Variety In, Variety Out: Imported Input and Product Scope Expansion in India

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1. Introduction

In 1970, the chairman of The Metal Box Company of India Limited, Baskhar Mitter, penned an article in *Economic and Political Weekly* reviewing the annual state of the metal containers industry in India. Virtually all aspects of India's complex industrial policies had shackled his company's operations. Controls on sugar and vegetable oils had prevented growth in the confectionary and biscuits markets, which required packing that his company supplied. Its upstream suppliers enjoyed a protected market through entry licenses and therefore had little incentive to engage in research and development. As a result, the technology of the firm's primary input, the tinplate, had lagged behind other countries. Moreover, the company faced restrictions on the import of cheaper tinplates from abroad. The unreliability and expense of its tinplates had become the company's major constraint on growth. Mitter wrote

> "For example, while we are ready to introduce containers made from 2CR tinplate, we cannot consider their marketing until Hindustan Steel are equipped to make such a plate or, alternatively, Government can assure continuing imports. In the development of new products such as improved versions of Crown Corks and other sophisticated closures, beer cans, easy opening ends, tinplate aerosol cans, aerosol valves, we have continuous access to the most advanced technology through our technical associates. We can over a reasonably short period equip ourselves to manufacture all these products, but we need to be certain that raw material of the right quality and specifications will be available…" (Mitter 1970)

Mr. Mitter was not alone. The quote replicates itself across firms operating in India at the time. Indian firms faced numerous constraints because of India's economic policies which prevented expansion in capacity, quality, and product scope. In this case, although the Metal Box Company had the technology to introduce new products for the market, it was unable to do so because of unreliable access to inputs. This anecdote reveals that constraints on inputs limited firms' ability to manufacture and market new products, even beyond constraints due to industrial license policies. Many economists believed that these frictions lead to a great distortion in the allocation of India's scarce resources and was responsible for the weak 3.2 percent per capital growth from the mid 1960s to early 1980s (Panagariya [2008]).

In this chapter, we discuss and extend the findings of our recent research agenda (Goldberg, Khandelwal, Pavcnik and Topalova, henceforth, GKPT, 2010a, 2010b, 2010c) that examines product mix adjustments by Indian firms during the 1990s. During this period, a large fraction of Indian added products to their product mix suggesting that these constraints felt by Mr. Mitter twenty years after his article appeared in press had been to some extent eased.

This period of firm-level scope expansion coincided with India's large-scale trade liberalization. Through reforms that began gradually during the mid-1980s and subsequently picked up speed in 1991, the Indian government removed many of the constraints that restricted industrial production. The reforms during the 1980s began to dismantle the licensing requirements and the major feature of the 1991 reform was a massive restructuring of India's trade policy.

Our research shows that India's trade liberalization substantially increased firms' access to intermediate inputs from abroad in both volume and variety terms. Leveraging these new imported inputs, firms subsequently introduced new products into the domestic market. The trade reform therefore enabled firms to expand their product scope in part due to lower tariffs on imported inputs.

There are advantages of India's context to study the relationship between imported inputs and domestic product scope. First, relative to most developing countries, India has historically provided researchers with relatively high quality data, a legacy that dates back to the establishment of large-scale surveys in the 1950s, and even earlier to the period of British rule. A unique firm-level database, Prowess, provides detailed product-level information for each firm over time. This enables us to track how firms responded to the trade reform along a number of typical dimensions, including output, and research and development (R&D), but more interestingly, product scope. This is the main variable of analysis in our research. Moreover, we complement these data with detailed product-level import data which records all of India's imports and information from India's plant-level manufacturing database, the Annual Survey of Industries (ASI). Together, these databases allow us to trace how the composition of India's imports at the macro level affected micro-level outcomes inside firms.

The second attractive feature of India's context surrounds the nature of India's trade liberalization. The challenge that empirical researchers face in examining the effects of trade liberalization is that trade policies are frequently subject to endogeneity concerns. For instance, a government may liberalize tariffs for selected industries that are doing well for reasons unrelated to

the reform, thus confounding the identification of impacts due to the trade policy. In the case of India, however, the reform was externally mandated and therefore came as a surprise to Indian firms, at least over the initial period of the reform. This setting therefore presents a unique opportunity to isolate the effects of trade reform on firm outcomes.

In response to the trade reform, Indian firms increased their import volumes. The import to GDP ratio increased from 7.6 in 1990 to 11.6 ten years later (Department of Commerce, Government of India). The increase in imports featured two important characteristics. Based on GKPT (2010b), we present evidence that growth in imports was driven by a growth in *intermediate inputs*. Second, new types of intermediate inputs—varieties that had not been imported prior to the reform—constituted the majority of the increase in the intermediate inputs. Examples include new products like computer data storage units, automatic data processing machines, and liquefied butane. Moreover, many of these new products were sourced from OECD countries suggesting that they were likely of relatively high quality. We also present corroborating evidence large firms in our sample expanded their total imports and present evidence from ASI that industries that experienced the largest declines in tariffs on inputs had relatively larger imported input scope after the reform. While the tariff declines increased competitive pressures for domestic firms, the liberalization also affected firms' cost structures by lower tariffs on intermediate inputs used for production.

As we mentioned above, this period coincided with product scope expansion at the firm level. These new products introduced by the firms had a sizable contribution to manufacturing output growth. GKPT (2010c) show that the product extensive margin—new products introduced by firms following the reform—contributed to 25 percent of overall manufacturing output. More disaggregated analysis in this paper suggests that sectors, such as chemicals and fabricated metals, new products accounted for more than half of output growth.

Using these two attractive features of India's context—detailed data and a plausibly exogenous shock—we demonstrate in GKPT (2010b) that declines in input tariffs had a causal affect on firm scope. Firms added relatively more products to their product mix in industries that experienced relatively larger declines in input tariffs. We provide additional evidence here that lower input tariffs accounted for a wide range of the increase in product scope during this period. Across all industries, lower input tariffs can explain approximately 30% of the increase in firm scope. Given that new products accounted for a quarter of India's manufacturing output growth, a

conservative estimate suggests that lower input tariffs accounted for 7.8 percent of overall manufacturing growth. Importantly, the input channel continues to hold after accounting for changes in output tariffs and other simultaneous market reforms such as de-licensing and FDI liberalization. We also present new evidence investigating heterogeneity in scope response depending on the economic environment in which firms operate.

Our results therefore support the complaints made by businesses during India's import substitution era, such as the quote above, that tariff barriers caused distortions not only within an industry, but also across industries interlinked through supply chains. And as these distortions were removed, increased competitive pressures were offset by beneficial responses to firms' input sourcing.

The remainder of this chapter is organized as follows. In Section 2 we document the changes in firm scope during the 1990s. In Section 3, we discuss in more detail the trade reform and examine the trade data. In Section 4, we discuss the link the two datasets together to establish how trade affects domestic activity. Finally, we conclude in Section 5.

2. New Product Growth

In this section, we document the changes in firm scope during the 1990s. The section summarizes the findings from GKPT (2010c) and provides some additional results. We demonstrate that many firms introduced new products during this period, and these new products contributed to a substantial fraction of manufacturing output growth.

2.1 Prowess Data

The production information for our analysis comes from the Prowess database. Prowess is collected by the Centre for the Monitoring of the Indian Economy (CMIE) and the database provides detailed firm-level information on India's manufacturing activity. Prowess contains a panel of medium and large firms and accounts for about 60-70 percent of economic activity in India's formal industrial sector.

There are several advantages of these data for our analysis. First, unlike India's nationally representative sample of manufacturing plants, the Annual Survey of Industries (ASI), the Prowess data is a panel of firms so we are able to track firms' performance over time. This is a particularly important feature in our context because it enables within-firm comparisons over the course of the reform period. Second, the data span the period of India's trade liberalization from 1989-2003. The

third important feature of our database is that we can track firms' product mix over a long time horizon. In contrast, the ASI only reports product-level information for a few years after the major reforms had already occurred. The ability to peer inside the activity of firms is relatively rare in empirical work and this gives us a unique opportunity to document product-level adjustments in response to changes in the economic environment.

We are able to track firms' product mix over time because Indian firms are required by the 1956 Companies Act to disclose product-level information on capacities, production and sales in their annual reports. In our earlier work, we have documented several features of the database give us confidence in its quality. Specifically, we found that product-level information is available for 85 percent of the manufacturing firms, who collectively account for more than 90 percent of Prowess' manufacturing output and exports. More importantly, product-level sales comprise 99 percent of the (independently) reported manufacturing sales. Prowess is therefore particularly well suited for understanding how firms adjust their product lines over time in response to increased access to intermediate inputs.

Our final sample after cleaning the data leaves us with 4,216 firms that manufacture 1,886 products for the period from 1989-2003. While the level of detail varies across countries depending on the industrial classification, we note that similar data for the U.S. contain approximately 1,500 products (Bernard et al. (2010)). As we show in GKPT (2010c), 47 percent of the firms in Prowess report manufacturing more than one product and these firms account for 80 percent of the total output. We compared these statistics to the ASI rounds which product-level information for manufacturing plants in 1997/98, 1999/2000 and 2001/02. The ASI data indicate that 51 percent of plants manufacture multiple products and these plants account for 78 percent of manufacturing output. Thus, the figures from the ASI data are remarkably similar to Prowess along the scope dimension. The average multi-product firm in our sample manufactures 3 products compared to 3.5 products (and 3.3 products per multi-product plant in ASI).

