects of Chinese import competition on firm performance in developing countries has received considerably less attention. Chinese import share in developing countries saw a large increase in the 2000s and by 2010, China accounted for over 18 percent of all manufacturing imports to India. The goal in this chapter is to study the pro-competitive gains from Chinese import competition for firms in a large developing country, India.

Import competition can lead to welfare gains through two distinct channels. First, import competition can induce firms to seek efficiency improvements and lead to decrease in marginal costs. Second, firms with market power may be forced to lower markups. However, under incomplete passthrough of costs to prices, the overall effect on markups is ambiguous, as part of cost-savings feeds into higher markups. Thus, while both channels lead to reduced output prices, the extent of reduction in prices depends crucially on the extent of passthrough. For sufficiently low passthrough, the increase in markups from the first channel can be larger than the direct reduction in markups from increased import competition.

While a large literature has examined the effect of import competition on changes in within firm productivity and markups, the lack of firm level price data implies that most studies are unable to separately identify the efficiency effects from those on markups. Productivity estimates from revenue based production function capture effects on prices, both output and input, in addition to efficiency effects. Thus, while these measures of productivity reflect overall firm performance, it is not possible to identify the distinct mechanism by which import competition affects firm performance. The increase in productivity could arise both due to increase in physical efficiency and due to increase in markups.

Identifying the effect of import competition on efficiency separately from markups, and in turn separating the direct effect on markups from that due to incomplete passthrough is important as each channel affects overall welfare and its distribution between producers and consumers differently. The direct reduction in markups due to increased competition leads to reduced prices and increases consumer surplus at the expense of producer surplus. The reduction in marginal costs from import competition will lead to increase in markups unless the passthrough of costs to prices is complete. If passthrough is low, the cost savings will lead to increase in markup of firms with only modest increase in consumer surplus due to lower prices. To isolate the direct effect on markups from increased competition, the effect of import competition on marginal costs is needed to be controlled for, which in turn requires firm-product level prices to be observed.

Detailed data on sales and physical quantities at the firm product level for Indian manufacturing firms is used to study the effect of Chinese import competition on prices and its underlying components, i.e. marginals costs and markups. As firm level prices are directly observed in the data, marginal costs and markups are separately identified. The methodology of De Loecker et. al. (2016) (DLGKP henceforth) is used to estimate firm product level marginal costs and markups. This method allows for multi-product firms and addresses concerns regarding unobserved heterogeneity in input prices and input allocations across products within a firm. Once the coefficients of the production function are estimated, markups are computed using output elasticity and cost share of output for the variable input under the assumption of a cost minimizing firm.

To preview the main results, it is found that Chinese import competition leads to: (1) increase in physical efficiency; (2) decrease in marginal costs; (3) only moderate decrease in prices; (4) increase in R&D expenditure and capital intensity; and (5) insignificant effect on product scope. Evidence of incomplete passthrough of cost savings to prices is found, both cross-sectionally and over time. The increase in markups from cost savings dominates the direct reduction in markups of firms from increased competition. Considerable heterogeneity is found in firm responses along several dimensions. First, it is found that firms with initially low marginal costs differentially reduce marginal costs, increase markups and product scope compared to firms with initially high marginal costs. Second, business groups and foreign owned firms show evidence of considerable market power and have very low passthrough leading to large increase in markups while other private firms pass on most of their cost savings to prices with no significant increase in markups.

This study contributes to a recent set of studies examining the effect of trade on efficiency and markups separately (De Loecker et al., 2016; Brandt et al., 2017). In contrast to earlier findings for India, this study finds strong evidence of efficiency gains and lowering of marginal costs from Chinese import competition.

The rest of the chapter is structured as follows. Section 2.1 describes the data. Section 2.2 discusses the construction of key variables and the identification strategy. Section 2.3 presents and discusses the empirical specifications and results. Section 2.4 concludes.

2.1 Data Sources

The primary source for firm level data is the Prowess database from the Centre for Monitoring the Indian Economy (CMIE). Prowess database has information on financial performance of over 45000 firms across manufacturing, services, financial and utility sectors. These firms account for a substantial fraction of output in the organized manufacturing sector and taxes collected by the governments. This study focuses on firms in the manufacturing sector for the sample period 1995-2010. A unique feature of Prowess database is that it captures detailed information on firms' product level production including quantity, sales and capacity of each product manufactured by the firm. The 1956 Companies Act requires firms to report detailed production data for all products manufactured by the firm. The internal product classification of CMIE assigns a 20 digit unique code to each product. Following DLGKP, the products are aggregated to 12 digits as the level of dis-aggregation is comparable across products at this level. The products in the data should be seen as narrowly defined categories within industries rather than a specific product variety like barcode scanner datasets. There are over 3500 unique products in the sample. These product codes were mapped to the National Industries Classification (NIC) 2004 4 digit industries.

The firm-product level data above is complemented with firm level data on exports, sales, materials, compensation, capital stock, and research and development expenses. The study also uses ownership information in the Prowess database. In particular, classification of firms into one of the following ownership categories, Business Groups, Private, Government and Foreign ownership is used. The study also uses the share of firm ownership by Hindu Undivided Family (HUF) to proxy for family-owned firms. Further, detailed data on managerial and executive compensation is used to calculate the share of managerial compensation in total compensation to employees.

The trade data on exports and imports is sourced from the UN-Comtrade database. The study uses the data on Chinese imports to India and other developing countries, namely Malaysia, Indonesia, Brazil and Mexico. The study also uses industry level data on total exports and imports for India. The trade data above is combined with industry level production data from Annual Survey of Industries (ASI) and National Sample Survey Office (NSSO), to construct the

Chinese import penetration ratio and its instrument. ASI data reports production data for registered manufacturing firms in the organized manufacturing sector. The NSSO surveys unregistered manufacturing units in the manufacturing sector. To control for alternative trade channels, data on Chinese imports to developed countries, Indian exports to China and imports from other developing countries to India, all at the 4 digit NIC 2004 industry level is also used.

2.2 Empirical Strategy

The main measure for Chinese import competition is the import penetration ratio for an industry j (NIC 2004 revision) and is computed as:

$$DComp_{j(p)t}^{China,IND} = \frac{M_{j(p)t}^{IC}}{Y_{j(p),94} + M_{j(p),94} - X_{j(p),94}}$$

where $M_{j(p)t}^{IC}$ is the total import of Chinese goods in industry j at time t; $Y_{j(p),94}$, $Y_{j(p),94}$ and $Y_{j(p),94}$ are total domestic production, imports and exports for industry j during 1994. To overcome endogeneity concerns Acemoglu et. al. (2016) is followed in instrumenting for Chinese exports to India by Chinese exports to other developing countries. The instrument is computed as:

$$IV_{j(p)t}^{China,IND} = \frac{M_{j(p)t}^{IC,Others}}{Y_{j(p),94} + M_{j(p),94} - X_{j(p),94}}$$

where $M_{j(p)t}^{IC,Others}$ is the lagged value of Chinese imports to an industry in Brazil, Indonesia, Malaysia and Mexico. This approach assumes that the rise in Chinese manufacturing exports to developing countries was primarily driven by internal supply shocks and reduced trade costs but not by unobserved import demand shocks in developing countries. In a scenario where a technology shock in an industry increases the demand for Chinese imports in developing countries, the estimates in this analysis will be capturing the effect of this technology shock and would erroneously attribute it to Chinese import competition. The specifications include industry-year fixed effects to capture these common technology or demand shocks that may drive increase in Chinese imports to developing countries. Another potential threat to the validity of the instrumental

variable strategy comes from possible correlation between the instrument and other trade channels. Alternative trade channels are controlled for in the specifications to show robustness of the results to inclusion of Chinese import share in foreign markets, import competition from developing countries in India and India's export share in total exports to China.

To study the effect of imported inputs from China on firm performance, the exposure of an industry is calculated as the weighted average of Chinese import penetration on inputs to the industry. The analysis also proxies for Chinese import competition in foreign markets by the import share of China in the US market. These industry level variables are matched with firm-product level data to study their effect on within firm product changes in outcome variables. These variables are also computed at the firm level by taking the sales weighted average of the firm-product level values.

2.3 Empirical Strategy and Results

Chinese Imports and Firm Performance

The analysis starts by examining the firm level effects of Chinese import competition by estimating the below specification at the firm-product level:

$$X_{ipt} = \alpha_0 + \alpha_{ip} + \alpha_{j(p)(3),t} + \beta_1 \, DComp_{j(p)t}^{China,IND} + \beta_2 \, DInputs_{j(p)t}^{China,IND} + \beta_3 \, FComp_{j(p)t}^{China,US} + \varepsilon_{ipt}$$

where X_{ipt} denotes log of unit value, marginal costs or markups for firm-product, ip. Firm-product and industry-year (NIC 3 digit) fixed effects are included to sweep out time invariant firm-product specific variables and yearly shocks to industries which may be correlated with Chinese imports. A similar specification at the firm level is also estimated to study the effect of Chinese imports on firm level productivity. The independent variables are calculated using a sales weighted average of firm-product level values of these variables. The analysis assigns a firm to an industry j based on the industry, j(p), of its product with the highest sales share.

Table 2.1 reports the results. Columns 1 to 9 report results for firm-product level unit values (columns 1-3), marginal costs (columns 4-6) and markups (columns 7-9) while columns 10 to 12 report results for firm level productivity. For each outcome of interest three variants of the baseline specifications are studied. In the first specification (columns 1, 4, 7, and 10), the Chinese import penetration ratio and Chinese import share in the US market are included. The second specification (columns 2, 5, 8, and 11) includes the measure for Chinese import penetration on inputs to the industry. Finally, the third specification (columns 3, 6, 9, and 12) adds output and input tariffs as control variables. The results remain consistent with magnitudes changing very slightly across different specifications for all outcome variables.

At the firm-product level, the results suggest that Chinese import competition resulted in a statistically significant and economically meaningful decrease in marginal costs. Interestingly, it is found that unit prices do not decrease proportionately, and markups increase in response to increased Chinese import competition. A 10 percentage point increase in Chinese import competition implies a decrease in marginal costs by almost 8.3 percent (column 6), increase in markups by 4.6 percent (column 9) and decrease in prices by only 3.7 percent (column 3). Finally, consistent with the results on marginal costs, the firm level estimates suggest that there was a significant increase in TFPQ in response to Chinese import competition. A 10 percentage point increase in Chinese import competition increases productivity by 12 percent (column 12). The findings are consistent with Brandt et. al. (2017), who find significant increase in firm level revenue productivity from reduction in output tariffs in China. The results suggest that Chinese import competition increases industry level efficiency by inducing within firm-product reduction in marginal costs and increase in within-firm productivity.

These results are indicative of incomplete passthrough of cost savings to prices by firms. Import competition can affect markups through two main channels. First, pro-competitive effects put downward pressure on prices and decrease the markups of firms with market power. Secondly, firms may reduce their marginal costs of production in response to import competition and imperfect passthrough of cost savings to prices will raise markups where the magnitude

of this change depends on the rate of passthrough. The results suggest that the markup increase due to incomplete passthrough is large enough to offset the pro-competitive effect on markups, leading to increase in markups overall and only a modest decrease in prices.

Consistent with the findings in the literature, it is found that significant reduction in marginal costs and increase in firm level productivity from increased access to Chinese intermediate inputs. Again, the study finds that firms increase their markups and there is very low passthrough of cost savings to prices. The coefficients imply that Chinese intermediate inputs resulted in reduction in marginal costs by 30.5 percent and increase in markups by 26 percent. The coefficient on prices is insignificant in all specifications. DLGKP find that during the tariff liberalization, input tariff reduction led to decrease in marginal costs by around 28 percent and increase in markups by around 19 percent. Brandt et. al. (2017) also find that Chinese firms only pass half of cost savings from lower input tariffs to prices.

