The Effect of Chinese Competition on the Product Variety of Indian Firms[1]

Pavel Chakraborty[2]
Jawaharlal Nehru University

Michael Henry[3]
University of Birmingham

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Abstract

A few recent studies in the international trade literature indicates how import penetration or competition impacts labor market conditions, innovation and product variety of the importing country. However, almost the entire literature concentrates on the effect of rise in imports from the low-wage countries on the developed economies. We make one of the very first attempts to understand what happens when one of the two most technologically similar countries face competition from another. In particular, what is the impact of import penetration from China on the product variety of the Indian manufacturing firms? Using detailed firm-product-year data across manufacturing sectors in India spanning over one and half decades, and exploiting the exogenous nature of China's entry into the WTO in 2001, we investigate the potential link between the two. We find no effect of Chinese competition on the product variety of the Indian manufacturing firms at the aggregate. However, on dividing the firms by size, we find very robust and significant effect of creative destruction or product drop for the big firms. The big firms drop their peripheral products and concentrates on the core ones. This observation is acute for: (i) both exporters and non-exporters; (ii) domestic-private firms; (iii) both final and intermediate goods; and (iv) both high and low-exposure industries. We also find some evidence of product innovation for small firms. Our results are consistent to a battery of robustness checks.

JEL classifications: F1, F14, F61
Keywords: Chinese competition, Import Penetration, Product Variety, Big Firms, Small Firms, Final Goods, Intermediate Inputs

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[2] Centre for International Trade and Development, School of International Studies, Jawaharlal Nehru University, New Delhi – 110067, India; email: pavelchakraborty@mail.jnu.ac.in; Tel: +91 9821778098
[3] Department of Economics, Birmingham Business School, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK; email: m.henry.1@bham.ac.uk

I Introduction

China's export performance post-1990, and more so since 2001 (with entry to the WTO), has been nothing short of spectacular! Its exports grew from 62 billion USD to 1.2 trillion USD between 1990 and 2007, an average of around 20% per year (Iacovone et al., 2013). In real terms, it increased by 25 times between 1990 and 2005 (Hanson & Robertson, 2010). The export-to-GDP ratio also went up from 15.9 to 34.9, more than double in the same period. In terms of sectoral composition of exports, manufacturing exports accounted for 89% of total merchandise exports between 2000 and 2005. China, alone accounted for around 25% of the total exports of all countries outside of the top 12 developed countries. China became the world's largest exporter in 2009, and the second largest economy in 2010. This meteoric rise of China to the status of a global exporting giant, particularly in terms of manufactured goods, has been the catalyst for both policy makers and researchers to understand the impact of import competition from low-wage countries, or China specifically, on different aspects of firm dynamics, such as labor markets, product variety, technological choices, etc. (see for e.g., Autor et al., 2013; Bernard et al., 2006; Iacovone et al., 2013; Bloom et al., 2015) for both developed and developing countries.

During the same period, manufacturing accounted for 75.3% of India's merchandise exports. Given that China and India are the two most technologically similar countries (di Giovanni et al., 2014) and India's trade with China has also increased significantly in the post-2001 period, we seek to investigate the effect of import competition from China on the product mix of Indian manufacturing firms. The paper's key empirical finding is: import competition from China induces significant product drop or creative destruction of peripheral products for big firms, forcing them to refocus on the core ones. On the other hand, we find some evidence of product innovation for small firms in low-exposure sectors.

We make an attempt to understand what happens when a large developing country, India, faces competition from another equally large developing country, China, that is technologically similar to it. In particular, what is the impact of import penetration from China on the product variety of Indian manufacturing firms? **Figure 1** shows a monotonically upward trend in the share of India's imports from China out of total imports. It rises from approximately 1% of total imports in 1992 to almost 16% in 2007. What is particularly striking is the dramatic increase in the import share from China in the post-2001 period, i.e., following China's accession to the WTO in December, 2001. In particular, between 1992 to 2001, the share of Chinese imports grew from 1% to around 5.5% in 2001, which shot to 16% between 2002 and 2007. **Figure 2** shows that there is also a lot of heterogeneity across industries within the Indian manufacturing sector in terms of its growth of Chinese imports relative to total imports. In other words, the share of imports from China rose for some industries; remained almost constant for others; and also declined for a couple of sectors. Unsurprisingly, there has been a steep increase in the share of imports in some of the labor intensive industries (e.g., Textiles, Wearing Apparel, and Leather), which is consistent with China's comparative advantage. However, **Figure 2** also surprisingly points out about the increase in the share of imports in capital intensive industries (e.g., Office, Accounting & Computing Machinery; Electrical Machinery & Apparatus; Communication Equipment).

Turning our attention to the other side of the story, we plot the number of products manufactured by a representative Indian manufacturing firm over the period 1992-2007 in **Figure 3**. It points to a clear upward trend over time. The average number of products produced by an average Indian manufacturing firm rises from around 1 during the early 1990s to almost 3 in 2007. The steady increase in the number of products exhibited is consistent with the finding of Goldberg et al. (2013). However, if we look more closely, the figure points out that there has been a slight drop in the post-2001 period and also the rate of growth in the increase in the number of products has slowed down. During the period of 1992-2001,

the rate of growth of products produced is more than two-fold, whereas in the post-2001 period, it dropped to a mere 20%.