For an international comparison, 39 percent of U.S. firms manufacture multiple products and these firms account for 87 percent of total output. This suggests that Indian firms tend to span more product lines but are smaller than U.S. firms. The diversification across product lines is consistent with observations by Kochhar et al. (2006) that India's economic policies have lead firms to diversify their portfolios but operate at a smaller scale compared to other similar countries.

3.2 Product Addition

In this chapter, we focus mainly on a time series analysis of firm's manufacturing activity, and in particular, changes to their product mix.[1] We begin by plotting the average number of products per firm in Figure 1. The solid curve plots the year coefficients of a regression of products per firm on year and firm fixed effects. That is, the figure reports average within-firm changes in the average products during the sample period. There is a very clear linear and positive relationship indicating a steady increase in the number of products manufactured per firm during the period of the reform. Across all firms, firms manufactured about 1.5 products in 1989 and this increased to about 2.25 by 2003, an increase of around 50%. Since firms enter the database over this period, the dashed curve performs the same analysis on a constant set of firms that appear in the beginning and end of the sample. Not surprisingly, these firms are larger and so they manufacture more products. Moreover, they exhibit the same overall pattern of a general increase in the number of manufactured products.

The figure indicates growth in the number of products manufactured by firms. This figure, however, reflects the net change in firms' product mix. In principle, firms could be adding and dropping a large number of products while on net growing their product lines. In order to uncover the dynamics of firm activity, in GKPT (2010c), we followed changes in firms' scope between 1989 and 2003. We classify firms into four mutually exclusive activity groups: no product mix changes, add products only, drop products only, and both add and drop products. A product is added in 2003 if it is produced that year but not in 1989. A product is dropped in 2003 if it was produced in period 1989 but not in 2003. We compute these figures only for surviving firms, so that the analysis focuses on product mix changes at incumbents.

We graphically summarize the findings from GKPT (2010c) in Figure 2. The figure indicates several interesting patterns. First, 53 percent of firms report adding a product over the sample period. This figure is mostly comprised of the firms that only added a product (45 percent) as opposed to firms that both added and dropped products (8 percent). Thus, a majority of firms added products during the 1990s. Moreover, this finding is not driven by the activity of (initial) multiple-product firms. While 59 of multiple-product firms added at least one product, 47 percent of single-product firms also added a product between 1989 and 2003.

[1] GKPT (2010c) provides an extensive analysis of the cross-sectional properties of these firms, such as the skewness of the distribution of sales within firms and correlations between intensive and extensive margins.

The second striking feature of Figure 2 is that very few firms report dropping products. So while the majority of firms report adding a product, only 13 percent (5 percent that drop only and 8 percent that add and drop) dropped a product during the sample.

The prevalence of product additions and lack of product deletions stands in sharp contrast to the activity of U.S. firms. According to Bernard et al. (2010), 39 percent of U.S. firms report adding a product between 1987 and 1997 while 40 percent report dropping a product. The numbers for the U.S. suggest significant product churning. The numbers for India, however, suggest a much greater likelihood that firms add a product to their production line, but only rarely report any removal of products. Thus, there is far less product churning in India during roughly the same time period.

The lack of product dropping may seem puzzling in light of recent open-economy multiple-product firm models (Bernard et al. (2006), Eckel and Neary (2010)). In these models, trade liberalization causes firms to rationalize their product scope and focus on their "core competences". Here, we observe a substantial fraction of firms adding products, with little product dropping, during a period that coincides with the trade reform. We note that these models are not necessarily inconsistent with our findings. In these models, trade liberalization does not provide a beneficial shock to firms in the form of cheaper inputs which could offset the competitive effects of tariffs. In the next section, we provide convincing evidence that intermediate inputs were a prominent feature of India's trade reform.[2]

The products that firms added had a large contribution to their overall output growth and are therefore important to understanding the dynamics of firm behavior over this period. To understand how products contributed to firm growth, we decomposed total output growth (across a constant set of firms) according the growth on incumbent products (intensive margin) and growth from new products added over the period (extensive margin). This decomposition illustrates relative contribution of each margin.[3] The last row of Table 1 reports the results across all industries (GKPT [2010c]). Manufacturing output among these firms grew approximately 200 percent over the sample. About 25% of this growth is attributed to new products introduced at the firm-level, while

[2] We refer the reader to GKPT (2010c) for a more detailed discussion of the reasons that India is characterized by a lack of product dropping compared to the U.S.

[3] We could also include the contribution of firm entry and exit by focusing on all firms rather than the firms that existed in 1989 and 2003. However, Prowess is not well suited for measuring the firm extensive margin because firm entry into the database is not an indication that the firm is new.

the remaining can be explained by growth among existing products.[4] Thus, the new products added by firms accounted for nearly one-quarter of manufacturing output growth. This is a sizable contribution of the product extensive margin.

The overall figures of course mask heterogeneity across industries. We extend the analysis from GKPT (2010c) and explore the importance of product extensive margin by sector. The top rows of Table 1 provide the product extensive margin contribution by sector. The industries in which new products contributed the most to growth were electrical machinery, chemicals, medical instruments, food and fabricated metal products. In each of these industries, new products contributed to *more than half* of the output growth. It is intuitive that these industries would experience rapid growth in product expansion because India's industrial policy sought to protect capital-intensive industries which often lead to deficient quality and supply shortages of intermediate inputs. This in fact is precisely the complaint of the Chairman of Metal Box Company case discussed in the introduction. His firm was unable to introduce new types of fabricated metals, such as beer cans and tinplate aerosol cans simply because of constraints on inputs supplies. The results here suggest frictions in introducing new products were alleviated during the 1990s, particularly in certain industries. In subsequent sections, we demonstrate that the trade reform is an important reason for why product scope expanded during this period.

In sum, the raw data highlight extensive product additions during the period of the reform, and these new products had an important contribution to overall growth during this period.

3. India's Trade Liberalization and Imported Production Inputs

3.1 Trade Liberalization Background

In this section, we briefly discuss the events surrounding India's liberalization of foreign trade. For a comprehensive discussion, as well as an extensive discussion of India's other market reforms (e.g., delicensing, privatization and foreign direct investment), we refer the reader to comprehensive analysis by Panagariya (2008).

After achieving political independence in 1947, India instituted a series of policies designed to achieve economic "independence". Central planners used a series of instruments to allocate

[4] It is important to remember that the product extensive margin is a firm-level concept. So a new product is a product that is new to the firm, not necessarily to the entire economy. If we include entering firms into this calculation, total output grew approximately 350 percent. This number is similar to the overall growth in output according to the ASI between 1989 and 2001 which is about 318 percent.

resources to targeted sectors and prevent unnecessary redundancies in production. Reflecting the attitude of the time, India's first Prime Minster Jawaharlal Nehru once quipped, "Why do we need nineteen brands of toothpaste?" (Khandelwal [2009]). The government instruments included controls on credit provision, prices, and foreign exchange, as well as a system of government monopolies, licensing restriction (often referred to as the "License Raj") and trade barriers.

India's trade regime was among the most restrictive in Asia, with high nominal tariffs and non-tariff barriers (Aksoy, 1992) Not only were imports of final goods restricted, but there were high tariffs on imported inputs. Certain intermediate goods were banned outright, restricted by import licenses controlled by the government. India's tariffs on intermediates were also much larger than other economies at similar levels of economic development at the time.[5]

In the aftermath of a balance-of-payments crisis in 1991, India launched a liberalization of the economy as part of an IMF adjustment program. An important part of this reform was to abandon the extremely restrictive trade policies.[6] Average tariffs fell from more than 87 percent in 1990 to 35 percent by 1997 and input tariffs fell 31 percent to 11 percent; non-tariff barriers (NTBs) also fell from 87 percent in 1987 to 45 percent in 1994 (Topalova and Khandelwal [2011]). The extent of the liberalization varied according to final and intermediate industries with tariffs and especially NTBs declining at a later stage for consumer goods.[7] In Section 4, we discuss in detail features of the trade reform that are important for our analysis.

3.2. Trade Liberalization and Imported Inputs

In this subsection, we document the changes in imports over the course of the reform period and discuss the key sources of import growth. The discussion, which summarizes the analysis conducted in GKPT (2010b), will highlight that a significant fraction of the growth in imports was concentrated in products classified as production inputs.[8] Moreover, within the surge in trade in inputs, the growth was driven primarily by new types of products (and mostly originating from

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[5] "Plain Tales of the License Raj," *The Economist*, May 4, 1991.

[6] The structural reforms of the early 1990s also included a stepped-up dismantling of the License Raj, the extensive system of licensing requirements for establishing and expanding capacity in the manufacturing sector, which had been the cornerstone of India's regulatory regime.

[7] See Panagariya (2004) for a more information on final goods liberalization.

[8] Mukerji (2009) has also documented the growth of the import extensive margin in the case of India. Her analysis is likely to underestimate the importance of new varieties since she documents the extensive margin at the industry-level rather than product-level.