Taken together, these results imply that passthrough of costs to prices play an important role in determining the distribution of gains from import competition and access to imported inputs between producers and consumers. In the present case, it is found that Chinese import competition and intermediate inputs resulted in large efficiency gains for producers and incomplete passthrough implied that most of this gain was captured by the producers with only modest reduction in output prices.

Mechanism: Distance to Technology Frontier

In this section, the mechanism driving the efficiency gains from increase Chinese imports is explored. Following Aghion et. al. (2005) and Aghion et. al. (2009), the analysis allows for the relationship between import competition from China and efficiency to be moderated by the distance from the technology frontier. 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. Thus, the relationship between import competition and productivity is non-monotonic, with firms above a cutoff productivity level innovating while firms below this cut-off are discouraged from innovating.

The distance from domestic frontier of a firm-product-year observation is defined as:

$$PF_{ipt} = \frac{min_{i\epsilon pt}(cost_{ipt})}{cost_{ipt}}$$

where PF_{ipt} denotes proximity to the domestic technology frontier and takes on value of 1 for firm-products at the domestic technology frontier, i.e., firm-products having lowest marginal cost within each product category. Similarly, the firm level distance from the technology frontier based on firm level productivity is defined as:

$$PF_{ijt} = \frac{TFPQ_{ijt}}{max_{i\epsilon jt}(TFPQ_{ijt})}$$

where PF_{ijt} is 1 for the firm with the highest productivity in the industry.

To test for heterogeneity based on proximity to the technology frontier, the analysis includes an interaction of $DComp_{j(p)t}^{China,IND}$ and PF_{ijt} to the baseline specification. **Table 2.2** reports the results. It is found that firm-products closer to the technology frontier differentially reduce marginal costs and increase markups. At the firm level, firms closer to the technology frontier differentially increase productivity. Thus, the overall effect on marginal costs, markups and productivity is mainly driven by initially low (high) marginal costs (productivity) firm-products (firms). Contrary to predictions from proximity to frontier models, the coefficient on $DComp_{j(p)t}^{China,IND}$ is negative (positive) and significant in column 2 (column 4) suggesting firm-products (firms) with initially high (low) marginal costs (productivity) also experience efficiency gains from Chinese import competition. Thus, the discouragement effect on innovation for firms away from the frontier is absent in this case. Two reasons are put forward for this. First, the Prowess data comprises primarily of medium and large sized firms and

hence, the sample may consist of firms which have higher initial productivity 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 induce increased managerial effort, especially for low productivity firms who are faced with bankruptcy risk (Chen, 2019). Chen and Steinwender (2019) find that for Spanish firms, this effect is driven by initially low productivity family managed firms. The subsequent sections provide suggestive evidence that alleviation of agency issues within firms are a major factor driving efficiency gains in response to import competition.

The result on markups in column 3 implies that the overall increase in markups that are found in the baseline results are driven by initially high productivity firms. The interaction term is positive and statistically significant and the magnitudes suggests firms closer to the technology frontier differentially increase markups compared to firms away from the technology frontier. These results imply that import competition overall leads to an increase in markup dispersion among domestic producers, as overall markup increases is driven by increase in markups of initially high productivity, high markup firms. The net effect of Chinese import competition then seems to be an equilibrium with higher aggregate productivity but with higher aggregate markups and higher markup dispersion.

Recent studies find large pro-competitive effects from trade liberalization. Edmond et. al. (2015) use a quantitative trade model with oligopolistic competition and find that increased import competition in Taiwan reduces markup distortions by almost one-half thus significantly reducing the loss of productivity from misallocation of resources. The findings here do not imply that pro-competitive effects are absent. Rather, highlight the importance of efficiency gains and associated passthrough of cost savings to prices in masking this effect and in this case overturning it. Thus, import competition may or may not reduce aggregate markups and improve resource allocation among domestic producers. These results also suggest the need to study the various channels by which competition affects productivity and markups together, as these channels interact in important ways which has implications for competitive gains from trade. These results also suggest that firm-product level data on prices is crucial to study the net effect of import competition on efficiency, markups and markup

dispersion or allocative inefficiency. In absence of firm-product level prices, estimation of revenue based production function does not enable identification of physical efficiency and markups as firm level price heterogeneity induces bias in the estimated production function coefficients.

The coefficient on $DInputs_{j(p)t}^{China,IND}$ and its interaction with PF in columns 2 and 4 imply that the efficiency gains from access to Chinese intermediate inputs is decreasing in the proximity to technology frontier. One possible explanation is that unproductive firms may not have had access to imported inputs and increase in access to cheaper Chinese inputs resulted in large cost savings. The most productive firms may have already been using high quality imported intermediate inputs and hence the cost savings are lower. The effect on prices and markups in columns 1 and 3 suggest that initially low productivity firms differentially increase markups and there is limited passthrough resulting in insignificant effects on prices. As this effect is decreasing in initial firm productivity (and initial markups), access to Chinese inputs increases aggregate markups but leads to reduction in markup dispersion.

In sum, the overall effect of Chinese imports, through increased competition and access to inputs, is to unambiguously increase markups for all firms. Chinese import competition results in increase of markups for initially high productivity firms while access to Chinese imported inputs increases markups for low productivity firms. These results again highlight the importance for studying the various channels by which trade affects markups together.

Reallocation of Resources and Output and Dynamic Gains from Trade

This section examines the reallocation of resources and output toward the high productive firms. Results from estimating the baseline specification with materials, compensation, capital, capital intensity and research and development (R&D) expenditure as the outcome variable are reported in **Table 2.3**. In columns 1, 3, and 5, it is found that Chinese import competition had no significant impact on factor input usage. Columns 2, 4, and 6, do not find significant heterogeneity in factor input usage based on initial productivity. It is found that firms increase capital intensity (column 7) and R&D expenditure (column 9) in response to Chinese import competition. However, no evidence

is found of significant heterogeneity based on initial productivity for capital intensity as well as R&D expenditure.

Table 2.4 report results from estimating the baseline specifications with total sales (columns 1 and 2), exports (columns 3 and 4), domestic sales (columns 5 and 6) and product scope (columns 7 and 8) as the outcome variable. Columns 1, 3, and 5, show that Chinese import competition results in reduced total sales for firms and this driven by drop in domestic sales while there is no significant effect on exports. No significant heterogeneous impacts based on initial productivity in columns 2, 4, and 6 is found. It is also found that access to Chinese inputs results in higher total sales for the firm and this is again driven by increase in domestic sales while the coefficient is positive but insignificant for exports as the outcome variable.

To check for dynamic gains from Chinese imports, the analysis studies their effect on log of product scope for firms. It is found that Chinese import competition leads to a negative but insignificant effect on number of products produced by a firm (column 7). However, the overall effect masks considerable heterogeneity based on initial productivity. It is found that initially low productivity firms reduced product scope while initially high productivity firms increased their product scope (column 8). It is also found that evidence of dynamic gains from access to Chinese inputs. Overall it is found that positive effect on product scope from access to Chinese inputs driven by initially low productivity firms.

Mechanisms for Efficiency Gains from Chinese Import Competition: Agency Issues

This section explores the mechanisms driving efficiency gains in response to Chinese import competition. Heterogeneous response based on firm level managerial compensation share and Hindu Undivided Family (HUF) ownership share is studied here.

Table 2.5 reports results for heterogeneity based on managerial compensation. It is found that the interaction term is positive but insignificant in column 2 with marginal costs as the outcome variable. The coefficient on the interaction term is also insignificant for unit values (column 1) and markups (column 3). At the

firm level, significant heterogeneity based on initial managerial compensation for the firm is found. The interaction term is negative and significant suggesting that there was higher productivity increase for firms with initially low share of managerial compensation in total compensation.

Table 2.6 reports results from for heterogeneity based on HUF share. Three indicator variables are defined to measure the share of firm ownership held by HUF. The first indicator variable takes a value of 1 if the firm has positive HUF ownership (columns 1,4,7, and 10). The second indicator variable takes a value of 1 if HUF ownership is greater than 0.3 and 0 otherwise (columns 2,5,8, and 11). In columns 3,6,9, and 12, the indicator variable takes a value of 1 if HUF ownership is greater than 0.5 and 0 otherwise. The results suggest that the effects on unit value, marginal cost, markups and TFPQ are differentially greater for family owned firms.

Next, heterogeneity based on type of ownership for firms is tested. Firms are categorized into Business Groups (BG), Foreign Owned (FO), Government Owned (GO) and Private Indian (PI). Of particular interest is the differential impact of Chinese import competition on BG firms compared to standalone PI firms. BG firms may perform better than standalone firms due to access to internal capital markets and other resources, especially in developing economies with underdeveloped capital markets (Khanna and Yafeh, 2007). However, highly diversified BG firms may also suffer from agency issues among division managers (Rajan et. al., 2000). BG firms are also thought to wield considerable market power and this has direct bearing on the competitive gains from trade.

Table 2.7 reports the results. The results suggest that the overall effect on marginal costs for BG firms was much larger in magnitude compared to PI firms (column 2). Comparing the results for unit values (column 1) and markups (column 3), it is seen that BG and PI firms differ considerably in the rate of passthrough. BG firms have very low passthrough rates and the large reduction in marginal costs have no significant reduction in prices and lead to large increase in markups. Evidence is also found of large reductions in marginal costs for foreign owned firms while the coefficient on government owned firms is negative but insignificant (column 2). Further, it is found that the reduction

in marginal costs from access to Chinese inputs is primarily driven by PI firms. Taken together, these results imply that the overall effect on marginal costs and markups in the baseline results are primarily driven by BG firms while PI firms drive the decrease in prices by passing through most of cost savings to prices.

Next, the analysis tests for heterogeneous effects based on exporting status of the firm and industry category based on end-use and **Table 2.8** reports the results. The results suggest that there is no significant difference in marginal cost savings in response to Chinese import competition between exporters and non-exporters (column 2). However, they differ in pass-through rates and it is found that non-exporters have low pass-through rates compared to exporters. Thus, non-exporters raise markups and have no significant effect on prices while exporters reduce prices significantly with no significant increase in markups (columns 1 and 3).

Conclusion

In this chapter, the effect of Chinese import competition on prices, costs, markups and efficiency of firm-products in the case of a large developing country like India is studied. Using detailed firm-product level data on prices and production from Prowess, recent advancements in estimation of production functions to separately identify the underlying component of prices, i.e., marginal costs and markups is used.

The analysis finds evidence of incomplete passthrough of cost savings to prices, both cross-sectionally and over time. The increase in markups from cost savings dominates the direct reduction in markups of firms from increased competition, implying only a modest decrease in prices. The findings highlight the need to study efficiency and markup effects of trade together in presence of incomplete passthrough of costs to prices. In presence of incomplete passthrough, the effect of competition on markups is ambiguous.