Given this as our background, we seek to investigate whether the slowdown of the products produced by the Indian firms' is a result of the rising import competition from China or not. To the best of our knowledge, this is the first paper that examines the impact of import competition, based on an import share measure, for these two large and successful BRIC countries. Using detailed firm-level data, which reports product-level information for firms across all manufacturing sectors in India spanning over two decades, and exploiting the exogenous nature of China's entry into the WTO, we explore the potential link between this unilateral liberalization policy imposed by a country (China, in this case) and an Indian manufacturing firm's product choice and/or mix. Our results are clear and robust. We find no effect of Chinese import competition on the product variety of Indian manufacturing firms in the aggregate. However, when we divide firms by size, we find a very robust and significant effect of creative destruction for the big firms. The big firms drop their peripheral products and concentrates on the core ones. This observation is acute for: (i) both exporters and non-exporters; (ii) domestic-private firms; (iii) both final and intermediate goods; and (iv) both high and low-exposure industries. We also find some evidence of product innovation for small firms in the low-exposure sectors. Our results remain largely unchanged when subjected to a battery of robustness checks.

The rest of the paper is organized as follows. Section 2 reviews and discusses both theoretical and empirical literatures related to this study. Section 3 describes the various datasets we use in this paper, together with some preliminary analyses. The direct impact of Chinese import competition on the product variety of Indian manufacturing firms has been estimated in Section 4. We do some additional estimations using product entry and exit in Section 5. Section 6 divides the entire manufacturing sector into several categories (product, industry and firm) to investigate whether the benchmark results hold if we divide firms across different groups, while section 7 does a battery of robustness checks. Section 8 concludes.

2 Review of Related Literature

In this section we discuss the literature that is most closely related to our work, namely, the literature on the multi-product firm. As a result of the overwhelming dominance of multiproduct firms in international production and trade, a range of theoretical models focusing on the behavior of these firms have been developed by trade economists over the last decade or so (Lopresti, 2014). In these models, a fall in trade costs can increase within-firm productivity by the reallocation of resources within the firm (Bernard, Redding and Schott, 2011; Eckel and Neary, 2010; and Mayer et al., 2014). Notwithstanding the aggregate importance ascribed to multiproduct firms by the different theoretical models of these firms, they proffer very different and contradictory conclusions regarding the manner in which multi-product firms adjust their product mix in response to changes in trade costs[4]. As noted by Lopresti (2014), the most common prediction in terms of firms' product level response to a bilateral reduction in trade costs is that all firms will reduce product scope. This prediction is present in the models of Eckel and Neary (2010) and Mayer, Melitz and Ottaviano (2014). Theoretically however, it is less clear

[4] See Lopresti (2014) for a detailed review of some of the more well cited theoretical models of the multi-product firm in the literature.

whether there is heterogeneity in the adjustment of product scope by firms following an episode of trade liberalization. For example, whether larger firms adjust product scope differently compared to smaller firms is not resolved in the theoretical literature and in fact remains an empirical issue that warrants investigation. Shedding light on this crucial issue is one of the fundamental aims of the current paper.

Multiproduct firms are seen as being quite dynamic. For example, Bernard, Redding and Schott (2010) finds that 54% of manufacturing firms alter their product mix every five years between Manufacturing Censuses. They also find that, on average, one-third of the output of a given product is produced by firms that either did not produce the product at the time of the previous Census or will have dropped the product by the next Census. In short, there is widespread evidence of product churning. Moreover, this product churning has substantial effects on the aggregate economy because changes in the firms' product mix can account for significant changes in their output over time (Lopresti, 2014; Goldberg et al., 2010). Indeed, Bernard, Redding and Schott (2010, 2011) show that the contribution of firms' product margin toward output growth exceeds the contribution of firm entry and exit. Consequently, product mix changes represent a potentially important channel through which resources are reallocated from less to more efficient firms.

There is a growing empirical literature examining the effects of import competition from either China specifically, and/or other low-wage countries more generally, on the economies of both developed and developing countries. Among the early studies that examined the effects of imports from China on the one hand, and low-wage countries on the other, on the economy of a developed country are Bernard, Jensen and Schott (2004, 2006). In the former study, the authors show that while Chinese competition in the U.S. boosts high-wage and high-skill companies, in contrast, it causes the decline of low-wage and low-skill industries. In the second one, Bernard, Jensen and Schott (2006), they investigate US firms' reaction to international trade (imports) from low-wage countries and provide evidence that import competition significantly decreases the probability of plant survival and growth. On the other hand, skill intensity and industry switching increases the probability of plant survival.

