



# Trade Liberalization, Rival Exporters and Reallocation of Production: An Analysis of Indian Manufacturing\*

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## Abstract

Employing a difference-in-difference estimation technique on firm-level data on Indian exporters, we show that the removal of US textile and apparel quotas was associated with a relative increase in sales of products where India was previously quota-restricted, but a relative decrease in sales of products where China was previously quota-restricted. We hence highlight the importance of accounting for falling trade barriers for rival exporters in analyzing trade liberalization effects. Additionally, we find that previously more productive firms see a greater increase in sales, suggesting potential gains from reallocation in an environment where quota rights were not allocated efficiently.

JEL codes: F10, F13, L11, O14, O24

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## 1 Introduction

The final removal of quota restrictions on the import of clothing and textile products under the Agreement on Textile and Clothing (ATC), the successor of the Multifibre Arrangement (MFA), on January 1 2005 led to a surge in imports of these products into previously protected markets of advanced economies such

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as the United States (US), European Union (EU) and Canada<sup>1</sup>. The increase in imports from China was most dramatic and has been studied widely in the context of US quota restrictions (Barrows and Harrigan 2009; Brambilla, Khandelwal and Schott 2010; Bernhofen, Upward and Wang 2011). Yet, quotas were also binding on other large labor-abundant economies with a comparative advantage in clothing and textile products. India, for example, exhibited a US quota fill rate of 87 percent, next to only China and Bangladesh, who both exhibited a quota fill rate of 88 percent (Brambilla, Khandelwal and Schott 2010).<sup>2</sup>

The effect of the end of the MFA on other countries is likely to be different to that on China. Quotas were applied at a product level on a country-specific basis, implying potentially differential effects of their removal across countries. The effects of the quota removal in each country are also potentially interdependent. The response by exporters in each country to the removal of restrictions on their exports will have been influenced by the simultaneous dismantling of quotas on rival exporters in other countries. Improved market access in response to the removal of quotas on one country's exports may be overshadowed by competition effects arising from the removal of quotas on rival country exports.

In this paper, we investigate the effect of the removal of the MFA/ATC (hereinafter MFA) quotas on sales of Indian exporting firms. We focus on quotas applied to Indian imports and to imports from India's largest competitor, China, by the US. Finally, we look at the differential effect of the quota removal on firms with varying productivity levels in the period before the quotas were removed. Our results are robust to controlling for the EU quota phase-down, the domestic Indian import tariff on textile and apparel imports, an alternate definition of quota-restrictiveness and a falsification test.

We argue that our study is important for various reasons. First, we are interested in studying the impact of a reduction in trade barriers on firm behavior, and the reallocation of production resulting from the absence of this market distortion, an exercise that, we believe, has important implications for ascertaining welfare gains. The ending of the MFA is useful in this regard as it was an externally-imposed reduction in trade barriers, and hence presents a suitable opportunity to control for some of the endogeneity in trade policy.

Second, we wish to look at the impact of the removal of quotas conditional on the removal of quotas on imports from rival countries. We believe that this is crucial for identifying nuances in the effects of the textiles and apparel quota regime on firms in developing countries<sup>3</sup>. In a broader context, we posit

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<sup>1</sup>Although quota restrictions had been relaxed during the earlier phase-down periods (1995, 1998 and 2001), the bulk of MFA liberalization was delayed until the final phase-down in 2005, when all quotas under this arrangement were abolished.

<sup>2</sup>Brambilla, Khandelwal and Schott (2010) look at the 'adjusted base quota', actual exports and quota fill rates (defined as exports divided by base quota) for major developing exporters of textile and clothing from 1984 through 2004 under the MFA/ATC. They define the 'adjusted base quota' as the originally negotiated quota level at the start of an agreement term, adjusted for "flexibilities" that allow countries to borrow unused base quotas across MFA groups and years.

<sup>3</sup>We believe that isolating the impact of the MFA quota removal on developing country

that trade liberalization effects can interact with the nature of trade barriers in competing, or rival markets<sup>4</sup>. Again, the removal of the MFA quotas provides us with a tool to delve into reallocation resulting from a simultaneous fall in trade barriers for two large, exporting countries. Quotas on China were far more restrictive than those for India. Hence, for a few products, while China was quota-restricted under the MFA regime, India was not, providing us with sufficient variation to disentangle the two effects.

We exploit a firm-level panel dataset on Indian textile firms that also has information on firm sales at the product level. This product-level information allows us to explore the differential impact of the MFA on quota-restricted and unrestricted products within the firm. Unlike other studies that focus on the export response by firms, we focus on the sales response<sup>5</sup>. An advantage of focusing on total firm sales is that we are able to capture the net effect of the quota removal on production by firms, after any substitution of exports for domestic sales, or exports to alternative destinations.<sup>6</sup>

Focusing on firms that exported in any year during 2002-2007, we adopt a difference-in-difference estimation technique that looks at differential sales of products that were subject to quotas and those that were not, before and after 2005, to identify the effect of the removal of quotas on firm behavior. This empirical strategy enables us to control for unobservable shocks such as changing consumer preferences, changes in technology or the policy environment, which might affect firm behavior. Additionally, the detailed nature of the data and our empirical strategy allow us to account for some of the firm-specific unobserved heterogeneity driving firm outcomes and selection into products jointly.