OECD countries) that were not previously imported prior to the reform. The underlying analysis relies on HS-level import data obtained from Tips Software Services.[9]

In GKPT (2010b), we document the growth of total (real) imports into India during the late 1980s and 1990s. The results of that analysis are graphically depicted in Figure 3. The first column depicts the growth in overall imports between 1987 and 2000 and shows that real imports grew 130 percent.[10] Given our focus on the importance of imported inputs for Indian firms, we differentiate imported products by their end use. The total import growth is a weighted average of the growth in final products and products that India firms use as production inputs, consisting of basic, capital, and intermediate product. We classify products into these end use groups using classification from Nouroz [2001]).[11] Columns 2-5 depict the growth in imports of these subgroups. Interestingly, the overall import growth was dominated by increased imports of imported inputs rather than products for final consumption. While imports of final products increased substantially (by 90 percent), increases in imports of production inputs were even more drastic: imports of basic products expanded by 260 percent, imports of capital goods by 125 percent, and imports of intermediate products by 297 percent. These numbers highlight that India's import growth during the 1990s was driven predominantly by imports of components required for production as opposed to final goods.

Further analysis suggests that the vast majority of this import expansion can be attributed to increased trade in products that India did not previously import. We define a product as a 6-digit category in the Harmonized System (HS6) and decompose the growth in imports into contribution of two margins: growth in HS6 products that were previously imported (intensive margin) and growth in products that India did not import in the previous period (extensive margin). We further decompose the product-extensive margin by OECD and non-OECD countries, so that the total effect of the product-extensive margin is obtained by adding up the OECD and non-OECD components.[12] The results of this decomposition are graphically depicted in Figure 4. We normalize each of three margins' contribution by the total growth from Figure 3, so the three margins sum to 100 percent.

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[9] Please see data appendix for details.

[10] Nominal imports, inclusive of tariffs, grew 516 percent over this period. Excluding tariffs, real and nominal import growth was 228 and 781 percent, respectively. The reason the growth numbers excluding tariffs are higher is because tariffs were very high prior to the reform.

[11] Nouroz (2001) assigns each code of India's IO matrix into one of these groups and then links these codes to the four-digit product codes of the Harmonized System (HS4). While some products can obviously be used simultaneously as production inputs and final outputs (for example, computers), the most common use of many products often justifies this end use distinction.

[12] The group of countries that we call OECD includes all OECD members and Hong Kong, Taiwan, and Singapore.

The first feature that emerges from Figure 4 is that the relative contribution of the extensive margin accounted for almost 64 percent of the overall import growth (column 1). In our earlier work, we have shown that during this period India started importing previously non-traded products, but did not stop importing many existing foreign products (see GKPT [2010b]). The lack of product dropping likely reflects India's restrictive trade regime, which hindered ability of India's firms and consumers to import products from abroad. Once restrictions were lifted, previously unavailable products flooded India's domestic market. The second feature that emerges from Figure 4 is that the role of extensive margin was substantially larger in imported inputs than in final consumer goods. New imported products accounted for about 59 percent of import growth in basic products, 30 percent in capital products, and 93 percent in intermediate products.[13] Notice also that the relative importance of extensive margin is smaller in final goods; the extensive margin accounted for 37 percent of the growth in imports, while the intensive margin contributed 63 percent of the growth. This difference could in part be due to the fact that non-tariff barriers on final goods were liberalized later.

The third feature that emerges from Figure 4 is that the new products were predominately sourced from OECD countries. In a developing country context, there is often a belief that imported inputs are of higher quality than domestic inputs. We have indirect evidence that supports this hypothesis. Kugler and Verhoogen (2008) show that within narrowly defined product categories, inputs imported inputs tend to have higher unit values than domestically produced products. This claim might be potentially most defensible for imports of inputs from OECD countries: products produced in OECD countries tend to be R&D intensive and of higher quality. Eaton and Kortum (1995), for example, show that 7 OECD countries account for a vast majority of all R&D intensive goods that are then exported worldwide. Schott (2004) and Khandelwal (2010) further show that within narrowly defined product categories, imports from high-income and capital abundant countries tend be associated with higher unit values and higher quality. This could in part reflect higher quality of imported inputs. Within each product category, we decompose changes in imports into growth driven by imports stemming from OECD and non-OECD countries (e.g., country-product pairs). All columns of Figure 4 illustrate that the majority of the growth in the new

[13] See GKPT (2010a) for decompositions of specific input sectors.

imported products was driven by imports from OECD countries, which given the evidence, suggests imports of relatively higher quality.

The import decompositions indicate that while there is a pro-competitive effect of trade resulting from increased competition (e.g., Krishna and Mitra [1998]), Indian firms appear to have easier access to imported inputs in the period after India's trade liberalization. This easing occurred through higher volumes, new varieties and probably higher quality goods.

The decomposition figures are useful for illustrating broad patterns in the underlying sources of Indian import growth. While suggestive, the analysis does not establish a causal link between declines in import tariffs and the sources of import growth. GKPT (2010b) conduct a detailed regression analysis after linking the import data with the India's tariff schedule at the 6-digit Harmonized System classification. Trade theory predicts that declined in import tariffs should increase total volume of imports and reduce the price of imported goods in India. The study further shows the usual benefits of trade liberalization in lowering domestic prices of imported goods. Lower tariffs are associated with declines in unit values of existing product lines. Finally, lower tariffs were also associated in increase in imports of new varieties. Consistent with the findings in Figures 3-4, these responses were especially pronounced for imported inputs, providing direct evidence that trade liberalization eased access of Indian firms to important production components.

3.3 Firm-level Intermediate Input Use

The above discussion illustrates that after the trade liberalization, Indian firms on average purchased imported inputs at a cheaper price and expanded the range of imported inputs in production. In principle, these aggregate figures should be observed in the micro firm-level data as well. However, there are caveats to analyzing firm-level import usage in India. There are four main reasons why analyzing product-level import data, as opposed to firm-level data, is appropriate for documenting firms' access to new imported inputs in our setting.

First, we are limited by data constraints on our ability to analyze the range of imported inputs in firm-level datasets for India. Custom-level transaction data by firm and product are not available during the period of India's trade reform. Neither Prowess nor ASI contains comprehensive information on imported inputs during this period either. Second, firm-level total imports, which we do observe, confound price and quantity information. Third, many firms do not

directly import inputs on their own and instead rely on intermediaries. Finally, there is potential measurement error in any firm's reported imported input usage since this requires that the firm know the origin of its inputs. This last point may be particularly problematic in industries where firms do not require highly specialized inputs for production, but instead require production inputs such as computers, power looms or communication devices.

Nonetheless, we use this section to document firm-level imported input usage using several sources of data. For each data source, we offer caveats to interpreting the results and this serves to re-enforce our strategy of identifying the expansion of imported inputs at a more aggregate level as we did in the previous section.

Prowess records some firm-level information on total imports that we can analyze. A measure of total imports spending is less than ideal in this context because we discussed in Section 3.1 that imported input prices fall. The price declines will tend to dampen the overall measure of imports based on total costs. Total imports could therefore fall even if firms start to import more. It would be more ideal if we could separately observe prices and quantities of product-level imports, but this information is either unavailable or of poor quality in Prowess.[14]

Our measure for imports is firms' spending on foreign exchange. This is an imperfect measure of imports because it includes any expense incurred by the firm in a foreign currency (e.g., interest payments, royalties, traveling expenses. In 1995, 81% of the firms report no imports; this figure is high because it includes many types of foreign expenses (and because Prowess contains relatively large firms).[15] However, the unconditional median import share of sales is only 4.7% and only 8% conditional on firms that import. Despite this imperfect measure of total-firm level imports, we examine the relationship between firm-level imports and input tariffs. We regress (the log of) imports on input tariffs, input tariff interacted with whether a firm size is above the size of the median firm and firm and year fixed effects.[16] The results are reported in columns 1-2 of Table 2. For relatively larger firms, total imports expand relatively more in industries that experienced larger declines in input tariffs. The coefficient for small firms is positive, which is counterintuitive,

[14] In 1995, product-level information on inputs is missing for 1,472 out of 1,934 firms. Of the 462 firms for which information exists, it poorly matches the firm-level raw material information that exists in a separate module in Prowess. On average, the sum of the product-level raw material values only accounts for 69% of the reported expenditure on raw materials. This poor quality is in stark contrast to the quality of the product-level production data (see GKPT [2010c]).

[15] 61 percent of firms report imports of raw materials and 42 percent report imports of capital goods.

[16] We use information from the first year of the sample to compute a measure of firm size and median.

but recall that the total import measure includes any expense in foreign currency. In columns 3-4, we report the same regression results using foreign spending on raw materials as the dependent variable. Here, we observe no statistical relationship for small firms, but large firms increased their direct imports of raw materials in response to lower input tariffs.