Table 2.1: Chinese Competition and Firm Performance

	Firm Product									Firm		
	Unit Price			Marginal Cost			Markups			TFPQ		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$DComp_{j(p)t}^{China,IND}$	-0.368*	-0.361*	-0.368*				0.512**	0.466*	0.460*			
	(0.205)	(0.192)	(0.193)	(0.091)	(0.114)	(0.114)	(0.219)	(0.265)	(0.265)	(0.388)	(0.387)	(0.388)
$DInputs_{j(p)t}^{China,IND}$		-0.906	-1.005					6.123*	5.948*		11.44**	11.42**
		(3.398)	(3.175)		(2.387)	(2.386)		(3.321)	(3.058)		(4.403)	(4.435)
$FComp_{j(p)t}^{China,US}$	-0.050	-0.053	-0.008	0.065	0.040	0.033	-0.114	-0.093	-0.042	0.826*	0.815*	0.814*
	(0.181)	(0.181)	(0.178)	(0.355)	(0.358)	(0.361)	(0.331)	(0.328)	(0.321)	(0.465)	(0.448)	(0.451)
Output Tariff			0.111			0.204			-0.093			-0.621
			(0.395)			(0.223)			(0.450)			(0.533)
Input Tariff						-0.087						0.699
			(0.196)			(0.323)			(0.274)			(0.508)

	Firm Product									Firm		
	Unit Price			Marginal Cost			Markups			TFPQ		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Instrumental Variables for:												
DComp_j(p)t^China,IND	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DInputs_j(p)t^China, IND	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Firm-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-
Firm FE	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
3-digit-industry (firm-product) × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-
3-digit-industry (firm) × Year FE	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
Observations	60,108	60,108	60,108	60,108	60,108	60,108	60,108	60,108	60,108	30,603	30,603	30,603
R-squared	0.977	0.977	0.977	0.947	0.947	0.947	0.810	0.810	0.810	0.756	0.756	0.756

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.2: Chinese Competition and Firm Performance: Heterogeneity Based on Distance to Technology Frontier

	Firm Product			Firm
	Unit	Marginal		
	Value	Cost	Markups	TFPQ
	(1)	(2)	(3)	(4)
$DComp_{j(p)t}^{China,IND}$	-0.343	-0.746***	0.403	0.790**
	(0.225)	(0.137)	(0.298)	(0.386)
$DComp_{j(p)t}^{China,IND}$ x PF	-0.169	-1.502**	1.333**	4.755**
	(0.327)	(0.610)	(0.636)	(1.985)
$DInputs_{j(p)t}^{China,IND}$	-1.365	-8.385***	7.019**	14.25**
	(3.635)	(2.846)	(3.027)	(5.785)
$DInputs_{j(p)t}^{China,IND}$ x PF	4.793*	13.63*	-8.835	-29.08***
	(2.766)	(7.649)	(6.748)	(9.499)
$FComp_{j(p)t}^{China,US}$	-0.008	-0.293	0.285	1.747***
	(0.200)	(0.356)	(0.336)	(0.587)
$FComp_{j(p)t}^{China,US}$ x PF	-0.440	5.177***	-5.617***	-5.347***
	(0.488)	(1.500)	(1.468)	(1.516)
Firm-Product FE	Yes	Yes	Yes	-
Firm FE	-	-	-	Yes
3-digit-industry (firm-product) Year FE	Yes	Yes	Yes	-
3-digit-industry (firm) Year FE	-	-	-	Yes
Observations	60,108	60,108	60,108	30,603
R-squared	0.977	0.947	0.811	0.758

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.3: Chinese Competition and Firm Performance: Factor Inputs and Technology Adoption

	Firm									
	Materials		Compensation		Capital		Capital Intensity		R&D	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$DComp_{j(p)t}^{China,IND}$	-0.466	-0.434	-0.126	-0.145	0.162	0.120	0.288**	0.265**	0.844**	0.787**
	(0.307)	(0.315)	(0.166)	(0.137)	(0.130)	(0.137)	(0.115)	(0.113)	(0.388)	(0.343)
$DComp_{j(p)t}^{China,IND}$ x PF		-0.252		0.215		0.559		0.344		0.556
		(1.257)		(0.917)		(0.874)		(0.867)		(2.237)
$DInputs_{j(p)t}^{China,IND}$	-2.546	-3.130	1.702	2.165	0.170	0.644	-1.532	-1.520	3.300	3.624
	(4.428)	(4.519)	(2.570)	(2.535)	(2.412)	(2.381)	(2.748)	(2.751)	(6.261)	(6.342)
$DInputs_{j(p)t}^{China,IND}$ x PF		5.002		-4.071		-4.681		-0.610		-2.561
		(5.377)		(3.163)		(3.652)		(3.073)		(11.74)
$FComp_{j(p)t}^{China,US}$	-0.411	-0.500	-0.142	-0.264	-0.052	-0.188	0.090	0.076	-0.349	-0.592
	(0.455)	(0.528)	(0.313)	(0.337)	(0.260)	(0.306)	(0.240)	(0.258)	(0.844)	(0.915)
$FComp_{j(p)t}^{China,US}$ x PF		0.515		0.591		0.638		0.047		1.499
		(1.084)		(0.575)		(0.588)		(0.495)		(1.902)

	Firm									
	Materials		Compensation		Capital		Capital Intensity		R&D	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-digit-industry (firm) x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30,603	30,603	30,603	30,603	30,603	30,603	30,603	30,603	7,358	7,358
R-squared	0.877	0.877	0.952	0.952	0.958	0.958	0.880	0.880	0.868	0.869

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.4: Chinese Competition and Firm Performance: Sales and Product Scope

	Firm							
	Total Sales		Exports		Domestic Sales		Product Scope	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DComp_{j(p)t}^{China,IND}$	-0.400*	-0.404**	-0.291	-0.588*	-0.402*	-0.375**	-0.100	-0.189*
	(0.222)	(0.196)	(0.371)	(0.330)	(0.213)	(0.180)	(0.117)	(0.100)
$DComp_{j(p)t}^{China,IND}$ x PF		-0.016		5.299		-0.442		1.087**
		(1.094)		(3.850)		(1.115)		(0.457)
$DInputs_{j(p)t}^{China,IND}$	5.614*	5.765*	5.539	5.675	6.217**	6.189**	2.950*	3.404*
	(3.018)	(3.035)	(5.577)	(5.546)	(2.881)	(2.896)	(1.603)	(1.720)
$DInputs_{j(p)t}^{China,IND}$ x PF		-1.152		-10.05		0.942		-5.170**
		(3.827)		(11.55)		(3.914)		(2.131)
$FComp_{j(p)t}^{China,US}$	-0.033	0.025	-0.290	0.064	-0.030	0.050	-0.258	-0.099
	(0.376)	(0.426)	(0.947)	(1.013)	(0.340)	(0.379)	(0.222)	(0.241)
$FComp_{j(p)t}^{China,US}$ x PF		-0.311		-2.288		-0.381		-0.930**
		(0.745)		(1.972)		(0.741)		(0.374)

	Firm							
	Total Sales		Exports		Domestic Sales		Product Scope	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-digit-industry (firm) x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30,603	30,603	17,214	17,214	30,538	30,538	30,603	30,603
R-squared	0.924	0.924	0.826	0.826	0.918	0.918	0.857	0.857

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.5: Heterogeneity Based on Managerial Compensation

	Firm Product			Firm
	Unit	Marginal		
	Value	Cost	Markups	TFPQ
	(1)	(2)	(3)	(4)
$DComp_{j(p)t}^{China,IND}$	-0.397*	-0.900***	0.503*	1.323***
	(0.202)	(0.112)	(0.266)	(0.412)
$DComp_{j(p)t}^{China,IND}$ x $MComp$	0.911	1.618	-0.706	-3.141**
	(0.749)	(1.029)	(0.718)	(1.399)
$DInputs_{j(p)t}^{China,IND}$	-0.939	-7.067***	6.128*	11.340**
	(3.392)	(2.377)	(3.333)	(4.383)
$DInputs_{j(p)t}^{China,IND}$ x $MComp$	-0.731	0.677	-1.408	0.523
	(8.088)	(11.23)	(11.42)	(14.21)
$FComp_{j(p)t}^{China,US}$	-0.086	-0.012	-0.075	0.799*
	(0.171)	(0.360)	(0.331)	(0.458)
$FComp_{j(p)t}^{China,US}$ x $MComp$	2.453	3.789	-1.336	1.135
	(2.892)	(3.928)	(3.679)	(5.013)
Firm-Product FE	Yes	Yes	Yes	-
Firm FE	-	-	-	Yes
3-digit-industry (firm-product) x Year FE	Yes	Yes	Yes	-
3-digit-industry (firm) x Year FE	-	-	-	Yes
Observations	59,995	59,995	59,995	30,603
R-squared	0.977	0.946	0.810	0.756

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.6: Heterogeneity Based on Family Ownership

	Firm Product									Firm		
	Unit Price			Marginal Cost			Markups			TFPQ		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$DComp_{j(p)t}^{China,IND}$ x $HUF\ Share = 0$	-0.293						0.399			0.468		
	(0.188)			(0.136)			(0.243)			(0.781)		
$DComp_{j(p)t}^{China,IND}$ x $HUF\ Share > 0$	-0.431*						0.568*					
	(0.223)			(0.149)			(0.297)			(0.423)		
$DComp_{j(p)t}^{China,IND}$ x $HUF\ Share < 0.3$		-0.358						0.301			0.916	
		(0.232)			(0.124)			(0.252)			(0.628)	
$DComp_{j(p)t}^{China,IND}$ x $HUF\ Share > 0.3$												
		(0.165)			(0.232)			(0.261)			(0.458)	
$DComp_{j(p)t}^{China,IND}$ x $HUF\ Share < 0.5$			-0.369*						0.453			1.143**
			(0.202)			(0.117)			(0.277)			(0.455)

	Firm Product									Firm		
	Unit Price			Marginal Cost			Markups			TFPQ		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$DComp_{j(p)t}^{China,IND}$ x $HUF\ Share > 0.5$			-0.294*									
			(0.175)			(0.184)			(0.245)			(0.439)
Firm-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-
Firm FE	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
3-digit-industry (firm-product) x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-
3-digit-industry (firm) x Year FE	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
Observations	60,108	60,108	60,108	60,108	60,108	60,108	60,108	60,108	60,108	30,603	30,603	30,603
R-squared	0.977	0.977	0.977	0.947	0.947	0.947	0.810	0.810	0.810	0.756	0.756	0.756

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.7: Heterogeneity Based on Ownership

	Firm Product			Firm
	Unit	Marginal		
	Value	Cost	Markups	TFPQ
	(1)	(2)	(3)	(4)
$DComp_{j(p)t}^{China,IND}$ x BG	-0.271	-1.854***	1.583***	0.702
	(0.228)	(0.443)	(0.593)	(1.985)
$DComp_{j(p)t}^{China,IND}$ x FO	-0.044	-1.027**	0.983	3.506***
	(0.370)	(0.479)	(0.607)	(1.212)
$DComp_{j(p)t}^{China,IND}$ x GO	-0.776	-1.649	0.873	1.971
	(0.556)	(1.218)	(0.970)	(2.941)
$DComp_{j(p)t}^{China,IND}$ x PI	-0.484***	-0.735**	0.251	2.456***
	(0.147)	(0.306)	(0.401)	(0.751)
$DInputs_{j(p)t}^{China,IND}$ x BG	2.321	-0.535	2.857	18.56**
	(2.405)	(3.655)	(4.969)	(7.317)
$DInputs_{j(p)t}^{China,IND}$ x FO	0.314	-7.902	8.216	9.468
	(3.482)	(4.872)	(6.154)	(7.694)
$DInputs_{j(p)t}^{China,IND}$ x GO	5.294	0.258	5.036	11.02
	(3.227)	(6.105)	(5.609)	(9.560)
$DInputs_{j(p)t}^{China,IND}$ x PI	2.000	-6.501*	8.500*	6.117
	(2.482)	(3.588)	(4.810)	(5.580)
$FComp_{j(p)t}^{China,US}$ x BG	-0.187	0.068	-0.255	-0.674
	(0.285)	(0.463)	(0.420)	(0.657)
$FComp_{j(p)t}^{China,US}$ x FO	-0.203	-0.970	0.766	1.812**
	(0.497)	(1.159)	(1.093)	(0.797)