We find that the quota removal was associated with an increase in sales of 49 percent in previously quota-restricted products, and a decrease in sales of 37 percent in products where China was previously quota-restricted. Results show that unit-values of products where China was previously quota-restricted decreased, a finding consistent with previous studies (Barrows and Harrigan 2009; Bernhofen, Upward and Wang 2011). Finally, we find that the increase in sales of previously quota-restricted products is larger for Indian firms that were

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manufacturing is in itself important. Textiles and apparel account for a large share of employment in developing countries. The Indian textile industry accounted for 21 percent of manufacturing employment and 8 percent of manufacturing value added in 2005-06 (National Productivity Council, 2010).

<sup>4</sup>Brambilla, Khandelwal and Schott (2010) provide some evidence of these competition effects and document widespread reductions (102 out of 143 countries) in other countries' exports to the US in those products where Chinese exports were bound in 2004. The largest South Asian exporters – Bangladesh, India and Pakistan - are the exception and report positive, but statistically insignificant, increases in their exports of these products. However, the study does not take into account reductions in US quotas on imports from these South Asian economies that may have offset the effect of competition from China.

<sup>5</sup>This decision is partly driven by data constraints. The Prowess database we use in this study does not provide information on firm exports for each product produced by a firm, nor does it provide information on export destinations.

<sup>6</sup>It is feasible, for example, that the increase in exports to the US in response to the removal of quotas is driven entirely by a shift in sales to the US from the domestic market and/or other export markets, leading to no change in productive activity within the firm.

previously more productive.

Our study relates to the broad literature using micro data to look at the impact of trade liberalization on firm behavior (Pavcnik, 2002; Melitz 2003; Goldberg, Khandelwal, Pavcnik and Topalova; 2010), and in general, market distortions on firm behavior (Hsieh and Klenow, 2009; Dollar and Wei, 2007; Petrin and Sivadasan, 2010). It also relates to the recent theoretical and empirical literature on multi-product firm models that emphasizes heterogeneous product and firm responses to trade liberalization (Bernard, Redding and Schott 2011).

More specifically, our study relates to the literature analyzing the impact of the MFA quota removal on exports, firm behavior and upgrading of product quality, focusing primarily on China (Bernhofen, Upward and Wang 2011, Brambilla, Khandelwal and Schott 2010, Barrows and Harrigan 2009). Our evidence is also consistent with the idea proposed by Khandelwal, Schott and Wei (2013), where inefficiencies in licensing institutions in China meant that quotas were not allocated to the most productive firms, causing a reallocation towards these firms with the removal of the quotas. India’s experience seems to mirror this story, underscoring that trade liberalization can bring additional gains when institutions are weak.

## 2 Conceptual Framework and Empirical Specification

We are first interested in identifying the effect of the removal of US quotas applied to imports from India, on total sales of Indian exporters. We expect the imposition of an import quota on India by the US to be associated with lower imports as long as the quotas are binding. Hence, a removal of a binding quota will be associated with an increase in imports from India by the US. We thus expect net sales of Indian exporters to increase, although it is possible that Indian firms simply divert sales from other destinations to the US. The net effect we observe is a lower bound on the true effect of the quota on exports to the US alone.

Our empirical strategy is to employ a difference- in-difference technique to examine the impact of the removal of the MFA quotas in 2005 at the firm level. The basic idea is to look at differential sales of quota- restricted products produced by firms that exported in any year between 2002 and 2007 over unrestricted products, before the MFA quotas were lifted in 2005 relative to after. Our specification is:

$$\ln Y_{ijt} = \alpha_1 + \beta_1 \text{India Bound}_i + \beta_2 \text{Pr } e_t + \beta_3 \text{India Bound}_i * \text{Pr } e_t + u_{1,ijt} \quad (1)$$

where  $Y_{ijt}$  refers to the outcome variable, log of sales of product  $i$ , firm  $j$  at time  $t$ ,  $\text{India Bound}_i$  is a dummy variable that equals 1 if the product was quota-restricted prior to 2005 and zero if not,  $\text{Pr } e_t$  is a dummy variable that

equals 1 for years before the end of the MFA and  $u_{1,ijt}$  is the idiosyncratic error term<sup>7</sup> We define a product as quota-restricted if the quota fill rate for that product category in 2004 was greater than or equal to 70 percent.