These studies, however point to heterogeneity in the effects of import competition. First, capital-intensive plants have a higher probability of surviving compared to labor-intensive plants. This is particularly true for plants in industries with greater exposure to low-wage country imports. Second, import penetration from low-wage countries is negatively and significantly correlated with plant level employment growth. Again there is heterogeneity in this finding based on the capital intensity of plants; the effect being smaller for capital-intensive plants.

A key finding of Bernard, Jensen and Schott (2006) is that firms adjust their product mix in response to trade pressures. They argue that plants are more likely to switch industries when exposure to low-wage countries is high. Indeed, the authors find that an average of almost 8% of surviving plants in each five-year period switch industries i.e. change their product mix. Further, the switches are inclined towards capital-intensive industries.

In another developed country study, Martin and Mejean (2014) examine the impact of low-wage competition on the product quality of French exporters over the period 1995-2005. They document that product quality upgrading is greater in sectors and destinations where firms are exposed to more intense competition from low-wage countries. The suggestion here is that the competitive pressures created by imports from low-wage countries either serve as a catalyst for French exporters to improve the quality of their products or the imports contribute directly to upgrading the quality of the final products exported by French firms. Mion and Zhu (2013) finds evidence of skill upgrading by Belgian firms in response to Chinese competition. In contrast, they find no evidence on firm exit. In considering the effects of

Chinese imports on Mexican Maquuiladoras in the U.S. market, Utar and Ruiz (2013) provide evidence of a significant negative effect of Chinese import penetration in the U.S. on the sales, employment and export value-added of the Mexican Maquiladoras.

Extending the analysis to a group of developed countries, namely 12 EU countries, Bloom et al. (2015) find that Chinese imports into a firms' sector of production increased the innovative activity of surviving firms in Europe. In contrast, import competition from China decreases the chances of survival and employment. Additionally, they find that low technology firms in heavily exposed sectors suffer reductions in jobs and survival while high-technology firms are relatively more protected.

In the developing countries' context, Iacavone et al. (2013) exploited the surge in Chinese exports to Mexico to examine the impact on the latter country's firms. The authors find evidence of selection and reallocation at both firm and product levels caused by the trade shock. Additionally, they find evidence of heterogeneity at both the extensive and intensive margins. Sales of smaller plants as well as marginal products were shown to be compressed and more likely to cease, while those of larger plants and core products seem to be more insulated from import competition.

Specifically, in terms of studies based on India, Goldberg et al. (2010) find evidence that shows Indian multi-product firms are quite similar to the U.S. manufacturing firms studied by Bernard, Redding and Schott (2010; 2011) along cross-sectional dimensions. For example, like their US counterparts, India's multi-product firms are larger, more productive, and are more likely to export compared to single-product firms. Additionally, Goldberg et al. (2010) provide evidence of a positive correlation between the extensive and intensive margins of firms.

In contrast to the U.S. data however, Goldberg et al. (2010) document important differences among Indian multi-product firms with respect to the time-series patterns of the data. One such finding is the small amount of product churning exhibited by Indian firms vis-à-vis their US counterparts as uncovered by Bernard, Redding and Schott (2010). Additionally, Indian firms were found to infrequently drop products or to simultaneously add or drop a product. Indeed, the authors find no evidence between product rationalization and output tariff declines following India's episode of trade liberalization in 1991.

These findings notwithstanding, Goldberg et al. (2010) contend that changes in firms' product mix in fact made a non-negligible contribution to output growth. They estimate that 25% of the total increase in Indian manufacturing output over the period 1989-2003 was accounted for by the net addition of products at the firm level.

In light of the above, the contribution of the net product margin to total output growth in India is driven almost exclusively by product additions as opposed to product discontinuation (Goldberg et al., 2010a). This the authors argue indicate the absence of "creative destruction" along the product dimension over the period of their study, notwithstanding the trade and other structural reforms undertaken by India during this time. In a later study (Goldberg et al., 2010b) the authors find that input tariff liberalization contributed significantly to the product growth observed among domestic Indian firms.

3 Data and Preliminary Analysis

3.1 Datasets

3.1.1 Firm-level data (PROWESS)

The foundation of our empirical analysis is based on Indian firm-level data for different manufacturing industries. This dataset gives detailed data on various indicators from the balance sheets of firms, in addition to other important firm-level and industry-level characteristics. We discuss our dataset in detail below.

The primary data source for our analysis is the **PROWESS** database, which is maintained by the Centre for Monitoring the Indian Economy (CMIE), a government sponsored agency. This database contains information primarily from the income statements and balance sheets of the listed companies and publicly traded firms. It comprises of more than 70 per cent of the economic activity in the organized industrial sector of India; accounts for 75 per cent of corporate taxes and 95 per cent of excise duty collected by the Government of India (Goldberg et al., 2010b). CMIE gives detailed information at the product level. The agency uses an internal product classification that is based on the Harmonized System (hereafter, HS) and National Industrial Classification (hereafter, NIC) schedules. As Goldberg et al., (2010c) noted, there are a total of 1,886 products linked to 108 four-digit NIC industries across the 22 manufacturing sectors (two-digit NIC codes) spanning the industrial composition of the Indian economy. In comparison, the U.S. manufacturing data contains approximately 1,500 products, as defined by the Standard Industrial Classification (SIC) codes, thus suggesting that the definition of product in India is slightly more detailed – Checked, OK**.**