One shortcoming of Prowess is that also do not comprehensively observe how the range of inputs changed; that is, we cannot separate the extensive and intensive margins of firm imported product use as we were able to do using the product-level data in Section 3.1. We therefore complement our firm-level analysis with information from the ASI. The ASI began collecting usage of imported inputs after 1997, so we cannot observe firm-level information on the range of inputs during the main period of the reform. We also cannot track input changes over time because the ASI is not a panel. However, since we directly observe comprehensive information on input scope in these data, we can compare the relationship between declines in input tariffs and input and imported input scope across industries. Only 10 percent of ASI plants report positive imported input use in this period; this figure is similar to Chilean firms (Kasahara and Rodrigue 2005).

Table 3 illustrates the results of running a plant-level regression of the number of inputs and imported inputs on the industry changes in input tariffs between 1997 and 1989. The regression clusters by industry and uses the sampling weights. We observe a very strong, statistically significant and negative relationship between input tariff changes and average inputs per firm. This implies that in industries with larger declines in input tariffs, plants were using more inputs, and especially imported inputs in 1999. That is, the plants that experienced the largest input tariff cuts had the largest extensive margin of inputs. Since these correlations are based on a levels-on-change-specification, we are cautious about their interpretation. However, we feel that they are suggestive that the input tariff liberalization led firms to use a broader range of inputs. This is not surprising given that we observe such a large expansion of imported varieties in the customs data.

Despite the evidence from these two datasets on increased imports, we believe the product-level analysis in Section 3.1 which determines the intensive and extensive product margins of imports is the correct level of disaggregation for India's context. The reason, quite simply, is that because the trade regime was previously so restrictive, we observe a large fraction of *new* products entering the economy during this period. Our data clearly show that many products or varieties were not imported by *any* firm prior to the reform. Thus, we can say with confidence that the large increase in the extensive margin reflects firms using new inputs previously, as opposed to new firms

adopting imported inputs that other Indian firms already used in their production process. These new inputs must have been imported by *someone*, be it directly by a firm in our sample or an intermediary/wholesaler.

Another advantage of our data is that it captures *all* imports and not just imports that firms directly obtain from abroad, Imports by wholesalers cannot be identified in conventional data sources such as Prowess and ASI. While customs data that record firm-product transactions provide information on the intermediary/wholesaler that imports, they do not identify the final firm that uses the product in its production.[17] Given that firms use middlemen, conventional firm-level surveys will undercount the total value and fraction of firms that use imported inputs, as well as the timing of when firms begin to import.

We attempt to provide some evidence that Indian firms make use of these intermediaries to source inputs. To our knowledge, the World Bank Enterprise Survey is the only database that provides firm-level information on the use of intermediaries. The data asks firms about the channel through which they obtain imported inputs. A firm can either directly import the input or *indirectly* import the input through an intermediary. Specifically, the survey asks: "What percentage of your establishment's material inputs and supplies are i) purchased from domestic sources, ii) imported directly, iii) imported indirectly (through a distributor)." Out of 2,037 (manufacturing) firms, 12 percent import materials. Of the firms that import materials, 56 percent import directly, 40 percent import through a distributor, and the remaining 4 percent obtain imported materials through both channels.

Ahn et al. (2010) provide theoretical and empirical evidence that less-productive firms are likely to use intermediaries because it allows firms to avoid directly paying the costs of trade. We look for this pattern in the Indian data by plotting the share of indirect and direct imports of inputs, conditional on using any imported inputs, against firm size (measured as the log of total reported sales). The figure therefore illustrates the relationship between mode of import and firm size, conditional on reporting use of any imported input. The results are presented in Figure 5. The blue line denotes indirect shares, red is direct imports. The reliance on direct imports increases with firm size relatively monotonically, while the indirect imports increase with firm size up to a point and then

[17] While we do not have the figures for India, Ahn, Khandelwal and Wei (2010) report that about one quarter of China's imports were through intermediaries in 2000.

declines. This suggests that smaller and potentially less-productive firms are more likely to use intermediaries and is consistent with Ahn et al. (2010).

The findings across these three datasets offer evidence that there was an expansion of imports in terms of scope and value (for large firms) for firms in industries that experience the largest tariff cuts. This is consistent with the findings based on the analysis of total product-level imports in section 3.1. However, there are caveats to interpreting each of the firm-level results because of limitations on data (for instance, not having a panel of firms that report its imported input scope). Firms, especially small and less-productive firms, often use intermediaries to source their inputs and this will not show up in conventional datasets. For instance, it will not show up as a foreign exchange expense if the firm pays the intermediary in local currency. Perhaps most importantly, it could easily be that firms themselves do not know which of their inputs are foreign. This will depend on the firm and the industry, but for many inputs, such as computer machines and peripherals, firms may not recognize that the input itself is an import. Thus, unlike output products, firms may have a fuzzier idea of their input scope.

This discussion of data limitations with firm-level imported inputs for the case of India sto justifies our reliance on product-level imports that aggregate across firms' imports to understand the growth and composition of India's imports following the reform.

4. Variety In, Variety Out

4.1 Imports and Domestic Product Growth

We can easily summarize the facts generated from the previous two sections: "variety in, variety out". That is, from the viewpoint of the external economy, the 1990s were characterized by increased access of intermediate inputs. Inputs became cheaper as tariffs fell, but also firms started to import new types of inputs which were previously unavailable under the restrictive trade regime. As the tariff barriers fell, new varieties entered the economy. Second, the domestic production data indicates that a large fraction of firms began to introduce new products during this period. More than half of the firms introduced at least one new product, and these products contributed to nearly a quarter of the manufacturing output growth. In some industries, the contribution of the extensive margin exceeded 50 percent. So in addition to the flood of varieties entering the economy, there was simultaneous expansion of domestic varieties manufactured by domestic firms.

In this section, we examine if the two facts are connected. That is, did increased access to intermediate inputs causally lead to the introduction of new varieties at the firm level? Endogenous growth models have long proposed this "variety in, variety out" story of economic development. While neo-classical trade models predict a one-time gain from trade as a country moves from autarky to trade, endogenous growth models predicted that trade could also affect the steady-state growth rate of any economy. This occurs when international trade expands the range of intermediate inputs, and these new inputs are used in the creation of new products.

Reduction in India's input tariffs affected a firm's decision to introduce a new product in two ways. First, the input tariff reductions lower the prices of existing imported inputs. Second, liberalization leads to the import of new varieties. Lower prices imply that higher variable profits and raises the likelihood that a firm can manufacture previously unprofitable products. The significance of this second channel will depend on the particular form of the production technology. In particular, it depends on the substitutability between domestic and imported inputs and substitutability across imported varieties. Take an extreme example of Leontief production technology where a certain intermediate input is essential. Output falls to zero if this input is unavailable. In this case, trade liberalization has large impacts on product scope because it relaxes technological constraints facing domestic firms. At the other extreme, if new imported inputs are perfect substitutes for domestic inputs (or previously imported inputs), there would be no effect through the extensive margin of imports.[18]

The overall effect of the trade reform on product scope is therefore ultimately an empirical question. However, isolating the microeconomic mechanisms in the endogenous growth models is empirically challenging. First, it requires very detailed data. As we discussed earlier, we have precisely the data on firm scope required to test the predictions of the model during the relevant time period. Second, one can easily imagine finding a correlation between imported inputs and domestic product growth if other factors, such as productivity or demand shocks, cause firms to introduce new products. Firms could subsequently start to import inputs to sustain their production. This reverse causality concern is difficult to disentangle without a source of exogeneity that can isolate which phenomenon occurs first.

[18] Intermediate inputs could also lower the fixed costs of production.

Fortunately, India's trade liberalization provides an unusually clear lens to test the causal story that imported inputs lead to domestic product growth.

First India's trade liberalization came as a response to the balance of payments crisis and was therefore a sudden shock. The conditions of the trade reform were set out under conditions mandated by the IMF in return for loans (Hasan et al. [2007]). Moreover, the reforms were also were passed quickly with little debate or analysis to avoid the inevitable political opposition (Goyal [1996]). This means that the tariff liberalization can be viewed as exogenous from the perspective of the firms and alleviates potential endogeneity of the trade reforms. For instance, industries that were growing rapidly in terms of output, product scope, productivity, etc, may have had less of an incentive to keep tariffs high. However, in GKPT (2010b) and Topalova and Khandelwal (2011), we demonstrate that this was not the case. The changes in tariffs were uncorrelated with many measures of firm and industry outcomes prior to the reform. As discussed in Topalova and Khandelwal (2011), a guiding feature of the tariff reduction was a harmonization of tariff lines across industries: industries with the highest tariffs received the largest tariff cuts. This also implies that some industries received larger tariff cuts than others, and we exploit this heterogeneity in tariff declines across industries.

Following an election in 1997, Topalova and Khandelwal (2011) find evidence that tariffs after 1997 changed in ways that were correlated with firm and industry performance in the previous years. This indicates that unlike the initial tariff changes following the reform, after 1997, tariff changes were subject to political influence. This concern leads us to restrict our analysis in this paper to the sample period that spans 1989-1997.