The coefficient  $\beta_3$  captures the differential effect on the outcome variable in quota-restricted products after the US quotas on Indian exports were removed. This coefficient, in other words, is the difference-in-difference estimate of the effect of the quota phase-down on the outcome. We expect  $\beta_3 < 0$ , implying that sales in quota-restricted products were lower relative to unrestricted products pre-2005 than after.

We also anticipate that the removal of US quotas on rival Chinese exports will have affected outcomes for Indian firms. The imposition of an import quota on China is expected to have boosted imports of these products from India. In fact, we argue that not accounting for the Chinese competition effect is likely to bias our estimate of the impact of the MFA quota-removal on Indian firms. To capture these effects, we extend specification (2.1) to include a dummy variable (*China Bound<sub>i</sub>*) that equals 1 if the product was quota-restricted for China prior to 2005, as well as its interaction with the MFA time dummy ( $Pr e_t$ ). The revised specification is given by:

$$\begin{aligned} LnY_{ijt} = & \alpha_1 + \beta_1 India Bound_i + \beta_2 Pr e_t + \beta_3 India Bound_i * Pr e_t + \\ & \beta_4 China Bound_i + \beta_5 China Bound_i * Pr e_t + u_{1,ijt} \end{aligned} \quad (2)$$

The coefficient  $\beta_5$  captures the differential effect on the outcome variable in products quota-restricted for China (where the Chinese fill rate in 2004 was greater than or equal to 70 percent) relative to other products. Note that since we condition on  $India Bound_i * Pr e_t$ , the coefficient on  $China Bound_i$  is identified from those products where India was not quota-restricted, but China was. We expect  $\beta_5 > 0$ . Indian firm sales in products where China was quota-restricted are expected to be higher relative to unrestricted products pre-2005 than after.

One concern with the simple specifications in (1) and (2) is that they are highly restrictive and do not allow for product-level heterogeneity in base-level prices. All quota-restricted and unrestricted products are grouped in exclusive categories. They also assume that the decline in sales in response to quotas is common across all products within the bound category. We therefore include product fixed-effects in both (1) and (2) to account for unobserved product-specific shocks correlated with quota-restrictiveness and sales jointly. We also include year effects to control for time-specific shocks common to all firms and products. These fixed effects mean that we now cannot estimate coefficients  $\beta_1, \beta_2$  and  $\beta_4$

A further concern is that particular firm types select into production of quota-restricted products and that the factors determining such selection are

<sup>7</sup>Note that in the Prowess database used in this study, data on sales are reported for the Indian financial year from April through March. Hence, sales reported in March 2005 are for the period April 2004-March 2005. The variable  $Pre_t$  therefore includes January to March of 2005.

unobserved. This would then lead to inconsistent estimates of the effect of the quota removal on firm sales. Additionally, we expect substantial heterogeneity in product-mix across firms. To address these concerns, we estimate a rigorous version of (1) and (2), with firm-product fixed effects, and call this our preferred specification. This specification identifies quota effects using variation within a particular firm-product over time

The removal of quotas on India and, particularly China, a large economy with considerable influence on the world price, is expected to also influence prices of products that were previously quota-restricted. The removal of quotas is expected to reduce prices as new competitors enter the market and as firms potentially downgrade the quality of their exports in response to the quota removal (Bernhofen, Upward and Wang 2011). To measure these effects, we consider the log of the product unit-value (as a proxy for price) as a dependent variable in our preferred specification (2).

Finally, we examine differential effects of the import quota removal on firms with varying productivity levels. Khandelwal, Schott and Wei (2013) argue that since the quota is likely to be binding for the most productive firms, if quota licenses were allocated to the most productive firms, quota removal is unlikely to have differential effects across firms with varying productivity levels. However, if the institutional structure allocated quota rights inefficiently, for example, to the most politically connected firms or the most ‘persuasive’ firms, we would anticipate the quota removal and subsequent dismantling of the quota licensing regime to result in increased market-share for the more productive firms. They find evidence for inefficiencies in quota license allocation for China. We look for evidence of inefficiencies in the quota licensing regime for India, which is a large emerging economy like China, but which has a vastly different political system, and hence a different institutional environment.

To do this, in an alternate version of (2), we include an interaction between mean total factor productivity of a firm in the pre-period (2002-2004) and the variable ( $India\ Bound_i * Pr\ e_t$ ) to look at differential effects of the quota removal across firms with varying productivity levels. A negative coefficient on this interaction would signify a stronger response by previously more productive firms to the removal of quotas, and hence, an inefficient allocation of quota licenses in the quota regime that penalized relatively efficient firms the most.