	Firm Product			Firm
	Unit	Marginal		
	Value	Cost	Markups	TFPQ
	(1)	(2)	(3)	(4)
$FComp_{j(p)t}^{China,US}$ x GO	-0.191	0.779	-0.970	2.531
	(0.481)	(1.287)	(1.155)	(2.198)
$FComp_{j(p)t}^{China,US}$ x PI	0.367	0.533	-0.165	1.370
	(0.271)	(0.485)	(0.479)	(1.047)
Firm-Product FE	Yes	Yes	Yes	-
Firm FE	-	-	-	Yes
3-digit-industry (firm-product) x Year FE	Yes	Yes	Yes	-
3-digit-industry (firm) x Year FE	-	-	-	Yes
Observations	53,336	53,336	53,336	27,870
R-squared	0.978	0.948	0.809	0.757

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 2.8: Heterogeneity Based on Exporting Status and End-use

	Firm Product			Firm	Firm Product			Firm
	Unit	Marginal			Unit	Marginal		
	Value	Cost	Markup	TFPQ	Value	Cost	Markup	TFPQ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DComp_{j(p)t}^{China,IND}$ x $Non-exporter$	-0.134		0.643**	1.366**				
	(0.218)	(0.186)	(0.297)	(0.612)				
$DComp_{j(p)t}^{China,IND}$ x $exporter$	-0.365*		0.455	1.054**				
	(0.185)	(0.130)	(0.273)	(0.438)				
$DComp_{j(p)t}^{China,IND}$ x $Intermediate\ Goods$					-0.204*		0.585**	1.097**
					(0.115)	(0.139)	(0.228)	(0.431)
$DComp_{j(p)t}^{China,IND}$ x $Final\ Goods$					-2.718	-1.387	-1.331	1.005**
					(2.348)	(1.481)	(0.973)	(0.486)
Firm-Product FE	Yes	Yes	Yes	-	Yes	Yes	Yes	-
Firm FE	-	-	-	Yes	-	-	-	Yes
3-digit-industry (firm-product) x Year FE	Yes	Yes	Yes	-	Yes	Yes	Yes	-
3-digit-industry (firm) x Year FE	-	-	-	Yes	-	-	-	Yes
Observations	58,818	58,818	58,818	29,829	58,818	58,818	58,818	29,829
R-squared	0.977	0.946	0.811	0.756	0.977	0.946	0.811	0.756

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

3. CHINESE IMPORT COMPETITION AND CONTRACT LABOR

The increased usage of workers on short-term contracts is a global phenomenon. This trend has been attributed to stringent employment protection legislations for permanent workers (Autor, 2003; Chaurey, 2015), the need for workers with specialized skills that are otherwise unavailable in the regular pool (Abraham and Taylor, 1996), and the usefulness of contract-employment as a screening device (Engellandt and Riphahn, 2005). While globalization has often been posited as an important reason for the increase in contract employment, the causal relationship between trade and contract work remains relatively unexplored. The goal in this chapter is to examine the causal link between import competition and the rise in contract employment.

India is an ideal setting for exploring this question as the Indian manufacturing sector underwent a significant change in the composition of its formal workforce, with firms substituting away permanent workers and employing more contract workers. The share of contract workers in total employment has increased substantially from around 12% in 1998 to over 30% in 2007, implying a compounded annual growth rate (CAGR) of 6.8%. Simultaneously, India also experienced a significant rise in Chinese imports. Chinese imports share in total imports rose exponentially between 1998 and 2007, with Chinese imports increasing by over 16 times compared to imports from other developing and high income countries which only doubled during the same period. By 2007, Chinese imports accounted for a substantial 18 percent of all manufacturing imports in to India, which is considerably higher than the Chinese import share in developed and other developing countries (see **Figure 3**).

The analysis studies if these two contemporaneous phenomena- that is the rise of contract labor and the rise of Chinese imports- are causally related. If firms seek short term cost savings in response to import competition, they are likely to employ contract workers rather than regular workers because contract workers are paid relatively lower wages, and have lower firing costs as compared to permanent workers (Chaurey, 2015). Further, firms in India interchangeably use contract and regular workers for performing tasks with similar complexities, making contract and regular workers imperfect substitutes.

The hypothesized causal mechanism linking Chinese import competition to contract employment is based on two observations. The first relates to recent heterogeneous firm trade models which predict intra-industry reallocation of output towards the most productive firms in response to increased import competition (Melitz, 2018). Further, studies find strong within industry reallocation of factor inputs towards high productivity firms in response to import competition (Bloom et. al., 2016; Bernard et. al., 2006). Second, there is increased evidence of substantial heterogeneity in union bargaining across firms within industries, with high rent firms which are larger and more productive facing stronger unions (Breda, 2015). Thus, the overall strength of unions facing a firm depends not only on labor institutions related to unions in the economy but also on its productivity

It is hypothesized that Chinese import competition increases contract employment through a within firm (cost saving) and a between (composition) firm channel. In the within firm channel, Chinese import competition leads all firms to seek short term cost savings and they increase contract share in employment because contract workers are cheaper. In addition, high productivity firms facing stronger unions differentially increase their contract share in employment to counter the bargaining power of regular workers in response to Chinese import competition. It is expected that this effect will be stronger in states with regulations that lead to stronger unionization. Further, it is hypothesized that Chinese import competition shifts output and resources toward high productivity and high contract share employment firms, thus, increasing aggregate contract employment share in the industry through a between firm composition effect. The reallocation effects also feeds into the

within effect as it leads initially productive firms to increase their contract share of employment as they face stronger firm level unions as they become larger.

The manufacturing sector plant level data from the Annual Survey of Industries is combined with trade flow data from the UN COMTRADE database between the years 1998 and 2007. Variation in domestic competition is exploited in narrowly defined industries (four-digit level) over time, induced by the inflow of imports from China. The outcome of interest is firm level contract employment and its share to the total employment. The main explanatory variable in the analysis is the Chinese import penetration ratio at the four-digit industry level, defined as ratio of Chinese imports to the initial size of the industry in 1994.

In general, studying the relationship between import competition and employment is challenging because demand-side factors in the importing country and technology shocks may simultaneously drive import flows and employment. However, in this setting, the analysis exploits the rise in Chinese imports that were primarily due to improvements in manufacturing productivity driven by internal reforms in China, and that were unlikely due to other factors arising due to technological or demand shocks. Among other things, these internal reforms enabled the setting up of special economic zones where foreign firms could operate free from government interference (Alder et. al., 2013), facilitated technology transfers from substantial inflows in foreign direct investments (Autor et. al., 2016), and from multinational activity (Naughton, 2007), and promoted the mass migration of workers from rural to urban areas (Chen et. al., 2010). Complementing these reforms, China's accession to the WTO in 2001 provided further boost to its exports because it was accorded the most favored nation status by WTO members (Branstetter and Lardy, 2006).

To address any remaining endogeneity concerns, an instrumental variables strategy that uses Chinese imports to other developing countries as an instrument for Chinese imports into India is employed. The set of developing countries that are considered for constructing the instrumental variable are Brazil, Indonesia, Malaysia, and Mexico. To overcome concerns regarding these countries being major trade partners with India, robustness is shown by constructing an alternate instrument based on a set of Latin American countries.

The instrumental variables estimate isolates the variation in Chinese imports into India driven by supply side shocks from China. All the specifications control for output and input tariffs, access to Chinese imported inputs for each industry and other potential trade channels like Chinese import share in foreign markets, import competition into India from other developing countries and Chinese exports as a share of total exports from India. The specifications also include establishment fixed effects, industry- and state- specific year fixed effects.

Firm level instrumental variables estimation results indicate that a 10 percentage point increase in import competition induces a 1.9 percent increase in contract worker employment and increases contract worker ratio by 0.004. In the sample a sizable number of firms have no contract employment. Once the sample is restricted to firms employing contract workers, the estimates imply an increased change in contract employment of 7.46 percent. No significant impact on the hiring of regular workers is found.

To understand aggregate implications for contract worker employment due to Chinese import competition, an industry level regression of the same specification is estimated. A 10 percentage point increase in Chinese import competition increases contract employment by 9.69 percent, and increases contract worker ratio by 1.63 percentage points. A counterfactual analysis based on the industry level regressions indicates that in absence of the increase in Chinese import competition, there would have been 92,000 fewer contract workers in 2007, as compared to the observed data. This figure implies that Chinese import competition accounted for a sizable 9 percent of the overall change in contract worker employment between 1998 and 2007.

Consistent with the hypotheses, the productivity-based heterogeneity analysis indicates that factor inputs (workers) are reallocated from low to high productivity firms. Further, the within firm increase in contract share in employment is driven primarily by the initially high productive firms. The analysis also finds evidence that this effect is larger in states with stronger unions. These results are consistent with firms employing contract workers primarily to cut costs and counter bargaining power of regular workers in response to import competition.

Two contributions to the literature are made. First, contribution is to the set of studies that examine the determinants of contract labor usage. Prior studies have focused on role of rigid employment protection laws by themselves (Autor, 2003), or in combination with transitory positive demand shocks for firms (Chaurey, 2015). Second, contribution is to the recent literature studying the employment effects of Chinese import competition (Autor et. al., 2013, Autor et. al, 2014, Acemoglu et. al., 2016). While these papers focus on employment changes in response to Chinese import competition, this study analyses the effects on changes in workforce composition.

The rest of the chapter is organized as follows. Section 3.1 presents the data sources and stylized facts. Section 3.2 presents the empirical strategy and results. Section 3.3 concludes the chapter.

3.1 Data Sources and Stylized Facts

Data Sources

The primary source for establishment-level data is the Annual Survey of Industries (ASI) conducted by the Industrial Statistics (IS) wing of the Central Statistical Office (CSO), Government of India. The ASI does not provide identifiers for firms, but only their constituent individual establishments/plants. It covers all registered establishments in the country with 100 or more workers, and randomly samples establishments with less than 100 workers. The ASI panel dataset from 1998-1999 to 2007-2008 is used for this study. 1998 is the first year for which ASI is available with an establishment identifier. The sample is restricted to 2007-2008 to avoid the potentially confounding effects of the financial crisis on the relation between Chinese imports and contract worker employment. Industries are classified as per the National Industries Classification-2004 (henceforth, NIC-2004), which has a one-to-one correspondence with International Standard Industrial Classification (ISIC) revision 3.1 at the 4 digit level.

The ASI is well suited for this study as it captures detailed information on employment, wages, inputs usage, and production at manufacturing establishments. Most importantly for this analysis, it reports data on the number of workers that are directly employed by the establishments (regular workers),

and separately the workers employed temporarily through a contractor (contract workers). Further, the ASI also reports data on mandays employed in manufacturing and non-manufacturing activities by both regular and contract workers.

The primary source of trade data is the UN-COMTRADE database. This database provides import and export data at the product level (Harmonized System 6-digit level classification). To construct the key variables at the industry level, these HS classifications are mapped into four-digit industry classification based on the NIC-2004 definitions. From this database, data on Chinese imports to India is compiled, to a set of developing countries, and to the United States. Total imports to India and to the US, and total exports from India are also compiled.

Trade data from UN-COMTRADE is complemented with several additional data sources. To construct the import competition measure, the baseline production data in India is also required. For this, both formal sector output from the ASI in the year 1994, and informal sector output from the survey of unorganized manufacturing enterprises conducted by National Sample Survey Organization (NSSO) in the year 1995 is used. The state level measure of strength of regulations related to unions from the OECD survey is used. This index captures state level differences in regulations related to different aspects of union representation (Dougherty, 2009). The OECD survey codes states based on labor law reforms relating to restrictions on the minimum number of workers in an union, recognition of unions as bargaining agents, provisions for union formation in an enterprise, rules related to strikes, and code of conduct between employers and unions. The data on union participation by workers from the employment-unemployment survey to create a measure of union participation rates at the state-industry level is also used.