4.2 Main Results

In GKPT (2010b), we estimate the overall impact of the trade liberalization on product scope by relating the changes in product scope, at the firm level, to changes in input tariffs. We estimate the following equation:

$$\ln\left(n_{it}^{q}\right) = \alpha_i + \alpha_t + \beta\tau_{qt}^{\text{inp}} + \varepsilon_{it} \tag{1}$$

where n_{it}^{q} is the number of products manufactured by firm *i* operating in industry *q* at time *t*, and τ_{qt}^{inp} is the input tariff that corresponds to the main industry in which firm *i* operates.[19] This regression also includes firm fixed effects to control for time-invariant firm characteristics, and year

[19] Please see data appendix for the details on how input tariffs were constructed.

fixed effects to capture unobserved aggregate shocks. The coefficient of interest is β which captures the semi-elasticity of firm scope with respect to tariffs on intermediate inputs. Standard errors are clustered at the industry level.

Table 4, which is reproduced from GKPT (2010b), presents the main results in column 1. The coefficient on the input tariff is negative and statistically significant: declines in input tariffs are associated with an increase in the scope of production by domestic firms. The point estimate implies that a 10 percentage point fall in tariffs results in a 3.2% expansion of a firm's product scope. During the period of our analysis, input tariffs declined on average by 24 percentage points implying that within-firm product scope expanded 7.7 percent. Firms increased their product scope on average by 25 percent between 1989 and 1997, so our estimates therefore imply that declines in input tariffs accounted for 31 percent of the observed expansion in firms' product scope.

Table 1 reported that the product extensive margin accounted for 25 percent of India's manufacturing output growth during our sample. If India's trade liberalization impacted growth only through the increase in product scope, our estimates imply that the lower input tariffs contributed 7.8 percent (.25*.31) to the overall manufacturing growth. This back-of-the-envelope calculation suggests a sizeable effect of increased access to imported inputs for manufacturing output growth. Moreover, it is likely to be a lower bound as input tariffs are likely to have affected the intensive margin as well.

Readers familiar with India's economy policies during this time period are aware that the trade liberalization coincided with additional market reforms. In the remaining columns of Table 4, we control for these additional policy variables so that we can isolate the effects of tariffs vis-à-vis other policies. Column 2 includes output tariffs to control for pro-competitive effects associated with the tariff reduction. The idea behind this control is related to recent models of how trade liberalization affects multiple-product firms (Bernard et al. (2006), Eckel and Neary (2010)) that we discussed above. The coefficient on output tariffs is not statistically significant, while the input tariff coefficient hardly changes and remains negative and statistically significant.[20]

In column 3, we include a dummy variable for industries delicensed (obtained from Aghion et al. [2008]) during our sample, and the input tariff coefficient remains robust. Finally, column 4 includes a measure of FDI liberalization from Topalova and Khandelwal (2011). The coefficient

[20] We refer the reader to GKPT (2010c) for a more extensive discussion of this finding and its relationship to trade models with multiple-product firms.

implies that firms in industries with FDI liberalization increased scope, but the coefficient is not statistically significant. The input tariff remains negative and significant, indicating that even after conditioning on other market reforms during this period, input tariff declines led to an expansion of firm product scope.

We can use these estimates to compare the predicted change in firm scope due to the input tariffs with actual changes by sector. In Table 5, we report the average change in product scope in the raw data for a constant set of firms in 1989 and 1997. As we saw earlier, there is heterogeneity across industries, but the average increase in firm scope was on the order of 42 percent (this is lower than growth in Figure 1 since that figure reports firm scope through 2003). In column 2, we report the average change in input tariffs by sector. Average input tariffs declined about 23 percent between 1989 and 1997 and again this ranged across sectors: input tariffs fell only 10.5 percent for tobacco products but fell nearly 34 percent for apparel. The third column multiplies the change in input tariffs in column 2 with the point estimate in column 1 of Table 4. This provides the average change in firm scope exclusively due to the decline in input tariffs. Column 4 divides column 3 by column 1 to show the percentage of the overall scope change that can be attributed to input tariffs alone. We can see that input tariffs accounted for about 15-20% of the growth in firm scope for chemicals, fabricated metal products, electrical machinery, but a lower fraction for medical equipment. The remaining fraction of overall growth can be attributed to general economic growth, which picks up during this period, and factors unexplained by either input tariffs or year fixed effects.

These results indicate that input tariffs causally increased firm product scope, as predicted by endogenous growth models. We demonstrate that the relationship is robust to controlling for additional industrial policies, and in GKPT (2010b) we perform a number of sensitivity results that control for various types of preexisting trends. The fact that the results are robustness to controlling for trends reinforces the fact that India's trade liberalization came as a surprise to Indian firms. Once the tariffs were slashed, firms re-adjusted their product mixes to reflect the new economic environment. Moreover, we also show that lower input tariffs affected firm TFP (Khandelwal and Topalova (2011)) and firm-level research and development expenditure. In addition to firm scope, these two findings are also consistent with endogenous growth theory.

One implication of the "variety in, variety out" model is that firms actually increase the range of inputs used in response to tariff cuts. Unfortunately, as discussed in section 3.3, due to

data limitations we cannot check this prediction with Prowess data nor in a time-series with ASI data. The product-level information on inputs within Prowess is only available for a small subsample of firms, only covers information on imported raw materials (and not all intermediate inputs) and is very incomplete. The ASI started collecting comprehensive information on products after 1997, so that we do not observe the firm-level information on the range of inputs during the period of our study. ASI is also not a panel, so we cannot track product changes over time. Nontheless, as we discuss in section 3.3, when we relate number of imported products used by ASI firms in 1999/00 to input tariff changes between 1997 and 1989, we find a very strong, statistically significant and negative relationship between input tariff changes and average inputs per firm. Industries that experienced the largest input tariff declines during the reform had a large input extensive margin in 1999. We observe a similar relationship for imported input usage. Since these correlations are based on a levels-on-change-specification, we are cautious about their interpretation. However, they are suggestive that the input tariff liberalization led firms to use a broader range of inputs. Again, this is not surprising given that we observe such a large expansion of imported varieties in the customs data.

We note that while this framework provides an overall assessment of the relationship between input tariffs and scope, it cannot disentangle the price and variety channels discussed above. This decomposition requires far more structure on firms' production functions and is beyond the scope of this chapter, but we note that in previous work (GKPT [2010b]), we have conducted an extensive analysis on this issue and found that the input variety channel was the dominant source for the increase in firm scope.[21] This further lends support for the "variety in, variety out" theory.

4.3. Heterogeneous Effects of Input Liberalization

Studies have documented large differences in output growth across Indian states (Kochhar et al. [2006]) and these differences have been in part explained by differences in institutions that govern labor relations, finances, and infrastructure across Indian States. For example, Besley and Burgess (2002) find lower output and investment in registered manufacturing in Indian states that passed pro-worker amendments to Industrial Disputes Acts.

These institutional differences might also affect how firms adjust to deregulation or trade policy. For example, Aghion et al. (2008) find that in response to dismantling of the license raj,

[21] Our methodology to decompose these channels is based on Feenstra (1994) and Broda and Weinstein (2004).

industries improved productivity more in states with pro-worker amendments to the Industrial Disputes Act. Hasan et al. (2007) find that trade reform increased sensitivity of industry employment to price shocks more in states with more flexible labor laws. It is possible that firms' ability to incorporate cheaper and greater variety of imported inputs into its production process and expand its product scope. For example, a firm located in a state where labor market regulations precludes it from reorganizing its production lines or where low financial development makes it difficult to secure financing, might be less likely to introduce a new products that takes advantage of increased access to cheaper and greater range of imported inputs.

In order to investigate this issue, we replicate the analysis from column 1 of Table 4 to examine the benefits of lower input tariffs varied across industries or states. We augment the specification in equation (1) by interacting input tariffs with measures with state-level investment climate measures. We consider four measures: level of financial development, geography, road networks, and labor market regulations. Table 6 presents the results. We first look for heterogeneous impacts depending on whether or not the industry had been delicensed by 1988. The idea is that industries that were delicensed earlier are more likely to benefit from input tariffs. Column 1 reports a negative coefficient on the interaction suggests that firms in industries that were deregulated earlier increased product scope more than industries that were delicensed after 1991. However, the coefficient is not statistically significant. Column 2 considers difference between states according to their level of financial development.[22] We identify the state of the headquarter office to determine the location of the firm. Again, while firms in financially developed states are more likely to add products, these effects are not statistically significant. In columns 3 and 4 we consider the role of infrastructure. Firms in coastal states might be better positioned to gain access to imported inputs. However, we find no evidence that this matters in column 3. In column 4, we use a (normalized) measure of road networks defined as the percentage of roads that were surfaced (these are taken from Fisman and Khanna (2004)). While the negative coefficient on the interaction of roads with input tariff is negative, suggesting that firms in states with more roads increase product scope by more, this effect is again not statistically significant.

Finally, to explore the potential role of labor market regulations, we classify states according to states according to the strength of their labor market regulations following Besley and Burgess

[22] We compute credit per capita in 1992 and classify states above and below the median level.

(2004)[23]. Note that our measure of labor market regulation is time-invariant. We also find that firm (especially smaller ones) in states with neutral or pro-labor labor market regulation are less likely to add products in response to lower input tariffs, but these results are very imprecisely estimated.