Our decision to focus on the US quota phase-down is motivated by the fact that by the end of Phase 3 of the MFA phase-down (2002-2004), the EU, the next largest importer of Indian textiles, had significantly reduced quotas on India in almost all product categories so that fill rates for most products in 2004 were below 70 percent (see Table 1)<sup>8</sup>. However, since we cannot observe exports to the US directly in our data, it is possible that our estimates, especially on the effect of quotas on China, confound the effects of US quotas with the effects of quotas by the EU. To ensure that this is not the case, in a robustness check, we include indicator variables for quota-restrictiveness for India and China under

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<sup>8</sup>The US and EU accounted for 55% of India’s textile exports in 2004, with other major importing countries like the United Arab Emirates, Saudi Arabia, Bangladesh and Turkey imposing no quota restrictions on Indian exports.

the EU's quota regime. We find that our results are qualitatively robust.

### 3 Data

We use firm-level data from the Prowess database of the Center for Monitoring the Indian Economy (CMIE), India. The firm level data are captured from annual income statements and balance sheets of mainly publicly listed companies. The companies in the database together comprise 60 to 70 percent of the economic activity in the organized industrial sector. The database records information on sales and quantities sold at the product level for each firm, which we exploit to explore dynamics resulting from the US quota removal. We use data for the period 2002 through 2006 and focus on exporting textile and clothing manufacturing firms.

Though the Prowess database does not have information on exports at the product level for each firm, it records total firm-level exports. We use this information to classify a firm as an exporter if it exports a positive value in any year between 2002 and 2006. The Prowess database also includes information on raw material expenses and labor inputs into production (salaries and wages), capital stock (fixed assets) and investment in capital (additions to fixed assets) at the firm level, which we exploit to obtain estimates of total factor productivity in the period 2002-2004.

We aggregate textile and clothing products into 22 broad categories based on product descriptions and material used in production. Textile products span fabrics, made-ups and yarn, each made of cotton, cotton/man-made fiber (blended), silk blends, wool and man-made fibers. All apparel products, irrespective of material, are considered a single group. The last group consists of products including raw fiber and certain miscellaneous products that were outside the quota regime and did not elicit quotas<sup>9</sup>. Our final data are hence at the firm-product level, where a product is one of the 22 described above<sup>10</sup>.

We obtain data on quota fill rates for the year 2004 for the US from the Office of Textile and Apparel (OTEXA). These fill rates are based on the US partners' Expired Performance Reports that records quota fill rates for each MFA quota category in Textiles and Clothing for years 1984 through 2004. Information is also available on the HS (Harmonized System of product classification) 10-digit product codes in each MFA quota category. We map these quota-categories to our broad Prowess product categories and derive weighted average fill rates for quotas imposed on imports from India and China using Indian exports of

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<sup>9</sup>Though the Prowess product classification theoretically classifies products at a fairly disaggregated level, practically, most products produced by firms are lumped into generic broad categories. The classification is especially noisy for apparel products, where most firms are recorded as producing 'Readymade Garments' or 'Textile Garments'. We hence adopt a broad product classification to avoid potential measurement error.

<sup>10</sup>We aggregate products produced by firms to correspond to the 22 broad categories. For sales, we sum over products within the firm, and for unit-values, we calculate the mean. It is possible that quantity units vary across firms. However, we argue that our firm-product fixed effects account for any biases introduced in our estimation.



textiles and apparel to the US in the year 2007 as weights. We select the year 2007 since trade flows in this year are more likely to represent true trade between the two countries in the absence of the quota distortions. We then classify products whose fill rates exceed or equal 70 percent in 2004 as ‘bound’ or quota-restricted.

We use a similar methodology to obtain EU quota fill rates in 2004 obtained from the European Commission *Système Intégré de Gestion de Licenses*. For both EU and US quotas we only use those products listed under the ATC agreement. Finally, average Most Favored Nation (MFN) applied tariff rates are obtained from the WTO and TRAINS database of the United Nations.<sup>11</sup>

Table 1 presents US and EU quota fill rates for the year 2004 for the products that were covered under the quota regime for these two countries. For imports into the US, apparel as a group was the most restricted product category for both India and China. Cotton fabrics and woolen yarn were two products quota-restricted in 2004 for China but not for India. In the EU’s case, most fabric products were quota-restricted for China, unlike for India.

Table 2 presents a summary of the Prowess data according to binding and non-binding US quota categories. Sales and unit-values are much smaller for quota-restricted products, consistent with the idea that it is these low-priced products that elicited trade protection in advanced economies. 58% of the number of firm-products were bound or quota-restricted for India, while 64% firm-products were bound or quota-restricted for China, giving us a fairly even split between bound and unbound products. The larger percentage of products quota-restricted for China reflects the relatively severe restrictions imposed on the country under the MFA quota regime.

In Table 3, we present Olley-Pakes (1996) estimates of total factor productivity in the year 2002, of entrants, exiters and incumbent firms into exporting.<sup>12</sup> Entrants are defined as firms that did not export before 2005 that started to export in 2005 or after. Exiters are firms that exported before 2005, but did not export in 2005 and after. Incumbents are those that exported in both periods. We find that entrants are more productive than incumbents or exiters. This lends support to the idea that the quota removal was associated with productive firms entering the export market, consistent with the idea that quota rights were probably not allocated based on firm productivity (Khandelwal, Schott and Wei 2011).