The PROWESS database contains information on about 27,400 publicly listed companies, of which almost 11,500 are in the manufacturing sector. We use information for around 9000 firms for our analysis for the years 1992-2007[5]. Firms in the dataset are placed according to the four-digit 2008 NIC level, but are reclassified at the 2004 NIC level in order to facilitate the matching with the industry-level (four-digit) trade data. The database covers large companies, companies listed on the major stock exchanges and also many small enterprises. Data for big companies are worked out from balance sheets, while CMIE periodically surveys smaller companies for their data. Therefore, PROWESS provides a reasonably good aggregate picture in terms of the mix of small and big firms. However, the database does not cover the unorganized sector. The variables are measured in Indian Rupees (INR) Million. We use an unbalanced panel for estimation. PROWESS has several features that make it particularly appealing and interesting for the purpose of our study and has several advantages compared to other available sources, such as the Indian **Annual Survey of Industries** (ASI) dataset. For e.g., it tracks a firm over a period of time, which helps us to see or measure the change in a firm's product mix or the number of products produced. In particular, the dataset is in effect a panel of firms, which enables us to study their behavior over time. This dataset reports direct measures on total sales, exports, imports, research and development (R&D) expenditures, royalty payments for technical knowhow (technology transfer), capital employed, labor, gross value added, assets, ownership, etc. Around 20% of the firms

[5] Although data are available till 2013, we consciously choose 2007 as the final year in order to avoid any possible effect of the financial crisis of 2008/2009 on our results. As part of our robustness checks on our results we extend our sample period to 2013. The results remain qualitatively the same.

in the dataset belong to the Chemical and Pharmaceutical industries, followed by Food Products and Beverages (13.74%), Textiles (10.99%) and Basic Metals (10.46%).

The database also provides detailed information on the number of products produced by each firm every year. This allows us to examine the dynamics of the product mix of a firm over a period of time. The dataset also provides the unit price and the quantity sold for each product produced by an individual manufacturing firm. This unique feature of the dataset allows us to identify changes in the product mix within firms over a fifteen-year period which coincided with significant unilateral trade liberalization from China as well as India. A key measure for our analysis contained in the PROWESS dataset is the total number of products produced by a firm in any given year. We use this information to estimate the effect of import penetration on the changes in the number of products produced by the manufacturing firms in India.

One disadvantage of the dataset however is that it does not give destinations of the products traded (neither exported nor imported) by firms. In order to overcome this, we complement our firm-level dataset with product-level trade data from UN-COMTRADE using an industry-trade concordance table. We describe this process in more detail below.

3.1.2 UN-COMTRADE

UN-COMTRADE presents destination-wise official foreign trade statistics of all the countries of the world. This is the most comprehensive database on trade flows that is collected and maintained by the United Nations (UN). It gives detailed information of every country's trade according to each of their trade destinations. The database is detailed up to HS six-digit level of classification. UN-COMTRADE follows the Harmonized System (HS) of Classification and provides both yearly and monthly statistics of countries' trade flows. The database provides quantity, value and unit value with respect to each of the products exported or imported and their respective destinations. The annual series is available from 1992 onwards till 2012. It also enables a comparative analysis of any country's trade performance in specific markets vis-a-vis its competitors. The trade flows are given in US Dollars (USD).

3.1.3 Matching PROWESS data with UN-COMTRADE data

Our main objective is to create a variable which reflects the extent of import competition from China on domestic Indian firms. To overcome the disadvantage of the PROWESS dataset regarding the trade destinations of the products, we match the production oriented firm level PROWESS data and the trade-destination based product level UN-COMTRADE datasets. The classification of the firms in the PROWESS database has been done on the basis of NIC 2004, whereas the data in UN-COMTRADE are in HS Code. Debroy and Santhanam (1993) kindly provided us with a document which matches the HS code items with the industrial groups according to NIC. However, Debroy and Santhanam (1993) used 1987 NIC classification to match the industrial groups with the HS code items. Therefore, for the purpose of our exercise, we first match 1987 NIC codes with the 1998 NIC codes, which is the next revision of the industrial group classification, and then match the 1998 coding with 2004 NIC classification, which is the classification of our firm-level dataset.

We proceed as follows: first, using the concordance of Debroy and Santhanam (1993), we match the relevant product lines (HS six-digit level) for each of the industrial categories (NIC 4-digit level). We then sum the values of all the HS code items belonging to each of the industrial group to obtain the total amount of imports by that particular industrial group with respect to two major destinations of India's import flows: China and Rest of the World. We are able to match around 90-95% of the HS six-digit

level products with each of the 2004 NIC four-digit level industrial categories. The dataset resulting from the matching of the firm-level and sectoral-level data is at the sector-product level. We acknowledge the fact that ideally it would be better to have firm-level information on import flows from different destinations, as our data is likely to leave some amount of intra-industry heterogeneity, due to heterogeneity across firms in trade destinations, unexplained. However, in the absence of any known dataset in the case of India which gives firm-level trade destinations, ours is a workable second-best option.