Overall, these results do not provide precise evidence that state level investment climate affects ability of firms to introduce products. However, one should be cautious about interpreting these results. Recall, that Prowess is more representative of medium and large enterprises. These firms might be better positioned to overcome the location specific investment climate concerns. Identifying the location of the firm based on its headquarter may also be imprecise if firms have plants in multiple states. Finally, there may not be enough states within each classification and this could explain why our results are imprecise.

Discussion and Conclusion

This chapter seeks to explain for the rise in the number of products manufacturing by Indian firms during a period which spans trade reforms. A large fraction of domestic Indian firms added new products during this period, and these products contributed a sizable fraction of manufacturing output growth. A key driving force of this phenomenon was imported intermediate inputs. When tariffs fell, firms increased their imports of intermediates from abroad by expanding the range of inputs, as well as capitalizing on cheaper prices. Together, this increased access to imported inputs enabled firms to expand their production lines. Interestingly, we do not find precise evidence that state-level investment climate affects ability of firms to introduce products in response to input tariff cuts. As we discuss in the paper, this last results could simply reflect that medium and large enterprises, which are overrepresented in our data, are better positioned to overcome business climate hurdles.

While our work has focused on a seemingly narrow response—product scope—our results have broader implications for the link between trade reform and economic development. Previous studies have analyzed the impact of lower input tariffs on firm productivity (e.g., Amiti and Konings [2007] and Topalova and Khandelwal [2011]). Estimating firm productivity is difficult given the data that researchers typically have access to. By focusing on product scope, we can cleanly identify one margin of adjustment to lower input tariffs. Moreover, we demonstrate that new products had a

[23] The labor measure is a time invariant variable that classifies states according the cumulative amendments to labor market laws up to 1991. See Topalova and Khandelwal (2011) for this list.

sizable contribution to overall economic output growth. We therefore view our analysis as peering inside the black box of firm productivity and investigating how one component adjusts with trade reform.

The introduction of new products is suggestive that India's trade reform led to dynamic gains as these new products fed into the domestic economy. In addition to providing a window on the adjustment process within firms, our results might thus have broader implications that relate to the literature on trade and growth. Neo-classical trade models emphasize static gains from trade. In the Ricardo and Heckscher-Ohlin models, a country that moves from autarky to trade will experience a one-time gain from trade. The endogenous growth literature as hypothesized, however, that trade could also lead to dynamic gains. For instance, Romer [1987, 1990] and Rivera-Batiz and Romer [1991]) emphasize that importing new varieties can deliver two gains to an economy: a) access to imported varieties will lead to productivity gains initially and b) the resulting growth fosters the creation of new domestic varieties which further contributes to growth. Our results here provide microeconomic evidence consistent with these channels, although we do not explicitly test for changes in steady-state growth.[24] A more detailed study of dynamic gains from trade associated with Indian trade reform remains a topic for future research.

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[24] Related papers by Feenstra, Madani, Yang, and Liang (1999) and Broda, Greenfield and Weinstein (2006) provide evidence that more import varieties lead to more export varieties. In our work, however, we have focused on production data, rather than exports, and make use of a trade liberalization for our identification strategy. Related papers by Feenstra (1994), Broda and Weinstein (2006), Arkolakis, Demidova, Klenow and Rodriguez-Clare (2008), and Klenow and Rodriguez-Clare (1997) also document overall welfare gains from imported varieties.

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Data Appendix

HS-level import data are obtained from Tips Software Services. The data record HS8-level imports from 160 countries 1987 and 2000.

The tariff data, originally reported at the HS6-level, is taken from Topalova and Khandelwal (2011). We use a concordance by Debroy and Santhanam (1993) to aggregate tariffs to the National Industrial Classification (NIC) level, which we use to trace out the impact of changes in tariffs on firm activity.

We obtain India's input-output matrix for 1993/94 from the Ministry of Statistics and Programme Implementation. For each industry, we create an input tariff for that industry as the weighted average of tariffs on inputs used in the production of the final output of that industry. The weights are constructed as the input industry's share of the output industry's total output value. Formally, input tariffs are defined as $\tau_{qt}^{\text{inp}} = \sum_i \alpha_{iq}\tau_{it}$, where α_{iq} is the value share of input *i* in industry *q*.[25] The weights in the IO table are also used to construct the components of the input exact price index.

[25] The IO table includes weights for manufacturing and non-tradeables (e.g., labor, electricity, utilities, labor, etc.), but tariffs, of course, only exist for manufacturing. Therefore, the calculation of input tariffs implicitly assumes a zero tariff for non-tradeables. All of our regressions rely on changes in tariffs over time and not cross-sectional comparisons.

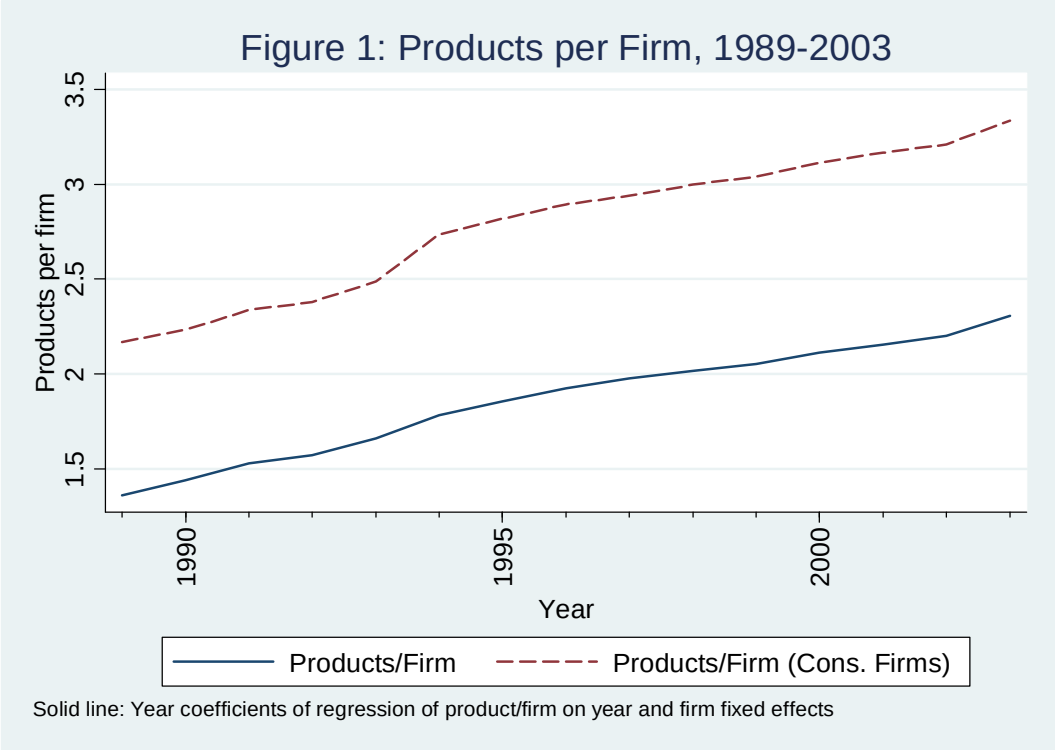
Figure 1: Products per Firm, 1989-2003
Products per firm
1.5
2
2.5
3
3.5
1990
1995
2000
Year
Products/Firm
Products/Firm (Cons. Firms)
Solid line: Year coefficients of regression of product/firm on year and firm fixed effects

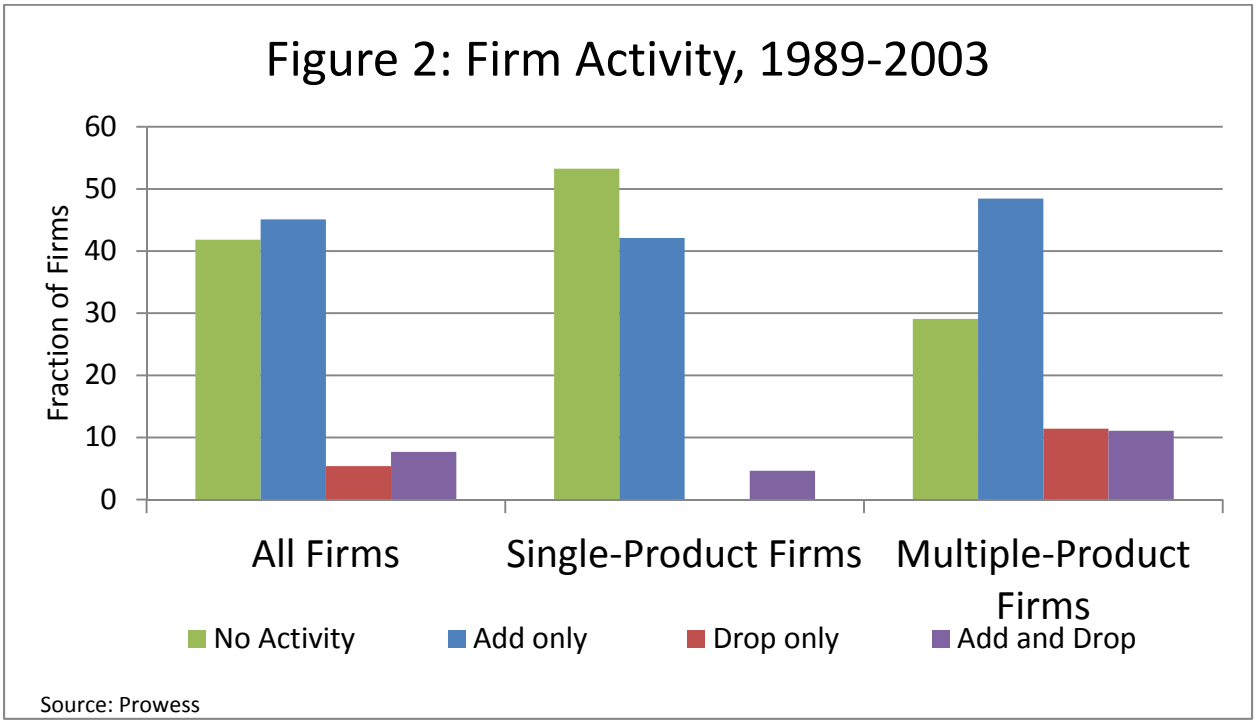
Figure 2: Firm Activity, 1989-2003
Fraction of Firms
0
10
20
30
40
50
60
All Firms
Single-Product Firms
Multiple-Product Firms
No Activity
Add only
Drop only
Add and Drop
Source: Prowess