Stylized Facts

In this section, the characteristics of firms based on whether they employ contract workers and also report the sector level differences in overall trends in employment and Chinese import penetration during the sample period, 1998-2007 are compared. **Table 3.1** reports summary statistics for key variables for firms with no contract worker employment (Panel A) and firms with positive

contract worker employment (Panel B). Firms employing contract workers on average have higher revenue from sales, higher gross value added, higher employment of production workers and lower ratio of capital to gross value added. Firms employing contract workers have very similar labor productivity on average compared to firms with no contract workers.

Next, sector wise trend in employment by type of worker and Chinese import penetration during 1998-2007 is reported in **Table 3.2**. All sectors except Tobacco, Apparel and Leather products saw an increase in Chinese import penetration during 1998-2007 (column 1). The largest increase in Chinese import penetration was in Communications equipment and Fabricated metal products sectors. All sectors saw an increase in overall employment except Tobacco, Basic metals, and other transport equipment (column 2). Interesting trends are found in overall employment by type of worker. The overall employment for regular workers decreased during 1998-2007 for 7 sectors (column 3) while contract worker employment increases for all sectors except Basic metals (column 4). Also, for sectors where both regular and contract employment increased, changes in contract worker employment were generally much higher compared to regular workers. Finally, all sectors experienced a rise in contract worker ratio. It is also found that generally, the sectors experiencing higher increase in Chinese import penetration also experienced larger increases in contract worker employment and contract worker ratio. Next, the analysis turns to more rigorous examination of the link between Chinese import competition and contract worker employment in the empirical analysis.

3.2 Empirical Strategy and Results

Empirical Strategy

The baseline specification to study the overall effect of Chinese imports on firm level employment is given by:

$$Y_{ijst} = \alpha_0 + \alpha_i + \alpha_{j(3),t} + \alpha_{s,t} + \beta_1 IMP_{j,t-1}^{China} + \beta_2 INP_{j,t-1}^{China} + \varepsilon_{ijst}$$

where i denotes a firm, s denotes a state, and j denotes an industry defined at the 4-digit level. Y_{ijst}, the outcome variable, could denote logarithm of contract workers, contract workers to total workers ratio, logarithm of contract

mandays in the manufacturing activities, or contract mandays to total mandays ratio in manufacturing activities. The main explanatory variable is the industry level import penetration ratio for Chinese imports, $IMP_{j,t-1}^{China}$. $IMP_{j,t-1}^{China}$. denotes Chinese import penetration on intermediate inputs to the industry. The specification includes firm, three-digit industry-year, and state-year fixed effects. Thus, within firm variation in employment is exploited while controlling for industry-year specific and state-year specific shocks that may be correlated with Chinese imports as well as employment variables.

Results

In **Table 3.3**, results from estimating the baseline specification and its variants are reported. Columns 1-3 report results for log of contract workers as the outcome variable while columns 4-6 report results for contract worker ratio as the outcome variable. In columns 1 and 4, the analysis looks at the overall effect of lagged measure of import penetration ratio from China on contract workers employment and contract worker ratio. Positive and significant effect of Chinese import competition on contract worker employment as well as contract worker ratio is found. For a 10 percentage point increase in IMP, there is a 1.9 percent increase in contract worker employment and an increase in contract worker ratio of 0.004. Columns 2 and 5, also control for the measure of access to Chinese imported inputs at the industry level. Columns 3 and 6 add both input and output tariffs as controls. The coefficient on IMP is robust to inclusion of these controls and increases slightly in magnitude and remains statistically significant.

Although the baseline specification includes firm, three-digit-industry-year fixed effects and state-year fixed effects, to alleviate further endogeneity concerns, the analysis also instruments for IMP using Chinese imports to a set of other developing countries. The results from the instrumental variables (IV) regression are reported in **Table 3.4**. The coefficient on IMP remains virtually unchanged from those in OLS estimates from **Table 3.3**, suggesting that the rich set of fixed effects were able to adequately control for time varying industry and state level technological and demand shocks that could be correlated with both Chinese imports and demand for contract workers.

The hypothesized relationship between Chinese import competition and contract employment assumes that contract workers and regular workers are imperfect substitutes in the core production process. However, firms may also employ contract workers in the non-core activities. To check if the results are not entirely driven by the hiring of contract workers in non-core activities, the availability of data on mandays in core and non-core activities is exploited separately. Specifications employing contract and regular mandays in core and non-core activities as outcome variables in the baseline specification are estimated. **Table A4** reports result from estimating the baseline specification with log of regular worker mandays (column 1), log of contract worker mandays (column 2) and contract manufacturing mandays as a share of total manufacturing mandays (column 3) as outcome variables. The coefficient on IMP in columns 2 and 3 remain statistically significant suggesting that the increase in contract mandays and the share of contract to total mandays ratio in response to Chinese import competition was being primarily driven by the mandays in the core manufacturing tasks. Further, the coefficient on IMP in column 3 is almost identical to the baseline results.

Table 3.5 reports the results from estimating the baseline specification with log of regular workers as the outcome variable. The coefficient on IMP is close to zero and insignificant. These results imply that firms adjust employment primarily through contract workers in response to Chinese import competition. **Table 3.6** presents the main results controlling for all other trade channels to and from India. The analysis controls for import competition into India from other developing countries and Chinese exports as a share of total exports from India. Finally, to control for Chinese import competition in export markets, the regressions also includes Chinese import share in other developing countries. Results remain robust after adding these controls separately (columns 1-3 and 5-7), and all of them together (columns 4 and 8). **Table A5** presents the main results after controlling for a slew of trend variables, including trends based on the age of the firm, as well as the organization and ownership type of the firm. Results remain robust to including these control variables.

Aggregate implications

To understand the implications of Chinese import competition on aggregate changes in contract workers employment, the following industry level regression specification is estimated:

$$Y_{jt} = \alpha_0 + \alpha_j + \alpha_{j(3),t} + \beta_1 IMP_{j,t-1}^{China} + \beta_2 INP_{j,t-1}^{China} + \varepsilon_{ijst}$$

where the outcome variable is either log of contract worker employment or contract worker ratio. To get a sense of what the estimates imply for overall contract workers employment in the manufacturing sector in India, a counterfactual analysis is conducted. The counterfactual is the scenario where there was no rise in Chinese imports to India. To calculate differences in contract workers employment in 2007 with and without increase in Chinese import competition between 1998-2007, this analysis follows Acemoglu et. al. (2016) and calculates the difference using the estimates from firm and industry level regressions as:

$$\Delta Y_{2007}^{counterfactual-firm} = \sum_i Y_{ij,2007}(1 - e^{-\hat{\beta}_1 \Delta \widehat{IMP}_{j,2007}})$$

$$\Delta Y_{2007}^{counterfactual-industry} = \sum_j Y_{j,2007}(1 - e^{-\hat{\beta}_1 \Delta \widehat{IMP}_{j,2007}})$$

where Y is firm or industry level contract workers employment. $\hat{\beta}_1$ is the coefficient on IMP from estimating the firm and industry level specifications, respectively. $\Delta \widehat{IMP}_{j,2007}$ is the portion of increase in Chinese import penetration between 1998-2007 that is solely due to supply side shocks in China. The analysis follows Autor et. al. (2013) and multiplies the overall change in Chinese import penetration in an industry with the partial R-squared from the first stage regressions in the firm and industry level specifications.

Table 3.7 reports results from estimating industry level regressions with log of contract workers employment (columns 1 and 2) and contract worker ratio (columns 3 and 4) as the outcome variable. Columns 1 and 3 report OLS estimates while columns 2 and 4 report results from IV estimation. The coefficient on IMP is lower in columns 1 and 3 as compared to columns 2 and 4, suggesting that OLS estimates understate the true effect of Chinese import competition on aggregate contract worker employment (by 21 percent) as well as contract worker ratio

(by 38 percent). This is in contrast to the firm level estimates where the OLS and IV estimates are very similar. For a 10 percentage point increase in IMP, the IV estimates imply an increase in contract employment by 9.69 percent (column 2) and increase in contract worker ratio by 1.63 percentage points (column 4).

Table 3.8 reports results from estimating a long differences version of specifications in columns 1-4. This is to check if the results are not being driven by employment decisions based on short term economic fluctuation in the economy due to movements around the business cycle. The coefficient on IMP remains statistically significant and similar to those in the baseline specifications.

Next, with firm and industry level estimates of coefficients on IMP in hand, a counterfactual analysis is undertaken, and the aggregate contract worker employment is calculated if there had been no increase in Chinese import competition during the sample period, 1998-2007, and it is compared with the observed contract worker employment. The analysis uses estimates of elasticity of contract employment with respect to IMP from firm level and industry level regression. The partial R squared equals 0.66 and 0.64 for first stage of firm and industry level specifications. These are used to get counterfactual contract worker employment in absence of increase in Chinese import competition. **Table 3.9** reports the observed and counterfactual contract employment figures based on estimates of coefficient on IMP from industry level regressions (column 1) and firm level regressions (column 2). The counterfactual calculations using industry level estimates suggest that in the absence of rise in Chinese import competition to India, there would have been 92,000 fewer contract workers as compared to the actual contract worker employment that are observe in 2007. This accounts for almost 9 percent of the actual change in contract workers employment during the period of this study, 1998-2007.

The implied change due to Chinese import competition are much lower in column 2 which are based on firm level estimates as most firms do not use contract workers, the average effect on firm level implies lower aggregate changes. Once the sample is restricted to consist of firms which employ contract workers at least once in this sample, a much higher coefficient on IMP (0.746) in the firm level specification is achieved and the implied change in contract workers in absence of Chinese import competition is 65602 (column 3) which is

much closer to the figure is calculated using industry level estimates of elasticity of contract employment to changes in IMP.

Testing the Mechanisms

The study then examining the causal mechanisms linking Chinese import competition to increased contract share in employment. First, reallocation of factor inputs across firms based on initial productivity is tested. For the main measure of productivity, the methodology proposed by Ackerberg et. al. (2015) is used. Results due to heterogeneity based on alternative measures like labor productivity are also reported.

It is hypothesized that firms hire contract workers as a cost saving strategy as contract workers have lower wages on average. Further, firms also face difficulties in reducing the wages of permanent workers to reduce labor input costs of production in response to higher competition. This downward rigidity in regular wages is likely to be more severe for large and productive firms as they face stronger unions. Heterogeneity based on initial productivity with contract workers and contract worker ratio as the outcome variable is checked. Initially high productive firms are expected to increase relative employment of contract workers as compared to regular workers, thus increasing the contract worker ratio in response to greater import competition from China.

The overall worker bargaining power faced by a firm would also depend on the strength of unionization at the state level. State level differences in worker bargaining power are exploited as proxied by share of workers who are members of a union and the OECD index for union related regulations. High productivity firms in states with higher worker bargaining power are expected to differentially increase contract worker employment and contract worker ratio as compared to firms in states with low worker bargaining power.

The results with log of capital and workers as the outcome variable are reported in **Table 3.10**. A strong shift of labor inputs toward initially high productive firms is reported in columns 2 and 4. For capital all coefficients are positive and it is found that firms in the top decile differentially increase their capital stock compared to low productivity firms. In **Table 3.12**, columns 1-3 report results for log of contract workers while columns 4-6 have contract worker ratio as the

outcome variable. For measure of strength of union institutions, columns 2 and 5 use the OECD index while columns 3 and 6 use the share of workers having membership of unions at the state-industry level. The coefficient on IMP is positive and significant in column 4, suggesting that low productivity firms also increase their contract worker ratio in response to Chinese import competition. In columns 1 and 4, the coefficient on the interaction term with the highest decile of initial productivity is positive and significant, implying that the initially most productive firms account for most of the change in contract employment and contract share in employment. Column 2 and 3 test for differential hiring of contract workers by high productivity firms based on strength of unionization in the broader economy. The coefficient on the triple interaction terms are positive but significant only for the top decile of the initial productivity distribution, suggesting that the high productivity firms in states with stronger unions differentially increase contract employment compared to high productive firms in states with weaker unions. Nonetheless, the effect on high productivity firms remains positive and significant even for weak union states, suggesting that intra-firm bargaining is an important driver of contract employment and this effect gets amplified in states with stronger unionization. Similar results are shown in column 5 for contract share in employment except that a positive and significant effect on the interaction term is also seen. Thus, above median initial productivity firms significantly raise their contract share in employment in states with stronger unions. Qualitatively similar results are received with the alternative measure of unionization measured as union participation rates at the state-industry level. The interaction coefficients are positive but not significant in column 3. The analysis finds positive and significant effect on the interaction with strong union states and the top decile of productivity in column 6. Taken together, these results provide support for the hypothesis that both firm level unions and regulations related to union institutions are an important motivations for firms increasing contract share in employment.