3.2 Trends in India's Imports from China and the Rest of the World

Before providing a more rigorous empirical analysis, we present some stylized facts on trends in the share of India's imports from China by each industrial category (two-digit NIC 2004), and the number of products produced by an Indian average firm belonging to each of these categories. Columns (1) - (3) of **Table 3** show the average share of imports from China relative to total Indian imports for three different time periods: 1992-1997; 1998-2002 and 2003-2007. For example, the number 2.21% (Row 1, Column 1) is the average share of Food and Beverages (NIC 2004, Sector 15) imports from China for the period 1992-1997. Most of the industrial categories show significant increases in the share of imports from China in total imports, especially after 2001/02. The growth in the share of imports from China is significantly higher in the post-2001 period with respect to before-2001. We also compute the average number of products produced by a representative manufacturing firm from each of the twenty-two two-digit NIC 2004 manufacturing industries for two distinct time periods - 1992-1997 and 1998-2007. And, the response is mixed. In some of the categories, there has been an increase in the number of products, whereas, we find the opposite in some others.

Table 4 divides the industrial categories into two major product categories - intermediate and final goods and repeats the exercise of **Table 3**. We find that imports from China have increased for both the two different type of product categories, with rate of growth more in case of intermediate goods. On the other hand, an average manufacturing firm producing final goods has increased over time, , but got decreased in case of intermediate goods. Having this as our background, in the next section, we investigate whether the increase in the import share from China is significantly correlated with the product mix of the manufacturing firms in India.

4 Chinese Competition and Product Variety

4.1 Benchmark analysis

In this section, we use the data described above to empirically investigate the link between the unilateral trade liberalization policy adopted by China, joining the WTO at the end of 2001, and the product variety of India's manufacturing firms. We use the event of China's entry to the WTO as a quasi-natural experiment to test its effect on the number of products produced by Indian manufacturing firms. We argue that the pursuit of this unilateral trade liberalization policy by China led to an increase in the import share of Chinese products relative to total imports by India from the world, and thus intensified the competition faced by Indian firms in their domestic market. The main aim of the paper is to determine the effects of this increased import competition on the product-mix of Indian firms.

The trade and other economic reforms undertaken by China in the post-1990 period in anticipation of becoming a member of the WTO, and thus fully integrated into the global economy, provide an important element of our empirical strategy. Since China's membership of the WTO agreement was influenced by factors not related to the activities of Indian firms in their domestic market, then the former's accession of the WTO can be interpreted as an exogenous shock from the standpoint of India. Furthermore, there were no trade agreements signed by India with China during the period prior to accession so that China's visibility in the World trade matrix (in terms of becoming a WTO member) could be confounded with other factors.

Notwithstanding the assumptions underlying our empirical strategy, there are a few concerns that we need to address. First, a primary concern is with the potential endogeneity - reverse causality - problem associated with our import competition index. For instance, there is a distinct possibility that the amount of imports undertaken by a given firm is influenced by the number of products that that firm produces. This occurrence may result in the causal relationship between import competition and the product mix decision of a firm to run in the opposite direction. Second, it may be the case that the importation of some goods (for e.g. intermediate inputs) is cheaper for Indian firms than producing them domestically. As noted by Goldberg et al. (2010b) the trade liberalization measures (particularly with respect to input tariffs) undertaken by India's policymakers during the 1990s had the effect of lowering the price of imported intermediate inputs for domestic Indian firms which led to an increase in the volume and variety of this category of imports by these firms. They further contend that access to this source of cheaper, higher quality and greater variety of inputs is a significant determinant of the expanding product mix and higher productivity levels that characterized the globally engaged Indian firms during this period.

Failure to address the above concerns may result in our coefficient estimates being biased and likely lead to incorrect inferences being drawn from our findings. Therefore, in order to control for these issues, we use an empirical strategy similar to Guadalupe and Wulf (2010), and Lu and Yu (2015) among others[6]. To avoid the possible endogeneity of the import competition variable, we treat all industries equally and exploit the share of imports from China before it became a member of the WTO. Specifically, we calculate the average share of Chinese imports before China's entry to the WTO by taking a simple mean of the share of imports from China by India for the years 1992-2000. This variable captures the extent of the prevailing competition from China for any given industrial category. Therefore, we define $AvgM01_j$ as a measure of Chinese competition that an industry faces as a result of the unilateral liberalization policies pursued by China; it is a 9-year average of the share of imports by industry j for the period 1992-2000. To create the $AvgM01_j$ index, we match the firm-level data with the HS 6-digit product-level destination-specific data (for China**)** on import flows to create a ratio that reflects the amount of competition faced by a firm i belonging to an industry j. We create this index at the NIC 2004 4-digit level using the concordance table by Debroy and Santhanam (1993). It is defined as the share of imports by an industrial sector, say j, from China in proportion to total imports by that sector. For example, let's consider the Textiles sector. The $AvgM01_j$ for the Textiles sector would be the total amount of Textile imports from China, relative to the total imports of Textiles from all countries for the years 1992-2000. To elaborate, we write our $AvgM01_j$ in the following way:

[6] These studies use reductions in tariff levels as their measure of trade liberalisation in contrast to the import share and import penetration ratios employed in this paper. However, consistent with our study, Lu and Yu (2015) also treats China's WTO Accession as a natural experiment.

$$AvgM01_j = Avg_{1992-2000}\frac{(imports^{jt}_{China})}{(imports^{jt}_{Total})}$$

$$= \frac{\text{average imports from China for the years } 1992-2000 \text{ for the industrial category } j}{\text{average imports from World for the years } 1992-2000 \text{ for the industrial category } j}$$

Finally, to mitigate against the possibility of bias arising from omitted variables we control for the effects of tariff liberalization on firms' decision to import intermediate and final goods by including measures of output and input tariff levels in our estimations.

Our basic empirical specification is the following linear regression of the fixed-effects type shown in Equation (1):

$$ln(x_{ijt}) = \beta_1(AvgM01_j * WTO_t) + \beta_2 WTO_t + \beta_3\, firmcontrols + \mu_j + \eta_t + \epsilon_{ijt} \qquad (1)$$

where our dependent variable, x_{ijt}, is the number of products produced by an Indian manufacturing firm i belonging to sector j at time t[7].

WTO_t is a year dummy variable intended to capture the effect of China's entry into the WTO. It takes a value of 1 for the years following the signing of the WTO agreement by China. Therefore, WTO_t equals 1 for the years 2002-2007. So, our variable of interest, $AvgM01_j * WTO_t$, will provide a measure of the amount of competition faced by Indian firms as a result of China becoming a member of the WTO. The interaction of $AvgM01_j$ with WTO_t provides a clear and exogenous measure of import competition from China and represents a difference-in-differences approach to measuring the effect of Chinese import competition on the product variety of Indian manufacturing firms. In other words, our variable of interest creates a pseudo 'treated' and 'control' group when estimating the required effect.

$firmcontrols_{ijt}$ is a vector of variables that includes firm size, age, age squared, an indicator for domestic or foreign ownership and a proxy for the extent of a firm's technology adoption. We use total assets of a firm as its size indicator[8]. The extent of technology adoption is measured as the share of R&D expenditure plus royalty payments for technical knowhow in Gross Value-Added (GVA). This captures technology differences between firms, which can potentially affect manufacturing of a product. Since our main variable of interest is at the industry-level, we follow Moulton (1990) and include industry fixed effects (μ_j) in Equation (1). η_t proxies for year fixed effects which control for any time-specific shocks that affect all firms equally. We cluster our standard errors at the industry level. We start by estimating Equation (1), of which results are shown in **Table 6**. Columns (1)-(5) show the results for the natural logarithm of the number of products produced by an Indian manufacturing firm in a single year regressed on the interaction of $AvgM01_j * WTO_t$. In addition to the industry and time specific fixed effects included in the estimation in Column (1), we use interactions of industry fixed effects with a time trend, and industry fixed effects (2-digit and 3-digit) with year fixed effects in columns (2), (3) and (4),

[7] Since the dependent variable is logged, we add 1 to accurately account for single product firms.
[8] Using the Prowess dataset to examine the effects of trade liberalisation on wages in India, Ahsan and Mitra (2014) also used the firms' total assets as an indicator of firm size.

respectively to control for all other factors, which can potentially influence the outcome of interest. Column (5) additionally uses input tariffs at the 4-digit level of NIC 2004 as a control. Our coefficient of interest doesn't change. We find no significant effect of the Chinese competition on the product-mix of the Indian firms.

Following Iacovone et al. (2013), who argue that competition may be felt as strongly in the export markets of the country that is the subject of import competition as in its home market, we also evaluate the causal link of Chinese imports on the product scope Indian firms not only in their domestic market but also in their main export markets. Consequently. in Columns (6) and (7), we use the share of Chinese imports by the US and EU respectively as the index of product market competition. We continue to find no effect of either US or EU imports from China on product scope of Indian firms

4.2 Disaggregating Firm size: In Search of Heterogeneity of Effect

Next, we augment Equation (1) by dividing our set of firms into different size distributions based on their total assets. The rationale for this is to test whether there are heterogeneous effects of Chinese import competition on the basis of firm size that are masked when no allowance is made for such heterogeneity across the sample of firms. To do so, we divide the entire sample of firms into four different quartiles according to the total assets of a firm. That is, total assets are used as the size indicator of the firms. The different size categories of firms are indicated by a dummy variable. For example, if the total assets of a particular firm are below the 25th percentile of the total assets of the industry, then that firm belongs to the first quartile and the variable would indicate 1 for that particular firm, and zero otherwise. Likewise, if a firm's total assets lie between the 25th percentile and the 50th percentile; the 50th percentile to the 75th percentile; and above the 75th percentile of the total assets of the industry, the firm belongs to the categories of second, third and fourth quartile, respectively. In each case, the variable measuring the different size category takes a value of 1 for the firms that meet the respective measurement criterion and zero otherwise. We then interact different quartile dummies with our variable of interest, $AvgM01_j * WTO_t$, in order to measure the effect of competition from Chinese imports on that particular quartile of firms. Our modified equation for estimating the effects on the different quartiles of the firms is specified as Equation (2) below:

$$\ln(x_{ijt}) = \beta^r \sum_{r=1}^{4} (AvgM01_j * WTO_t * Q_{it}^r) + firmcontrols_{ijt} + \mu_j + \eta_t + \epsilon_{ijt} \qquad (2)$$