Figure 1 presents trends in US imports of textiles and clothing from India using data on trade flows, with products classified according to whether the quotas were binding or non-binding in 2004. We see a sharp upturn in imports of previously bound products in 2005 relative to unbound products in 2005. The gap in imports of bound and unbound products widens in 2006 and 2007. We anticipate that this relatively strong growth in exports of previously bound products from India to the US that we observe in the trade data will be reflected

<sup>11</sup>We fill in tariff rates for the years that they are missing using linear interpolation.

<sup>12</sup>The Olley-Pakes method accounts for the fact that firms observe productivity shocks and adjust their inputs, generating simultaneity bias in productivity estimation. The idea is to use investment in physical capital as a proxy for productivity shocks.

in changes in production at the firm-level in our analysis.

Figure 2 uses trade flows and presents the growth of US imports of bound and unbound products from India between 2004 and 2007, but now further groups the products within each of these categories into whether the Chinese quotas on them were binding or not. Consistent with Figure 1, the growth in US imports of bound Indian products exceeded unbound products, but within these categories, import growth was weaker if imports from China were bound. This is most noticeable in the growth in US imports of previously bound products from India after the end of the MFA that was 34 percentage points lower if quota restrictions were also binding on imports from China. This pattern of trade is consistent with our expectation that the removal of US quota restrictions on imports from China attenuated the response by Indian firms to the removal of quota restrictions on their exports.

Overall, trade patterns using disaggregated trade data provide a consistent picture of strong growth in Indian exports to the US of previously bound products relative to unbound products. We also see some evidence of a competition effect from China, the largest rival exporter. We now analyze the Indian firm data to see if these effects are present in firm sales and prices.

## 4 Results

### 4.1 The Impact of Quotas on Exporting Firm Sales

Table 4 presents results for our baseline specifications (2.1) and (2.2). In column (1), we estimate the specification (2.1) for Indian quotas imposed by the US. This column also includes product and year fixed effects. We find that relative firm product sales in quota-restricted products in the pre-2005 period were lower than in the post-2005 period. In other words, the difference-in-difference estimate suggests that the removal of quotas on Indian imports was associated with an increase in firm product sales. However, this effect is not statistically significant, indicating that we cannot reject a zero effect of the quota.

In column (2), we control for the restrictiveness of the quota on China, as in specification (2.2). We also include a variable for MFN applied tariffs. While tariff reductions were concentrated in the early 1990s when India's trade liberalization began, reductions in tariffs on several textile and apparel products continued until the mid-2000s. If tariffs are correlated with quota-restrictiveness, our results might be susceptible to omitted variable bias. We hence control for the Indian import tariff. As expected, the difference-in-difference estimate on the China quota suggests that the removal of the MFA quotas was associated with a decrease in firm sales in those products where China was previously quota-restricted. However, we find that effects are not precisely estimated.

In column (3), we estimate column (1), but with firm-product fixed effects to account for unobserved heterogeneity at the firm-product level. The results mirror those in column (1). Finally, in column (3), we estimate column (2) with firm-product fixed effects. Here, we find that the quota removal is associated

with an increase in firm sales of products previously quota-restricted, and a decrease in firm sales of products where China was previously quota-restricted. The coefficients are now statistically significant.

The magnitudes of the effects indicate that the removal of MFA quotas by the US was associated with a 49 percent increase in sales in previously quota-restricted products, and a 37 percent decrease in sales in products where China was previously quota-restricted. These results underscore the importance of accounting for falling trade barriers in rival markets in exploring the impact of trade liberalization on domestic firms. Also, our results show that accounting for firm-product specific heterogeneity in outcomes can be crucial in identifying the effect of changes in the environment on firm behavior.

In Table 5, we check for robustness of our key result. In column (1), we account for EU quotas. This is relevant because we are unable to observe exports to the US by each firm. We only observe total firm sales. Given that firm sales might be affected by EU quotas, which might also be correlated with US quotas, we ensure that our results are robust to accounting for the EU quota phase-down. From column (1), we find that our results qualitatively hold for US quotas. The coefficient on the Indian quota is negative, and that on the Chinese quota is positive, as expected. What is surprising is that we observe a negative and significant coefficient on the EU quota on China. This coefficient says that with the removal of EU quotas, Indian firm sales increased in those products where China was previously quota-restricted. This seems counter-intuitive.<sup>13</sup>

One possible explanation for these results is the re-imposition of quotas on Chinese imports in 2006 when the EU exercised the safeguard option under the WTO. The US also exercised the safeguard option, however, at the broad product category level we employ in this study, fill rates for China under the safeguards were less than 70 percent for all products. Hence, in column (2) we replicate column (1), but now incorporate EU safeguards that were imposed on Chinese imports in 2006. Our EU quota variable for China switches back to one in the year 2006 for cotton fabrics.