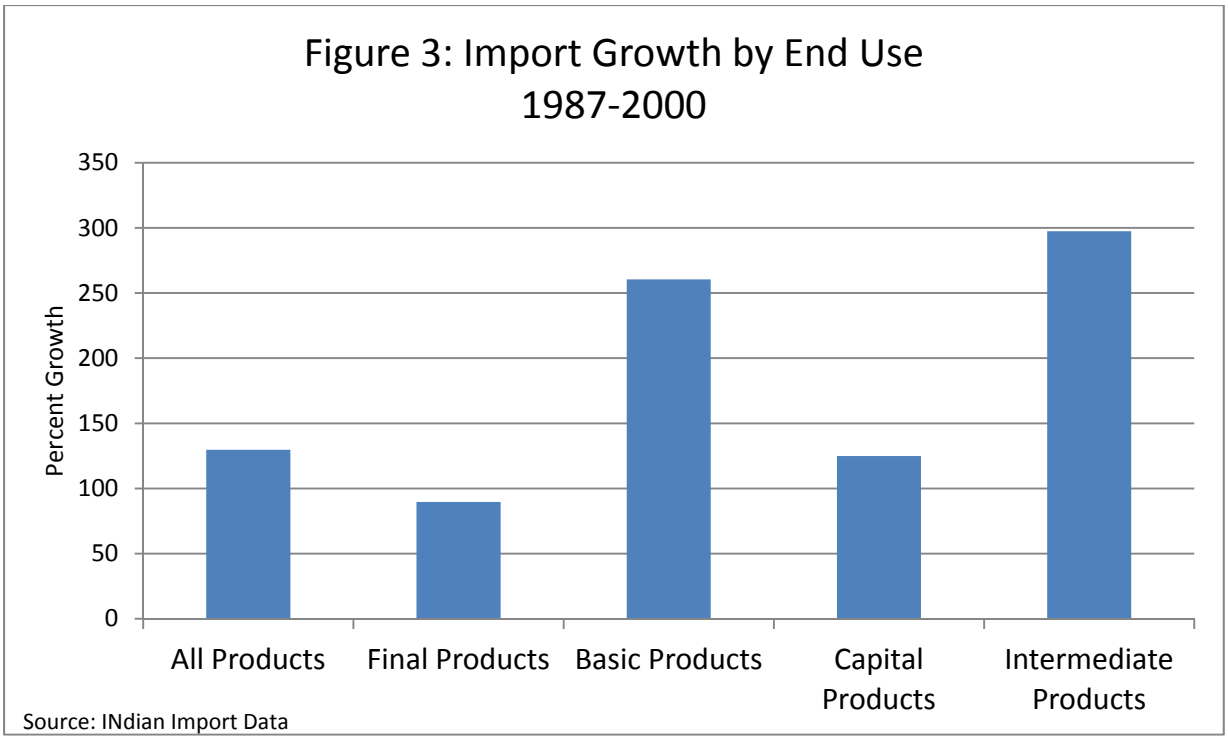
Figure 3: Import Growth by End Use
1987-2000
Percent Growth
350
300
250
200
150
100
50
0
All Products
Final Products
Basic Products
Capital Products
Intermediate Products
Source: INdian Import Data

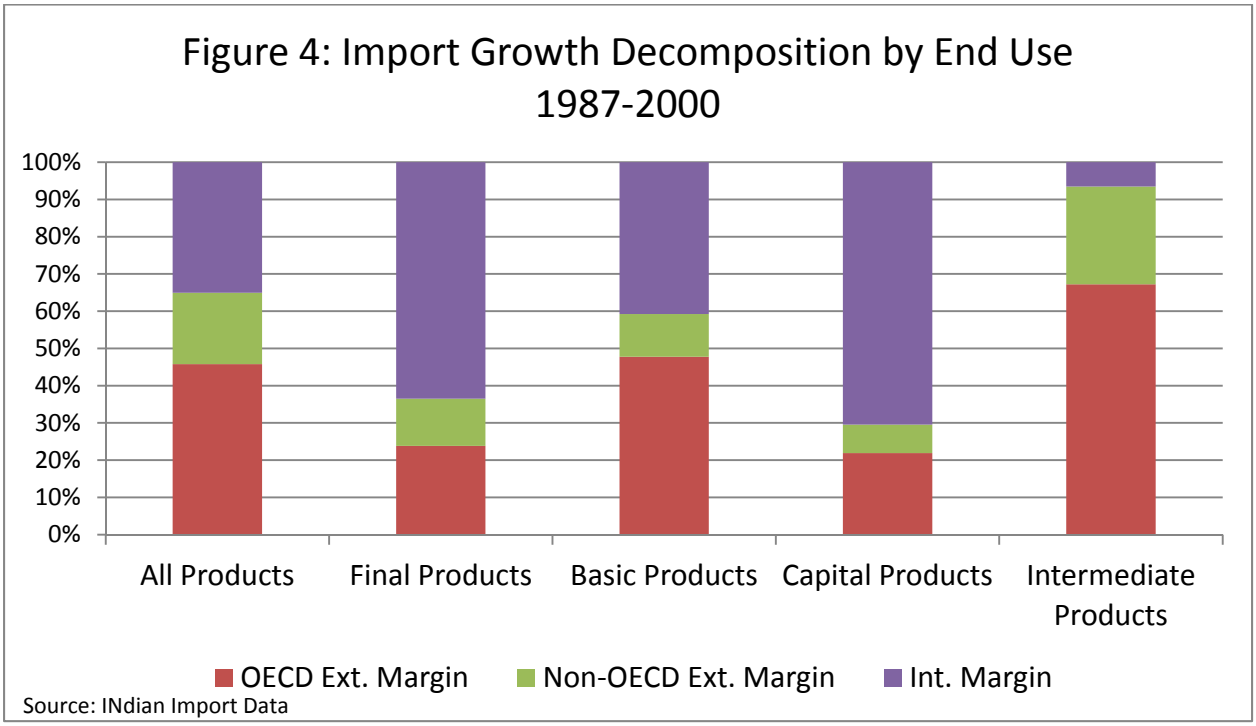
Figure 4: Import Growth Decomposition by End Use
1987-2000
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
All Products
Final Products
Basic Products
Capital Products
Intermediate Products
OECD Ext. Margin
Non-OECD Ext. Margin
Int. Margin
Source: INdian Import Data

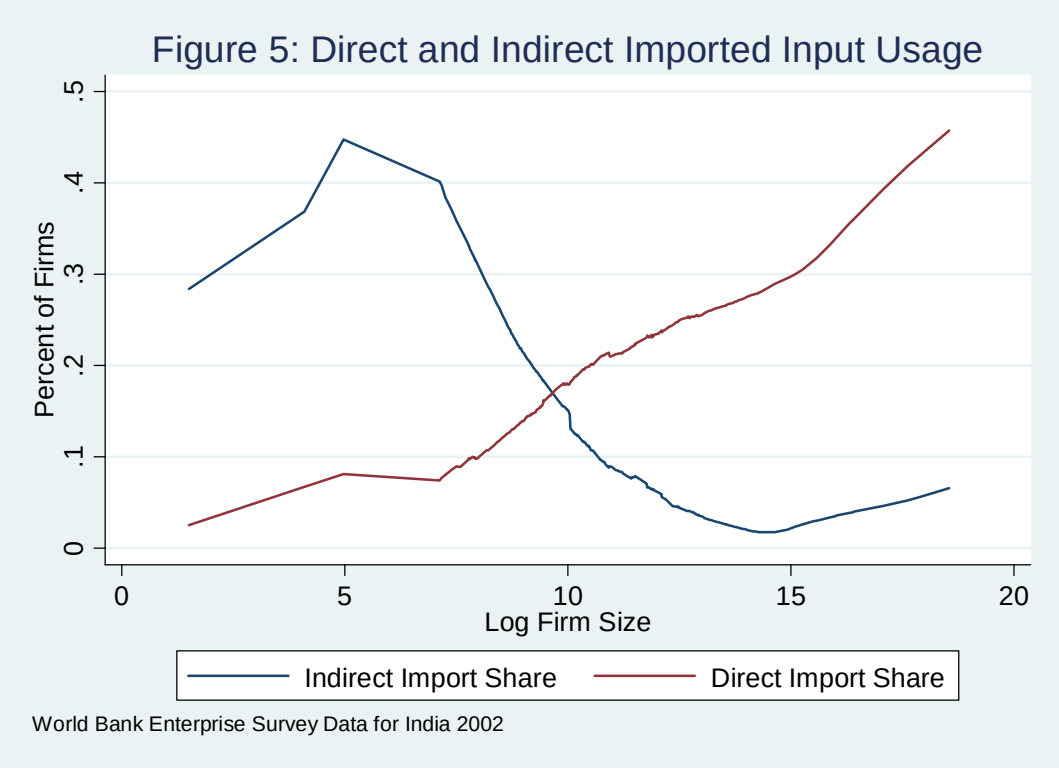
Figure 5: Direct and Indirect Imported Input Usage
Percent of Firms
0
.1
.2
.3
.4
.5
0
5
10
15
20
Log Firm Size
Indirect Import Share
Direct Import Share
World Bank Enterprise Survey Data for India 2002