Table 7 shows the results from our estimations of Equation (2) and variations thereof. Unlike the results obtained from our previous estimations where no distinction was made on the basis of firm size, we now unearth evidence of within firm reallocation of products by Indian firms based on the size categories of firms. First, across all columns, firms in the 4th Quartile (i.e. the largest firms) are shown to drop products from their product mix when import competition increases. This finding is consistent with that of Bernard, Jensen and Schott (2006), Iacavone et al. (2013) and the core competency argument which posits that in the presence of increased import competition, multi-product firms drop production of their peripheral products and retreat to the production of their core products (see for example Liu, 2010; Liu and Rosell, 2013; Dhingra, 2014**).** Further, this result is robust across all specifications shown in Table 8, even when we control for trade policy reforms by including input tariffs at NIC 4-digit level in column

(5). Second, in contrast, there is some evidence (albeit weak and sensitive) in Columns (1-5) that smaller firms add products to their existing product mix.

When the share of Chinese imports by third countries, namely the US and the EU, are used as the measure of import competition – in columns (6) and (7) – there is strong and robust evidence of within firm reallocation of products depending on firm size. Smaller firms – those in the 1st and 2nd Quartiles – are conclusively shown to be broadening their product scope, while larger firms are once again shown to be contracting theirs when Chinese competition increases in third country markets. In short, our results point to evidence of heterogeneity in the effects of Chinese exports on Indian manufacturing firms. Large firms clearly exhibit significant evidence of creative destruction as a result of import competition from China, while there is weak evidence of product innovation by small and medium-sized firms.

4.2.1 Other Possible Channels of Influence

It is possible that factors other than those that we explicitly controlled for, including our main variable of interest (the average share of Chinese imports in total imports Indian from the world for the period 1992-2001), may be driving our findings. To the extent that these underlying factors are not captured by the industry and year fixed effects included (either singly or interacted) in our earlier regressions, then our estimates could possibly be affected by omitted variable bias. To determine whether this is in fact the case, we examine other possible channels of influence by incorporating additional controls, both at the industry and firm levels, in our estimations. **Table 8** shows the results for these estimations.

In terms of industry-level controls, skill intensity is a crucial factor in determining the number of products produced by a firm. For example, a decrease in skill intensity may cause firms to drop products. We define skill intensity as the share of non-production workers in the total employees of an industry at the NIC 2004 3-digit level. Inclusion of skill intensity in column (1) as a possible channel does not alter our benchmark result: large firms continue to drop products as a result of import competition from China. We also find, somewhat surprisingly, weak evidence (at 10% level of significance) of higher skill intensity to be associated with narrowing of product scope for large firms. It is also possible that closure of plants (for reasons other than import competition) could force a firm to drop some of the products produced in those plants. In column (2), we use the number of factories at the industry level to see whether it affects the product-mix of the firms. Again, our finding with respect to large firms (i.e. those firms in the 4th Quartile of the distribution) is robust to the inclusion of the number of factories as an additional variable.

We consider two additional channels in columns (3) and (4), to further test the sensitivity of our results. In column (3), we use domestic production by industry to capture the fact that variations in domestic demand may also influence the number of products produced, while in column (4), following Bloom et al. (2013), we use management technology as a determinant of firm performance. By surveying a large number of firms in across all but couple of manufacturing industries in India (among other countries) throughout 2004, Bloom et al. (2010) construct a composite index for management quality for different manufacturing sectors. The index is a number between 1 and 5; with 5 representing the best quality. In both columns (3) and (4), our results with respect to the product drop by the largest firms remain primarily unchanged: creative destruction for large firms in response to import competition from China. We also find one additional result. Column (3) shows that higher levels of domestic production results in addition of products for all sizes of firms, with the level of significance increasing with firm size.

Despite controlling for industry-level factors whose omission may have biased our results, we also omitted other factors that can also potentially explain intra-industry heterogeneity. To account for these, we use several firm-level channels which can also possibly influence our previous findings. For instance, a firm can suffer a drop in sales (for reasons unrelated to import competition) and this could force to drop some of its products. The results using these channels are shown in Columns (5)– (8) of **Table 8**. Like the industry-level controls, the sequential inclusion of the four firm-level controls also doesn't alter our previous finding that the largest firms drop products as the share of Chinese imports in total Indian imports increases. Additionally, like the domestic production variable measured at the industry-level, increases in firm-level sales (Column 5) lead to an increase in the product scope for all firms in the sample except for those in the lowest quartile of the distribution. In contrast, the positive and statistically significant relationship between a firm's export share and its product mix is limited to firms in the 2nd Quartile: column (6).