From column (2), we see that the negative and significant coefficient in column (1) is now only weakly significant (p value=0.098) and much lower in magnitude. The results suggest that the relatively strong growth of Indian exports to the EU in previously bound Chinese products is, in part, attributable to the imposition of safeguards on China subsequent to the end of the MFA. To conclude, from column (2), accounting for the EU quota phase-down does not qualitatively change our results on the impact of the US phase-down on Indian firms.

In column (3), we replace the indicator variables for US quota-restrictiveness with the log of the actual fill rates under the quota regime. This is to address the concern that the 70 percent cutoff we use to define a product as quota-restricted or bound may be arbitrary. From column (3), using actual fill rates,

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<sup>13</sup>To assess if the results are driven by irregularities in the firm data we also look at disaggregated trade flows from India to the EU. We find similar patterns. Bound Indian exports to the EU grew more strongly from 2005 in products where China was also previously bound. The positive market access effect for India dominated the rival-exporter effect.

we find that our results retain their flavor. Indian firms increase sales in products that were previously quota-restricted or bound, and contract sales in products where China was previously bound, though the Chinese effect is not estimated precisely.

Finally, in column (4), we conduct a falsification test. If our identifying assumption under the difference-in-difference estimation technique is valid, and our estimation technique isolates the effect of the quota phase-down, we will observe no differential sales between quota-restricted and other products in years other than in 2005. In column (4), we set 2004 as the year in which quotas were removed, and estimate our preferred specification for the years 2002-2004. We do not observe any effects of the Indian or Chinese quota removal on firm sales. This reassures us that our difference-in-difference estimator does indeed isolate the impact of the MFA quota removal on Indian firms.

## 4.2 Extensions

In Table 6, we interrogate our results further. In column (1), we estimate equation (2.2) with the log of the product unit-value as our dependent variable. Results indicate that the US quota-phase down was associated with falling unit-values for Indian firms in products where China was previously quota-restricted, indicating that the negative effect on Indian firm sales was partly driven by a fall in product prices due to competition from China. This evidence is consistent with previous literature that finds significant drops in unit-values associated with China's surge in exports following the end of the MFA regime (Barrows and Harrigan 2009; Bernhofen, Upward and Wang 2011). We find no significant effects for products in which India was previously quota-restricted.

Finally, in column (2) of Table 6, we explore differential effects of the quota removal on firms with varying levels of productivity in the 2002-2004 period. This idea is motivated by our observation that firms that entered the export market in or after 2005 are much more productive than firms that are incumbent or that exited. In addition, we hope to gain information on the efficiency of quota licensing institutions in India. Khandelwal, Schott and Wei (2013) show that for China, substantial gains from the removal of MFA quotas resulted from the break-down of the quota licensing institution, which misallocated quotas and penalized relatively efficient firms. They conclude this by observing relatively strong export growth and entry of more productive firms subsequent to the quota removal, which would not be observed if quotas were allocated to the most productive firms. We ask if a similar story holds for India, a country similar to China in its size, but different in political and economic structure. We do this by interacting the Indian quota variable with pre-period firm total factor productivity, which we estimate using the Olley-Pakes (1996) method of productivity estimation.

A negative and significant effect on this interaction term would mean that the increase in Indian firm sales is higher for previously more productive firms in products where India was quota-restricted. This is consistent with the hypothesis that Indian institutions, like the Chinese licensing system, did not efficiently

allocate quota licenses. Indeed, we find that this is true. From column (2), the interaction between the Indian quota variable and pre-period firm TFP is negative and statistically significant, suggesting that Indian institutions were susceptible to the same inefficiencies as their Chinese counterparts.

## 5 Conclusion

This study looks at the impact of a reduction in trade barriers, particularly the MFA textile and clothing quotas, on reallocation of market share (sales) across Indian manufacturing firms. It finds that the removal of US quotas on India was associated with an increase in sales of previously quota-restricted products relative to other textile and apparel products, and that the removal of quotas on China was associated with a decrease in sales of products where China was previously quota-restricted, relative to other products. Results indicate that the effect of the removal of Chinese quotas operated through a fall in product prices. We additionally find that the impact of the quota removal on sales was stronger for firms that were more productive in the period before the removal, consistent with the fact that quota licenses were not issued based on firm productivity. The study throws some light on adjustment mechanisms of manufacturing firms in developing economies to trade liberalization shocks in a global world, where firms compete with rival exporters. It also highlights an additional mechanism for gains from a fall in trade barriers brought about by reallocation of resources across firms when inefficient institutions are dismantled.