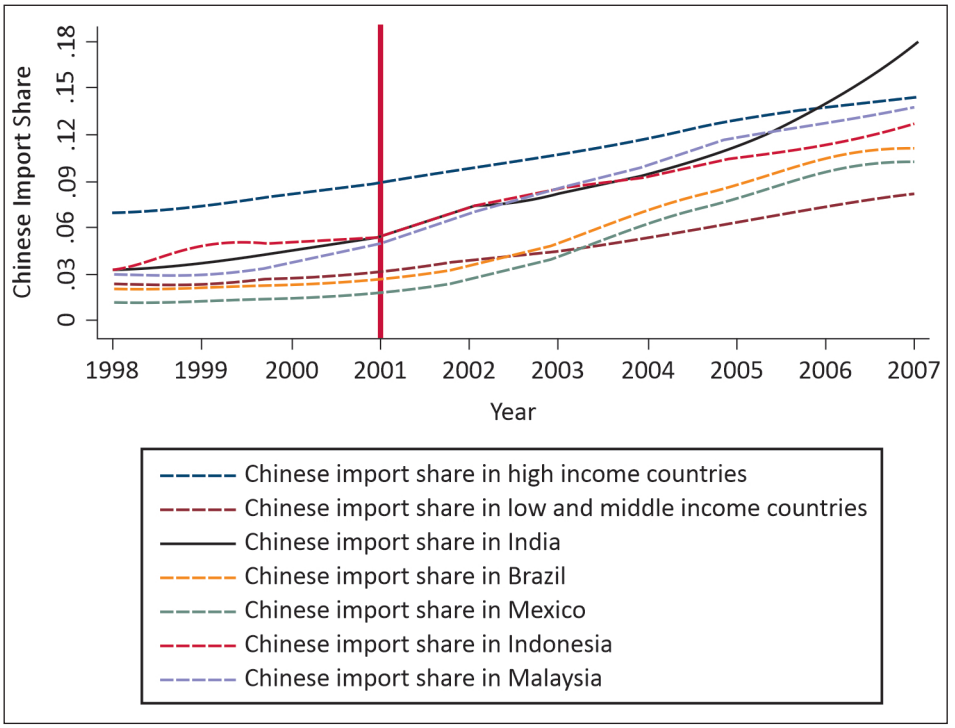
Conclusion

There has been a structural shift in the composition of manufacturing employment in India since the 1990s, with firms drastically increasing the share of workers employed on contract in their workforce. While this phenomenon has been widely acknowledged by policymakers and academicians, the causal factors driving this shift remain poorly understood. This study shows that

import competition is an important factor in driving the shift toward contract employment. It is found that import competition from China led to significant increase in contract employment. Ther causal estimates imply that Chinese import competition accounted for nearly 9 percent of contract employment increase between 1998 and 2007. Support is also found for the hypotheses that firm and state level worker bargaining power is an important driver of contract employment. The study also provides evidence of a composition effect, where contract share in employment increases as more output and resources shift toward high productive high contract share firms in response to import competition.

The findings of this study suggests that product market competition plays an important role in firms' choice to hire contract workers. Studying the effect of domestic policies and foreign direct investments which affect product market competition on contract employment is a fruitful area for future research.

Figure 3: Evolution of Chinese Import Share



Source: UN Comtrade Database

Table 3.1: Summary Statistics for Key Variables

	(1)	(2)	(3)	(4)
Variable		**Mean**	**Median**	**Std. Dev.**
Panel A: Firms with no Contract Workers				
Revenue	164939	243.64	20.19	2810.02
Gross Value Added	164939	86.78	4.75	1282.23
Production Workers	164939	106.34	18	466.73
Log of Labor Productivity	164893	13.52	13.52	1.3
Capital/Gross Value Added	163669	18.09	1.27	2657.87
Panel B: Firms with Contract Workers				
Revenue	60261	895.79	106.7	9061.07
Gross Value Added	60261	294.1	27.38	2284.75
Production Workers	60261	264.58	87	1158.74
Log of Labor Productivity	60261	13.84	13.94	1.34
Capital/Gross Value Added	59529	6.91	1.23	190.39

Table 3.2: Sector Wise Changes in Chinese Import Competition and Employment Variables

Sector Code	Sector Name	IMP	Workers	Regular Workers	Contract Workers
15	Foods Products and Beverages	0.005	153937	19668	134269
16	Tobacco Products	0	-31855	-262106	230251
17	Textiles	0.153	76394	21861	54533
18	Wearing Apparel	-0.094	285229	232337	52892
19	Leather Products	-0.063	88764	74633	14131
20	Wood and Wood Products	0.017	17553	5928	11625
21	Paper and Paper Products	0.026	82695	60207	22488
22	Publishing and Printing	0.001	9238	4560	4678
23	Coke, Refined Petroleum, Nuclear Fuel	0.171	38396	-2037	40433
24	Chemical and Chemical Products	0.054	92702	-23580	116282
25	Rubber and Plastics	0.036	85353	44317	41036
26	Non-metallic Mineral Products	0.035	77522	15734	61788
27	Basic Metals	0.082	-308553	-245673	-62880
28	Fabricated Metal Products	0.333	179158	53030	126128
29	Machinery and Equipment	0.171	32178	-41182	73360
31	Electrical Machinery and Apparatus	0.187	64899	10170	54729
32	Communication Equipment	0.381	879	-21411	22290
33	Medical, Precision and Optical Instruments	0.107	5950	1742	4208
34	Motor vehicles, Trailers and Semi-Trailers	0.004	32644	14248	18396
35	Other transport equipment	0.121	-58527	-63930	5403
36	Furniture; Manufacturing n.e.c	0.133	83697	63411	20286

Table 3.3: Chinese Imports and Contract Workers, OLS

	Log Contract Workers			Contract to Total Workers Ratio		
Chinese Import Competition (IMP)	0.194***	0.196***	0.198***	0.0408***	0.0418***	0.0416***
	(0.0537)	(0.0532)	(0.0532)	(0.00998)	(0.00988)	(0.00987)
Chinese Intermediate Inputs		3.106	3.023		0.345	0.361
		(2.666)	(2.568)		(0.501)	(0.510)
Output Tariff			-0.00180			0.000102
			(0.00284)			(0.000499)
Input Tariff			0.00124			0.000285
			(0.00201)			(0.000463)
Factory FE	Yes	Yes	Yes	Yes	Yes	Yes
3-digit Industry x year FE	Yes	Yes	Yes	Yes	Yes	Yes
State x year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	208,455	204,273	204,273	208,383	204,203	204,203
R-squared	0.784	0.784	0.781	0.781	0.765	0.765

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.4: Chinese Imports and Contract Workers, IV

	Log Contract Workers			Contract to Total Workers Ratio		
Chinese Import Competition (IMP)	0.192***	0.188***	0.188***	0.0403***	0.0404***	0.0403***
	(0.0554)	(0.0565)	(0.0565)	(0.0121)	(0.0120)	(0.0120)
Chinese Intermediate Inputs		6.089	5.983		0.836	0.906
		(4.026)	(3.798)		(0.687)	(0.693)
Output Tariff			-0.00153			0.000150
			(0.00274)			(0.000494)
Input Tariff			0.00117			0.000271
			(0.00208)			(0.000471)
Instrumental Variables for:						
Chinese Import Competition	Yes	Yes	Yes	Yes	Yes	Yes
Chinese Intermediate Inputs	No	Yes	Yes	No	Yes	Yes
Sanderson-Windmeijer (SW) first-stage F-statistics						
Chinese import competition	1887.1833	1820.26	1833.15	1880.82	1814.11	1826.94
Chinese Intermediate inputs		29.80	31.41		29.81	31.43
Factory FE	Yes	Yes	Yes	Yes	Yes	Yes
State x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
3-digit Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	208,455	204,273	204,273	208,383	204,203	204,203
R-squared	0.784	0.784	0.781	0.781	0.781	0.765

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.5: Chinese Imports and Regular Workers

	(1)	(2)	(3)
Chinese Import Competition (IMP)	0.00185	0.00330	0.00396
	(0.0175)	(0.0171)	(0.0171)
Chinese Intermediate Inputs		2.640	2.320
		(2.388)	(2.342)
Output Tariff			-0.00125
			(0.00141)
Input Tariff			-0.000588
			(0.00117)
Instrumental Variables for:			
Chinese Import Competition	Yes	Yes	Yes
Chinese Intermediate Inputs	No	Yes	Yes
Sanderson-Windmeijer (SW) first-stage F-statistics			
Chinese import competition	1887.1833	1820.26	1833.15
Chinese Intermediate inputs		29.80	31.41
Factory FE	Yes	Yes	Yes
3-digit-industry Year FE	Yes	Yes	Yes
State Year FE	Yes	Yes	Yes
Observations	208,455	204,273	204,273
R-squared	0.900	0.900	0.900

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.6: Robustness to Alternate Trade Channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log Contract Workers				Contract to Total Workers Ratio			
Chinese Import Competition (IMP)	0.164**	0.289***	0.288***	0.165*	0.0425***	0.0562***	0.0557***	0.0435***
	(0.0825)	(0.0713)	(0.0704)	(0.0836)	(0.0150)	(0.0133)	(0.0130)	(0.0154)
Chinese Intermediate Inputs	7.883	6.244	6.241	7.886	1.015	0.842	0.843	1.011
	(5.682)	(5.423)	(5.394)	(5.702)	(1.106)	(1.070)	(1.074)	(1.109)
Output Tariff		-0.000797	-0.000923	-0.0000267	0.000277	0.000208	0.000133	0.000232
	(0.00222)	(0.00253)	(0.00262)	(0.00229)	(0.000431)	(0.000452)	(0.000454)	(0.000453)
Input Tariff	0.00125	0.00114	0.00129	0.00120	0.000389	0.000359	0.000444	0.000422
	(0.00165)	(0.00179)	(0.00184)	(0.00175)	(0.000383)	(0.000426)	(0.000428)	(0.000440)
Import Competition from Developing Countries	4.198***			4.193***	0.448*			0.421*
	(1.225)			(1.204)	(0.237)			(0.234)
Chinese Import Share in Developing Countries		0.0528		0.0330		0.0191		0.0124
		(0.297)		(0.312)		(0.0970)		(0.0979)
Chinese Exports as a Share of Total Exports From India			-0.0836	0.00344			-0.0611	-0.0512
			(0.269)	(0.237)			(0.0664)	(0.0653)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log Contract Workers				Contract to Total Workers Ratio			
Instrumental Variables for:								
Chinese Import Competition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chinese Intermediate Inputs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Factory FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-digit Industry Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sanderson-Windmeijer (SW) first-stage F-statistics								
Chinese Import Competition	203.99	678.21	648.01	210.82	203.93	678.26	648.04	210.76
Chinese Intermediate Inputs	24.54	29.47	28.30	25.18	24.54	29.48	28.31	25.19
Observations	177,074	177,089	177,089	177,074	177,019	177,034	177,034	177,019