Table 1: Product Extensive Margin Contribution

NIC Sector	Output Growth (%)	Extensive Margin Contribution
15 Food products and beverages	56	63%
16 Tobacco products	54	17%
17 Textiles	75	43%
18 Wearing apparel	337	0%
19 Tanning and dressing of leather	-2	0%
20 Wood and products of wood	-49	9%
21 Paper and paper products	41	45%
22 Publishing/printing	-59	2%
23 Coke, refined petroleum products	230	1%
24 Chemicals	256	72%
25 Rubber and Plastic	208	9%
26 Non-metallic mineral products	68	17%
27 Basic Metal	342	17%
28 Fabricated metal products	107	56%
29 Machinery/equipment n.e.c.	115	23%
30 Office, accounting and computing machines	183	17%
31 Electrical machinery and apparatus	152	85%
32 Radio, TV and communication	424	19%
33 Medical, precision and optical instruments	588	71%
34 Motor vehicles, trailers	185	4%
35 Other transport	280	21%
36 Furniture	291	18%
Total	198	25%

Notes: Table decomposes aggregate sales growth into contribution of the extensive and intensive product margin within Prowess from 1989-2003. The table reports the output growth of continuing firms. The final row reports aggregate output growth across all industries. The first column reports sales growth and the second column reports the contribution of the product extensive margin. Values are deflated by sector-specific wholesale price indices.
Source: Authors' calculations from the Prowess database.

Table 2: Import Values and Input Tariffs

	(1)		(2)		(3)	(4)	
Input Tariff	-0.060		1.524	***	-0.623	0.727	
	0.487		0.486		0.618	0.602	
Input Tariff X Large Firm	-0.323	**	-2.036	***		-1.734	***
	0.139		0.204			0.186	
Year Effects	yes		yes		yes	yes	
Firm FEs	yes		yes		yes	yes	
R-squared	0.88		0.88		0.86	0.86	
Observations	14,233		14,233		14,233	14,233	

Notes: The dependent variable in columns 1-2 is (log one plus) total foreign exchange spending by the firm. The dependent variable in columns 3-4 is (log one plus) total spending on raw materials. The large firm dummy takes a value of one if the firm averages above median sales over the sample period. All regressions include firm and year fixed effects and are run from 1989-1997. Standard errors clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Table 3: Number of Inputs and Input Tariffs

Change in Input Tariffs	-6.464	***	-1.351	***
	(1.790)		(0.348)	
R-squared	0.03		0.01	
Observations	27,970		27,970	

Notes: Table uses information from the 1999/00 ASI on inputs. The first column regresses plant-level number of inputs on the industry change in input tariffs from 1989-1997. The second column uses average imported inputs per plant. Each column clusters standard errors by industry and uses the sampling weights provided by the ASI. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Table 4: Product Scope and Input Tariffs

	(1)		(2)		(3)		(4)	
Input Tariff	-0.323	**	-0.310	**	-0.327	**	-0.281	**
	0.139		0.150		0.150		0.125	
Output Tariff			-0.013		-0.014		-0.010	
			0.043		0.041		0.041	
Delicensed					-0.032		-0.026	
					0.023		0.021	
FDI Liberalized							0.037	
							0.024	
Year Effects	yes		yes		yes		yes	
Firm FEs	yes		yes		yes		yes	
R-squared	0.90		0.90		0.90		0.90	
Observations	14,882		14,864		13,435		11,135	

Notes: This table is reproduced from GKPT (2010b). The dependent variable in each regression is (log) number of products manufactured by the firm. The delicenced variable is an indicator variable obtained from Aghion et al (2008) which switches to one in the year that the industry becomes delicensed. The FDI variable is a continuous variable obtained from Topalova and Khandelwal (2011) with higher values indicating a more liberal FDI policy. As with the tariffs, the licensed and FDI policy variables are lagged. All regressions include firm and year fixed effects and are run from 1989-1997. Standard errors clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Table 5: Product Scope Expansion and Input Tariffs

Sector	Change in Product Scope (1)	Change in Input Tariffs (2)	Predicted Change in Product Scope (3)	Percentage Explained by Input Tariffs (4)
15 Food products and beverages	43%	-18.1%	5.8%	14%
16 Tobacco products	6%	-10.5%	3.4%	61%
17 Textiles	21%	-23.1%	7.5%	35%
18 Wearing apparel	-25%	-33.9%	11.0%	-44%
19 Tanning and dressing of leather	-33%	-28.3%	9.1%	-27%
20 Wood and products of wood	60%	-12.8%	4.1%	7%
21 Paper and paper products	40%	-25.5%	8.2%	21%
22 Publishing/printing	0%	-24.1%	7.8%	Na
23 Coke, refined petroleum products	10%	-19.9%	6.4%	64%
24 Chemicals	46%	-28.5%	9.2%	20%
25 Rubber and Plastic	41%	-31.0%	10.0%	25%
26 Non-metallic mineral products	44%	-15.7%	5.1%	12%
27 Basic Metal	46%	-29.0%	9.4%	20%
28 Fabricated metal products	61%	-27.3%	8.8%	15%
29 Machinery/equipment, nec.	46%	-25.3%	8.2%	18%
30 Office and computing machines	20%	-19.4%	6.3%	31%
31 Electrical machinery & apparatus	69%	-27.4%	8.8%	13%
32 Radio, TV and communication	37%	-29.0%	9.4%	25%
33 Medical and optical instruments	143%	-25.0%	8.1%	6%
34 Motor vehicles, trailers	45%	-24.8%	8.0%	18%
35 Other transport	22%	-25.8%	8.3%	38%
36 Furniture	100%	-18.4%	5.9%	6%

Notes: Table compares the actual change in product scope for firms in 1989 and 1997 with the predicted change due to input tariffs. The first column reports the average change in actual product scope across firms within the sector. The second column reports the average change in input tariffs by sector. The third column multiplies column 2 by -.323, the point estimates input tariffs from equation (1). Column 4 divides column 3 by column 1.

Table 6: Product Scope and Input Tariffs, Heterogenous Effects

	License (1)	Financial Development (2)	Coastal (3)	Road Networks (4)	Labor Regulation (Small Firms) (5)	Labor Regulation (Large Firms) (6)
Input Tariff	-0.324 **	-0.327 *	-0.352 **	-0.284 *	-0.346	-0.358 **
	(0.155)	(0.188)	(0.145)	(0.161)	(0.249)	(0.181)
Input Tariff X Delicensed by 1998	-0.109					
	(0.122)					
Input Tariff X Financial Developm		0.009				
		(0.143)				
Input Tariff X Coastal State			0.048			
			(0.078)			
Input Tariff X Road Network				-0.056		
				(0.092)		
Input Tariff X Neutral Labor Regu					0.140	0.086
					(0.219)	(0.141)
Input Tariff X Pro-Worker Labor R					0.257	-0.020
					(0.181)	(0.121)
Year Effects	yes	yes	yes	yes	yes	yes
Firm FEs	yes	yes	yes	yes	yes	yes
R-Squared	0.90	0.90	0.90	0.90	0.89	0.90
Observations	13,435	14,873	14,873	13,802	5,457	9,416

Notes: This table reports heterogenous impacts of input tariffs across different state and industry characteristics. The dependent variable in each regression is the (log) number of products manufactured by the firm. Column 1 reports the interaction of a dummy that equals 1 if the industry was delicensed by 1988. Column 2 interacts input tariffs with a measure of financial development which takes an indicator of 1 if the state is above the median credit per capita in 1992. Column 3 identifies states that are on the coast. Column 4 uses a measure of road networks from Fisman and Khanna (1998). Column 5 reports the interaction with labor market regulations, taken from Besley and Burgess (2004), for (initially) small firms (below median sales). Column 6 uses initially large firms in the regression. The left out category in these regressions are pro-business states. All regressions include firm and year fixed effects and are run from 1989-1997. Standard errors clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.