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**Table 1: US and EU quota fill rates (%)**

<b>Product</b>	<b>Material</b>	<b>US fill rate</b>		<b>EU fill rate</b>	
		<b>India</b>	<b>China</b>	<b>India</b>	<b>China</b>
Apparel	All materials	84	90	57	64
Fabric	Cotton	32	71	58	89
	Cotton/man-made fibre	32	40	36	72
	Man-made fibre	100	70	1	6
	Silk blends	0	0	0	83
	Wool	0	32	7	29
Made-ups	Cotton	67	58	58	65
	Cotton/man-made fibre	0	0	0	0
	Man-made fibre	3	41	18	22
	Silk blends	0	0	0	0
	Wool	0	1	2	9
Yarn	Cotton	100	85	77	24
	Cotton/man-made fibre	100	81	7	43
	Man-made fibre	41	10	39	12
	Silk blends	0	0	0	0
	Wool	0	70	2	6

**Source:** US fill rates are obtained from OTEXA. EU fill rates are obtained from the European Commission Système Intégré de Gestion de Licenses. For both EU and US quotas we only use those products listed under the ATC agreement. The categorization of clothing and textiles into products and materials is based on the OTEXA Textile and Apparel Category System for the US. For the EU, trade flows were allocated to each broad product category based on the HS 6-digit product description. For the US, trade flows were allocated using a detailed concordance map provided by OTEXA. Average fill rates for India and China are calculated using Indian exports to the US (at HS 10-digit level) and EU (HS 8-digit level) in 2007 as weights.

**Table 2: Descriptive Statistics for Key Variables, 2004**

	<b>India Unbound</b>	<b>India Bound</b>	<b>China Unbound</b>	<b>China Bound</b>
Mean Sales Value (Rs. Million)	1,019	644	1,158	606
Mean Ln(Unit Value – Rs. Million)	20.9	2.8	24.5	2.7
% Firm-Products		58		64

**Source:** CMIE Prowess database and authors' calculations.

**Table 3: Mean Productivity, 2002-2004**

<b>Export status 'pre' and 'post' 2005</b>	<b>TFP</b>
Entering exporters	2.83
Exiting exporters	2.32
Incumbent exporters	2.17

**Source:** CMIE Prowess database and authors' calculations. TFP estimates are obtained using the Olley-Pakes (1996) method of productivity estimation.

**Table 4: Impact of US Quotas on Firm Sales**

	Ln(Sales)	Ln(Sales)	Ln(Sales)	Ln(Sales)
Bound – India ( $\beta_3$ )	-0.025 [0.156]	-0.074 [0.201]	-0.187 [0.149]	-0.491*** [0.120]
Bound – China ( $\beta_5$ )		0.075 [0.198]		0.369*** [0.096]
Ln(Tariff)		0.160 [0.248]		0.145 [0.169]
Year Fixed Effects	YES	YES	YES	YES
Product Fixed Effects	YES	YES	NO	NO
Firm x Product Fixed Effects	NO	NO	YES	YES
R-squared	0.098	0.098	0.031	0.035

(1) Data are from 2002-2006. (2) Bound is a dummy = 1 if quota fill rate was greater than 70% in 2004. (3) Observations = 2,654 and Firm-products = 702. (4) Standard errors clustered at the product level are in parentheses. (4)\*\*\* p<0.01, \*\*p<0.05, \*p<0.10

**Table 5: Robustness Checks**

	Include EU Quotas	EU Quotas + China Safeguard	Ln(1+Quota Fill rate)	Falsification test: 'Post' year=2004
	Ln(Sales)	Ln(Sales)	Ln(Sales)	Ln(Sales)
Bound – India ( $\beta_3$ )	-0.729*** [0.154]	-0.641*** [0.148]	-0.104*** [0.023]	-0.053 [0.122]
Bound – China ( $\beta_5$ )	0.473*** [0.067]	0.394*** [0.078]	0.054 [0.042]	-0.031 [0.139]
EU: Bound - India	0.254* [0.147]	0.253 [0.147]		
EU: Bound - China	-0.228** [0.105]	-0.172* [0.099]		
Ln(Tariff)	0.257 [0.172]	0.248 [0.173]	0.151 [0.160]	-7.718*** [2.159]
Observations	2,654	2,654	2,654	1,537
R-squared	0.040	0.039	0.034	0.009
Firm-products	702	702	702	631

(1) Data are from 2002-2006, except for column (4), where they are for 2002-2004. (2) Bound is a dummy = 1 if quota fill rate was greater than 70% in 2004, except in column (3), where it is the actual quota fill rate in 2004. (3) All columns include firm-product and year fixed-effects. (4) Standard errors clustered at the product level are in parentheses. (5)\*\*\* p<0.01, \*\*p<0.05, \*p<0.10