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.7: Aggregate Effects: Industry Level Regressions

	(1)	(2)	(3)	(4)
	Log Contract		Contract to	
	Workers		Total Workers Ratio	
Chinese Import Competition (IMP)	0.780***	1.064***	0.105**	0.164***
	(0.243)	(0.101)	(0.0419)	(0.0209)
Chinese Intermediate Inputs	12.35	9.553	2.531	0.387
	(10.43)	(16.37)	(1.708)	(3.530)
Output Tariff	-0.0199**	-0.0207***	-0.00123	-0.00172
	(0.00785)	(0.00668)	(0.00153)	(0.00139)
Input Tariff	0.0140**	0.0145**	0.000478	0.000749
	(0.00678)	(0.00556)	(0.000546)	(0.000632)
OLS/IV:	OLS	IV	OLS	IV
Instrumental Variables for:				
Chinese Import Competition	-	Yes	-	Yes
Chinese Intermediate Inputs	-	Yes	-	Yes
Sanderson-Windmeijer (SW) first-stage F-statistics				
Chinese Import Competition	-	496.63	-	348.73
Chinese Intermediate Inputs	-	10.87	-	7.63
Industry FE	Yes	Yes	Yes	Yes
3-digit-industry Year FE	Yes	Yes	Yes	Yes
Observations	888	619	890	890
R-squared	0.983	0.955	0.983	0.983

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.8: Long Differences: Industry Level

	(1)	(2)	(3)	(4)
	Log Contract		Contract to	
	Workers		Total Workers Ratio	
Chinese Import Competition (IMP)	1.469***	1.320***	0.159***	0.144***
	(0.533)	(0.170)	(0.0394)	(0.0121)
Chinese Intermediate Inputs	-9.395	25.32	3.398*	4.126
	(30.32)	(44.36)	(1.914)	(2.697)
Output Tariff	-0.0815	-0.0321	-0.00184	-0.000782
	(0.0572)	(0.0769)	(0.00370)	(0.00477)
Input Tariff	0.00984	-0.0332	-0.00272	-0.00366
	(0.0493)	(0.0760)	(0.00340)	(0.00446)
OLS/IV:	OLS	IV	OLS	IV
Instrumental Variables for:				
Chinese Import Competition	-	Yes	-	Yes
Chinese Intermediate Inputs	-	Yes	-	Yes
Industry FE	Yes	Yes	Yes	Yes
3-digit-industry Year FE	Yes	Yes	Yes	Yes
Sanderson-Windmeijer (SW) first-stage F-statistics				
Chinese Import Competition	-	435.70	-	439.17
Chinese Intermediate Inputs	-	26.24	-	27.53
Observations	86	86	88	88
R-squared	0.829	0.817	0.945	0.945

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.9: Counterfactual Analysis

	(1)	(2)	(3)
	Industry Level	Firm Level	
		Full Sample	Firms with
		Contract Workers	
Contract employment (1998)	679071	679071	679071
Contract employment (2007)	1714200	1714200	1714200
Total Change in contract employment (1998-2007)	1035129	1035129	1035129
Counterfactual change in contract employment (1998-2007)	943025	1016231	969527
Change due to Chinese imports (1998-2007)	92104	18898	65602
Share of Total Change in Contract Employment	8.9	1.82	6.34

Table 3.10: Reallocation of Factor Inputs Based on Initial Firm Productivity

	(1)	(2)	(3)	(4)
	DW		Labor Productivity	
	Capital	Workers	Capital	Workers
Chinese Import Competition (IMP)	0.0588	-0.0170	0.0811*	-0.133**
	(0.0751)	(0.0411)	(0.0453)	(0.0556)
IMP X TFPR(p50-p90)	0.127	0.143*	0.0142	0.240***
	(0.144)	(0.0780)	(0.0509)	(0.0738)
IMP X TFPR(p90-p100)	1.444***	0.437**	0.246	0.851***
	(0.314)	(0.167)	(0.169)	(0.316)
Chinese Intermediate Inputs (INP)	0.179	2.393	3.383	2.020
	(4.549)	(3.486)	(4.069)	(3.092)
INP X TFPR(p50-p90)	2.370	1.972**	2.558***	3.875***
	(1.799)	(0.992)	(0.755)	(1.119)
INP X TFPR(p90-p100)	4.444	1.050	2.739***	7.143**
	(4.461)	(1.670)	(0.743)	(3.471)
Output Tariff	-0.00118	-0.000908	-0.00176	-0.000913
	(0.00239)	(0.00146)	(0.00257)	(0.00174)
Input Tariff	0.000737	0.000395	0.00140	0.000896
	(0.00228)	(0.00141)	(0.00221)	(0.00181)
Factory FE	Yes	Yes	Yes	Yes
State Year FE	Yes	Yes	Yes	Yes
3-digit-industry Year FE	Yes	Yes	Yes	Yes
Observations	160,065	160,065	195,099	200,253

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 3.11: Heterogeneity Based on Unionization

	1	2	3	4	5	6
	Log Contract			Contract Worker		
	Workers			Ratio		
Chinese Import Competition (IMP)	0.0348	0.00649	0.0485	0.0196*	0.0213	0.0258
	(0.0494)	(0.0825)	(0.101)	(0.0103)	(0.0197)	(0.0230)
IMP X TFPR(p50-p90)	0.145	-0.00550	-0.0869	0.0297	-0.0128	-0.0172
	(0.121)	(0.110)	(0.249)	(0.0202)	(0.0273)	(0.0317)
IMP X TFPR(p90-p100)	0.580***	0.447***	0.229		0.0518**	-0.0330
	(0.170)	(0.163)	(0.270)	(0.0258)	(0.0238)	(0.0283)
IMP X TFPR(p50-p90) X UNION -OECD		0.363			0.104**	
		(0.307)			(0.0507)	
IMP X TFPR(p90-p100) X UNION -OECD		0.689***			0.136***	
		(0.206)			(0.0453)	
IMP X UNION –OECD		0.0407			-0.0112	
		(0.151)			(0.0278)	
IMP X TFPR(p50-p90) X UNION -NSSO			0.258			0.0610
			(0.311)			(0.0508)
IMP X TFPR(p90-p100) X UNION -NSSO			0.744			0.220***
			(0.561)			(0.0415)
IMP X UNION -NSSO			0.0241			-0.00412
			(0.119)			(0.0266)
Factory FE	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
threedigitind-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	160,065	127,360	146,224	160,065	127,360	146,224

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Conclusion

This study examines the firm level adjustments to two major events related to international trade in the post liberalization period in India. The first is the increasing use of regulatory measures following the progressive decline of tariffs. Second is the spectacular rise of China as an exporting hub leading to a large increase in Chinese import share for most countries.

First, the study examines how reduced access to intermediate inputs from the introduction of restrictive TBT measures on intermediate inputs negatively affects firm level productivity and markups. Further, the analysis is also able to isolate the effects on importing firms from non-importing firms. The study shows that there are significant productivity and markup losses for importers from reduced access to imported intermediate inputs. The results suggest that regulatory measures aimed at addressing market failures in the domestic economy can have unintended consequences for firm performance in developing countries if they negatively affect the import flows of intermediate inputs. The main policy implication from the findings in this study is that regulatory measures, while unavoidable, should not impose more cost than is necessary to achieve the public policy objective. Restrictive regulatory measures disproportionately affect importers-exporters that are the most productive firms.

Next, the pro-competitive effect of Chinese import competition on Indian manufacturing firms are analyzed. The main finding is that, in the presence of incomplete passthrough, the overall effect of imports on prices is modest. In contrast to the literature, this study finds that Chinese import competition led to a large increase in firm level productivity and firm-product level marginal costs. These findings are important as they highlight the importance of studying efficiency and markups together in the presence of incomplete passthrough. The findings also have implications for the distribution of gains from trade between consumers and producers. At least in the short run, these results suggest that producers are able to capture most of the rents and consumers only see a moderate increase in their surplus owing to a moderate decrease in prices.

Finally, the study analyses the causal effect of Chinese import competition on contract employment in India. It is found that Chinese import competition led

to an increase in formal employment in manufacturing firms in India, primarily driven by increased contract employment. The key finding is that, contrary to popular perception, Chinese import competition did not lead to job losses for formal manufacturing firms but induced reallocation of market share from informal firms toward formal firms. However, due to strong worker bargaining power, formal firms prefer to hire contract workers over regular workers. Thus, at least in the short-run, imports from China increase overall productivity in the Indian manufacturing sector by shifting resources towards more productive formal firms. This process of reallocation is enabled by the institution of contract labor.

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APPENDIX TABLES

Table A1: Robustness Checks: Alternative Method for Production Function Estimation

Dependent variable	log (TFPQ)				log (markups)			
		year < 2008		year < 2008		year < 2008		year < 2008
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern_{i,t-1}^{output}$	0.0434	0.0377	0.0433	0.0378	0.0470	0.0511	0.0466	0.0509
	(0.0119)	(0.0156)	(0.0118)	(0.0152)	(0.0134)	(0.0174)	(0.0134)	(0.0171)
$concern_{i,t-1}^{input}$	0.0766	0.0843	0.0250	0.0231	0.135	0.165	0.0729	0.0841
	(0.0796)	(0.0805)	(0.0789)	(0.0773)	(0.0935)	(0.0961)	(0.0918)	(0.0901)
$concern_{i,t-1}^{input} \times \text{importer}_{it}$	-0.0982	-0.108			-0.0934	-0.136		
	(0.0254)	(0.0243)			(0.0305)	(0.0336)		
importer_{it}	0.0843	0.0951			0.0555	0.0613		
	(0.00849)	(0.00944)			(0.0117)	(0.0129)		
$concern_{i,t-1}^{input} \times \text{importshare}_{it}$			-0.231	-0.247			-0.0877	-0.210
			(0.0886)	(0.0869)			(0.118)	(0.113)
import share_{it}			0.0882	0.0904			-0.0293	-0.0105
			(0.0300)	(0.0325)			(0.0462)	(0.0445)

Dependent variable	log (TFPQ)				log (markups)			
		year < 2008		year < 2008		year < 2008		year < 2008
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	37,590	23,986	37,590	23,986	37,490	23,925	37,490	23,925

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table A2: Impact of TBT Concerns on Firm Level Productivity: Robustness Checks

Outcome variable	TFPQijt							
		Single		Firm characteristics				
		Product	Tariffs	Capital	Size	Age	exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern_{i,t-1}^{output}$	-0.0331	0.0533	-0.0211	-0.0381	-0.0361	-0.0394	-0.0379	-0.0240
	(0.0848)	(0.0868)	(0.0621)	(0.0666)	(0.0657)	(0.0649)	(0.0666)	(0.0604)
$concern_{i,t-1}^{input}$	0.442	0.789	0.488	0.442	0.422	0.241	0.425	0.305
	(0.421)	(0.669)	(0.367)	(0.381)	(0.401)	(0.689)	(0.406)	(0.683)
$concern_{i,t-1}^{input} \times \text{import share}_{it}$	-1.558	-1.843	-1.527	-1.496	-1.455	-1.554	-1.515	-1.535
	(0.434)	(0.960)	(0.495)	(0.438)	(0.449)	(0.441)	(0.426)	(0.498)
import share	-0.00880	-0.00844	0.00310	-0.00922	-0.00945	-0.0109	-0.00923	0.0101
	(0.00184)	(0.0316)	(0.105)	(0.00180)	(0.00183)	(0.00195)	(0.00179)	(0.101)
$tariff_{i,t}^{output}$			-0.550					-0.474
			(0.265)					(0.244)
$tariff_{i,t}^{input} \times \text{import share}_{it}$			-0.000192					-0.000330
			(0.00162)					(0.00155)