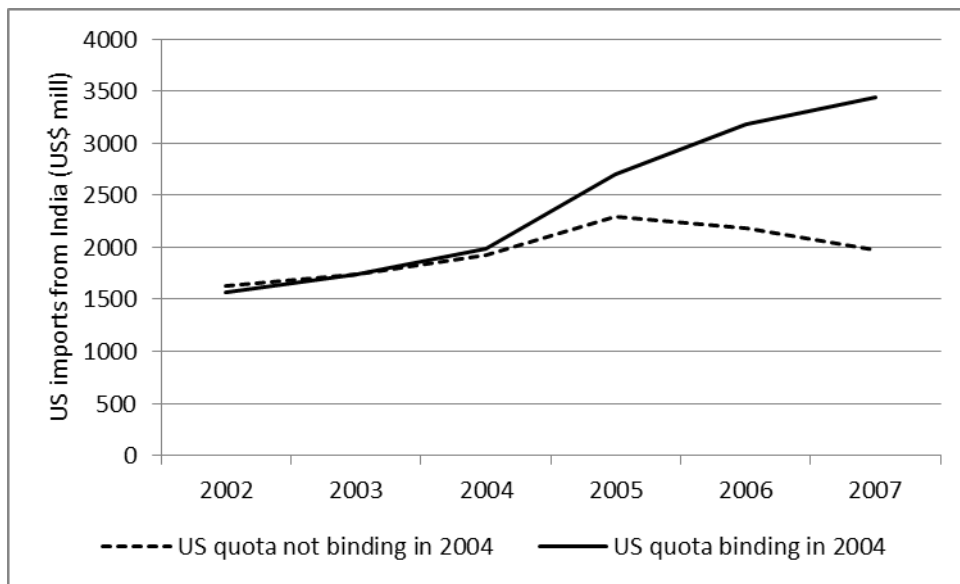


**Table 6: Impact of US Quotas on Unit Values and Differential Effects by Firm Productivity**

	Ln(Unit Value)	Ln(Sales)
Bound – India ( $\beta_3$ )	-0.031 [0.024]	-0.279** [0.129]
Bound – India x Pre-TFP		-0.058*** [0.010]
Bound – China ( $\beta_5$ )	0.084** [0.040]	0.275** [0.121]
Ln(Tariff)	-0.102 [0.074]	0.175 [0.127]
Observations	2,551	2,480
R-squared	0.010	0.037
Firm-products	688	645

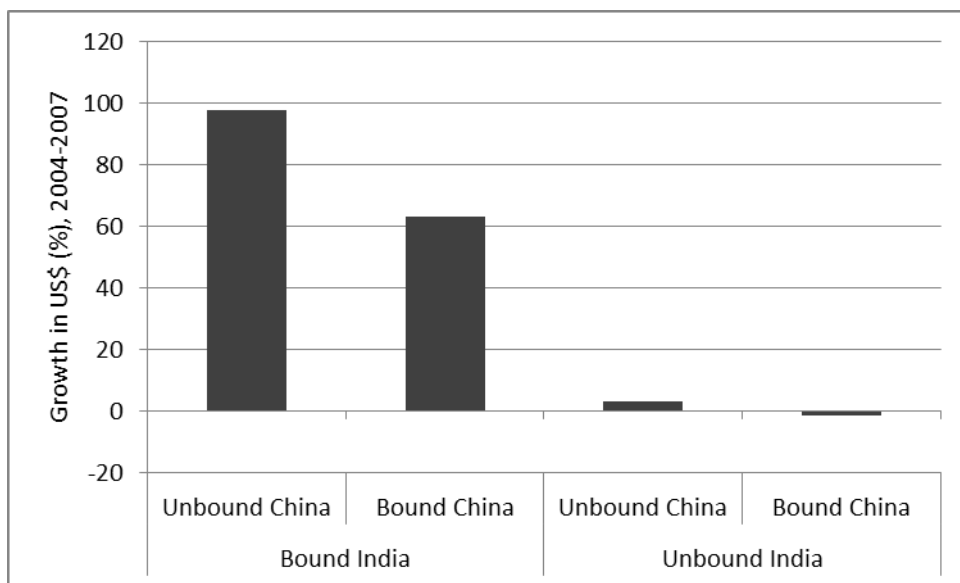
- 1) Data are from 2002-2006. (2) Bound is a dummy = 1 if quota fill rate was greater than 70% in 2004. (3) Pre-TFP is total factor productivity of the firm averaged over the years 2002-2004 (before quota removal in 2005). (4) All columns include firm-product and year fixed-effects. (5) Standard errors clustered at the product level are in parentheses. (6)\*\*\* p<0.01, \*\*p<0.05, \*p<0.10

**Figure 1: US imports from India of clothing and textile products in Indian bound and unbound quota categories**



**Notes:** US import data at the HS 10-digit level are obtained from Schott (2008) and are originally sourced from the US Census Bureau. Bound products are those products (at the HS 10-digit level) with fill rates of 70% or above.

**Figure 2: Growth in US imports from India of clothing and textile products in Indian and Chinese bound and unbound quota categories, 2004-07**



**Notes:** Growth rates are calculated using the total value of imports by bound or unbound category.