Outcome variable	TFPQijt							
		Single		Firm characteristics				
		Product	Tariffs	Capital	Size	Age	exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$tariff_{i,t}^{input}$			0.709					0.692
			(0.340)					(0.299)
$concern_{i,t-1}^{input} \times \text{capital intensity}_{it}$				0.00351				0.00493
				(0.0116)				(0.0111)
$\text{capital intensity}_{it}$				-0.000459				-0.000643
				(0.00151)				(0.00145)
$concern_{i,t-1}^{input} \times \text{sales share}_{it}$					-0.0601			-0.649
					(0.742)			(0.808)
sales share_{it}					-0.646			-0.560
					(0.282)			(0.288)
$concern_{i,t-1}^{input} \times \text{age}_{it}$						0.0764		0.0760
						(0.147)		(0.142)
age_{it}						-0.161		-0.156
						(0.0494)		(0.0495)

Outcome variable	TFPQijt							
		Single		Firm characteristics				
		Product	Tariffs	Capital	Size	Age	exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern_{i,t-1}^{input} \times \text{exporter}_{it}$							0.0355	0.00570
							(0.164)	(0.163)
exporter_{it}		-0.133	-0.0779	-0.0786	-0.0748	-0.0717	-0.0839	-0.0684
		(0.0345)	(0.0198)	(0.0198)	(0.0197)	(0.0187)	(0.0306)	(0.0298)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector - Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry (3-digit) - Year FE	Yes	No	No	No	No	No	No	No
Industry time - trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32,814	15,715	32,814	32,814	32,814	31,119	32,814	31,119

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table A3: Impact of TBT Concerns on Markups: Robustness Checks

Outcome variable	markups_{ipt}							
		Single		Firm characteristics				
		Product	Tariffs	Capital	Size	Age	Exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern^{output}_{j(p),t-1}$	0.049528	0.008491	0.035563	0.049562	0.044220	0.050790	0.049328	0.030960
	(0.038185)	(0.032698)	(0.037635)	(0.038186)	(0.038743)	(0.042587)	(0.038308)	(0.042896)
$concern^{input}_{j(p),t-1}$	-0.023225	0.082924	-0.011694	-0.022670	0.083091	0.090636	0.011457	0.094011
	(0.393287)	(0.279245)	(0.400229)	(0.393184)	(0.390361)	(0.511400)	(0.399428)	(0.515859)
$concern^{input}_{j(p),t-1} \times \text{import share}_{it}$	-0.986487	-0.416617	-0.865761	-0.987264	-0.921078	-0.977224	-0.962508	-0.786606
	(0.332271)	(0.246672)	(0.383450)	(0.332257)	(0.312941)	(0.340777)	(0.338853)	(0.372980)
import share_{it}	-0.009405	-0.058919	-0.067357	-0.009403	-0.009319	-0.007602	-0.009391	-0.067468
	(0.007775)	(0.032249)	(0.101498)	(0.007774)	(0.007717)	(0.006970)	(0.007797)	(0.095997)
$tariff^{output}_{j(p),t}$			0.279663					0.263724
			(0.259009)					(0.263780)
$tariff^{input}_{j(p),t} \times \text{import share}_{it}$			0.000901					0.000931
			(0.001485)					(0.001411)

Outcome variable								
		Single		Firm characteristics				
		Product	Tariffs	Capital	Size	Age	Exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$tariff_{j(p),t}^{input}$			-0.567970					-0.586882
			(0.289224)					(0.287179)
$concern_{j(p),t-1}^{input} \times \text{capital intensity}_{it}$				-0.000002				-0.000002
				(0.000000)				(0.000000)
$\text{capital intensity}_{it}$				0.000001				0.000001
				(0.000000)				(0.000000)
$concern_{j(p),t-1}^{input} \times \text{sales share}_{it}$					-2.333253			-2.186026
					(1.020987)			(1.105817)
sales share_{it}					0.245040			0.128955
					(0.218232)			(0.252992)
$concern_{j(p),t-1}^{input} \times \text{age}_{it}$						-0.076126		-0.039607
						(0.086457)		(0.086621)
age_{it}						0.125538		0.124265
						(0.037764)		(0.037911)

Outcome variable								
		Single		Firm characteristics				
		Product	Tariffs	Capital	Size	Age	Exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$concern_{j(p),t-1}^{input} \times \text{exporter}_{it}$							-0.055484	-0.001196
							(0.079731)	(0.082736)
exporter_{it}	0.028620	-0.005373	0.028083	0.028688	0.028552	0.024392	0.036506	0.024241
	(0.017488)	(0.018789)	(0.017543)	(0.017491)	(0.017474)	(0.017795)	(0.023895)	(0.025074)
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	No	No	No	No	No	No	No
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	77,548	19,083	77,548	77,548	77,548	73,235	77,548	73,235

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table A4: Chinese Import Competition and Worker Mandays

	(1)	(2)	(3)
	Manufacturing Mandays		
	Log	Log	Contract
	Regular	Contract	Mandays
	Mandays	Mandays	Ratio
Chinese Import Competition (IMP)	-0.0456	0.504***	0.0397***
	(0.0508)	(0.141)	(0.0119)
Chinese Intermediate Inputs	1.298	13.57	0.910
	(5.081)	(9.175)	(0.699)
Output Tariff	-0.00386	-0.00190	0.000224
	(0.00373)	(0.00662)	(0.000484)
Input Tariff	0.000016	0.00241	0.0000527
	(0.00404)	(0.00482)	(0.000437)
Instrumental Variables for:			
Chinese Import Competition	Yes	Yes	Yes
Chinese Intermediate Inputs	Yes	Yes	Yes
Factory FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
3-digit-industry Year FE	Yes	Yes	Yes
Observations	204,273	204,273	203,862

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table A5: Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Log Contract Workers						Contract Worker Ratio					
Chinese Import Competition (IMP)	0.264***	0.188***	0.188***	0.190***	0.179***	0.188***	0.0468***	0.0403***	0.0403***	0.0393***	0.0393***	0.0403***
	(0.0311)	(0.0469)	(0.0341)	(0.0597)	(0.0557)	(0.0565)	(0.00770)	(0.0109)	(0.00967)	(0.0120)	(0.0120)	(0.0120)
Chinese Intermediate Inputs	6.832	5.983	5.983	5.452	4.376	5.903	1.220	0.906	0.906	0.819	0.707	0.896
	(4.784)	(4.942)	(4.162)	(3.626)	(3.306)	(3.848)	(0.855)	(1.038)	(0.840)	(0.672)	(0.669)	(0.704)
Output Tariff	0.00125	0.00117	0.00117	0.00107	0.000918	0.00148	0.000296	0.000271	0.000271	0.000268	0.000253	0.000339
	(0.00230)	(0.00254)	(0.00236)	(0.00209)	(0.00209)	(0.00233)	(0.000515)	(0.000557)	(0.000491)	(0.000483)	(0.000476)	(0.000504)
Input Tariff	-0.00128	-0.00153	-0.00153	-0.000967	-0.000676	-0.00173	0.000355	0.000150	0.000150	0.000278	0.000246	0.000111
	(0.00322)	(0.00296)	(0.00268)	(0.00261)	(0.00254)	(0.00281)	(0.000570)	(0.000496)	(0.000437)	(0.000497)	(0.000489)	(0.000506)
Instrumental Variables for:												
Chinese Import Competition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chinese Intermediate Inputs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Log Contract Workers						Contract Worker Ratio					
Factory FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-digit-industry Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Trend	Yes	No	No	No	No	No	Yes	No	No	No	No	No
Age Controls	No	No	No	Yes	No	No	No	No	No	Yes	No	No
Organization type Trend	No	No	No	No	Yes	No	No	No	No	No	Yes	No
Ownership Trend	No	No	No	No	No	Yes	No	No	No	No	No	Yes
Observations	204,273	204,273	204,273	200,851	204,163	204,165	204,203	204,203	204,203	200,785	204,093	204,095

*Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

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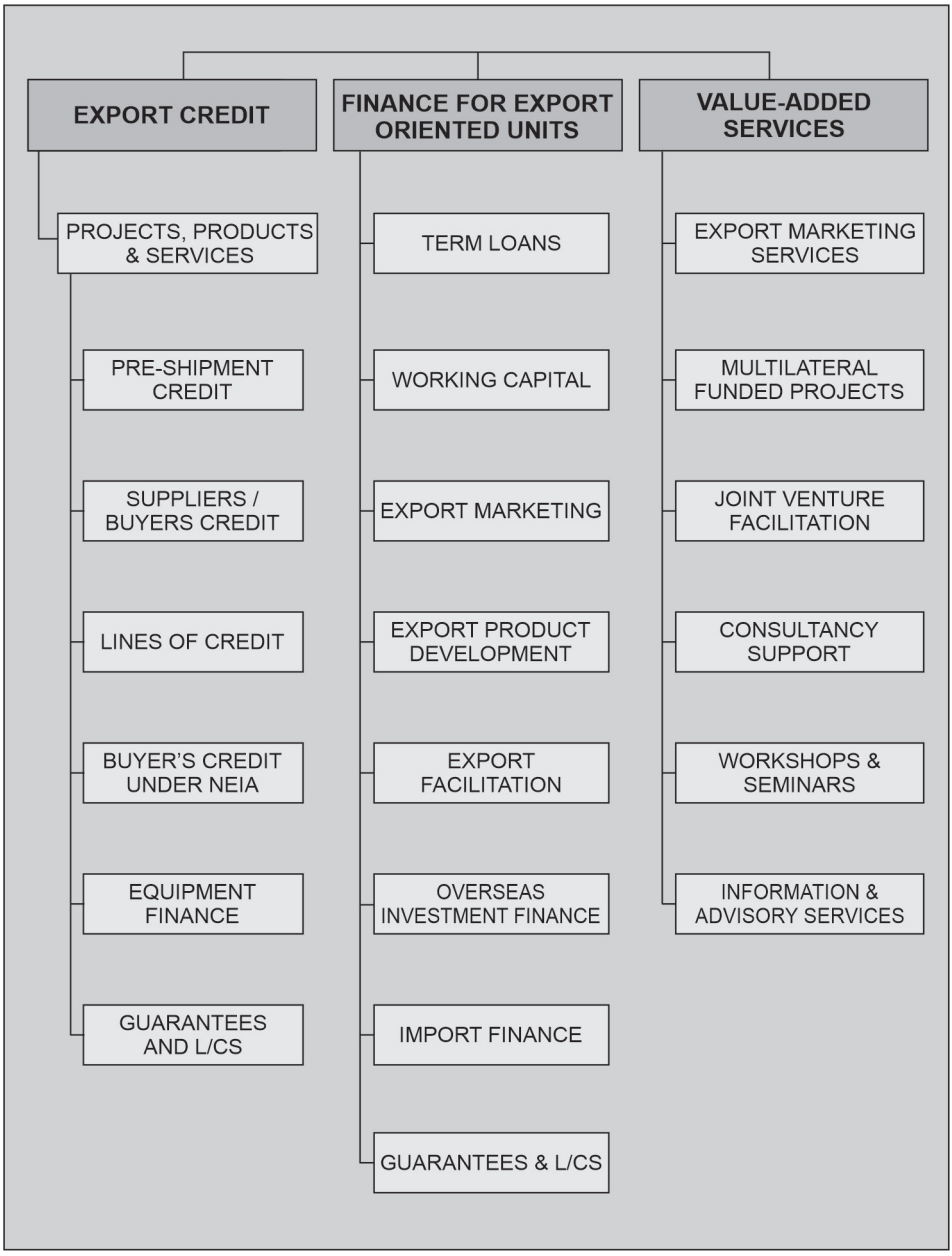

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