Lastly, we use firm-level productivity and the degree of market power of firms (concentration index) relative to the industry in which they are located, to see whether they can also significantly explain the product-mix of firms in columns (7) and (8), respectively We measure the former using the Levinshon-Petrin (2003) methodology. Column (7) indicates that even when controlling for productivity of firms, big firms drop products in response to higher Chinese import competition. We get an additional result. Firms of higher productivity drop their products, as when controlled for import competition from China. Column (8) computes Herfindahl index to check whether higher market concentration can explain product mix of the manufacturing firms. Our primary result continues to hold. However, we find a surprising result: increase in market power of firms' results in narrowing of their product scope. Our results from column (7) and (8) are in complete sync with the outcome from column (1): firms of higher efficiency are dropping their products.

4.3 Untangling the Puzzle

In this section, we seek to investigate the reason(s) behind our primary findings: product drop or creative destruction of big firms (firms belonging to 4th Quartile) and product add by small firms (firms of 1st Quartile) on the other hand. Results are shown in **Table 9**. We start with the case of the small firms. Our previous findings indicate some evidence of product innovation in case of these firms. In order to know whether this is a result of a higher level of technology adoption or process innovation, we use the sum of R&D expenditure and royalty payments for technical knowhow as the outcome of interest. Our coefficients in columns (1) and (2) show us that although there is no effect at the aggregate level, however, when dividing the firms' by size, we do find significant evidence only in case of the small firms (firms of 1st Quartile). This gives us some indirect evidence in support of innovation of new products by the small firms as a result of expenditures made on technological upgrading.

Next, we analyze the core competency of the firms to find out whether this is case of refocusing to the core products (at the expense of the peripheral products) by the big firms as a result of import competition from China. We define the core product of a firm as the product which has the highest average sales share (in total sales) over time. This product takes a value 1, while the other products take a value of 0. We interact the core product dummy with our measure of import competition from China in order to measure the required effect. Column (3) distinguishes the core product (the product that generates the largest share of sales within a firm) from the rest of the products (peripheral products) the firm produces and includes the interaction of the import competition measure with the core product dummy. The interaction between import competition and the core dummy is negative and statistically

significant. The negative sign indicates that the firms drop their peripheral products in the face of rising import competition from China. That is, import competition leads firms to refocus on their core products by dropping peripheral products. We take a step forward and do the same estimation, but by dividing the firms by size, in column (4). The coefficients point out that the aggregate effect (firms dropping their peripheral products) comes from the effect of import competition on the big firms, which seems consistent with our earlier results. In other words, it is the big firms, who refocus on their core products and drop their peripheral ones, as a result of import competition from China.

Bernard, Redding and Schott (2006, 2009) contend that import competition leads not only to the dropping of marginally viable products but also to a shift in the distribution of firm output towards high-profitable products. Following Liu (2010), we use the change in the sales share in total sales as a dependent variable to capture the compositional change of firm output in response to firm competition. Our dependent variable here is $\Delta Sales\ Share_{pit}$. This is the change in sales share of product p. The right-hand side variables remain the same. We report the results in Columns (5) and (6). Column (5) shows the existence of a positive and significant relationship between the interaction of the import competition measure and the core product dummy, and the change in sale share for the entire sample of firms. This finding indicates that increases in import competition from China result in growth in the share of sales for the firms' core products. Once we allow for heterogeneity based on firm size, our results in Column (6) clearly indicate that our finding in the previous Column (i.e. Column 5) are driven by the larger firms in the sample i.e. those in the 3rd and 4th Quartiles of the distribution.

In other words, we find consistent evidence that rising import competition is associated with an increasing share of core products and a decreasing share of peripheral products. This result is particularly strong in case of the big firms. Thus, the results indicate that more centralized distribution of production is related to the rising import competition faced by the Indian firms. This is very consistent with the case of the U.S. firms (Liu, 2010).

5 Product Entry and Exit

In this section, we follow Iacovone et al. (2013) and consider the effects of import competition on product entry and exit. We use firm-product level data to define product entry and exit. Consequently, our panel data analysis is now three-dimensional in contrast to the two-dimensional approach adopted in our earlier estimations. Product entry is defined as:

$$y_{ikt} = \begin{cases} 1 \\ 0 \end{cases}$$

where, y_{ikt} is a firm-product specific outcome of interest for firm i or firm-product ik at time t. It takes a value 1 in the first year that the firm or firm-product is observed in the sample and 0 in all other years. We use the same measure for product exit. Thus exit is defined as $y_{ikt} = 1$, in the year when the firm or firm-product is last observed in the sample. Likewise, Iacovone et al. (2013), we drop the last year of the sample (2007) in the exit regressions, since for this year we can't distinguish firms (products) that exit from those who do not. We do the same for the entry regressions, but in this case, we drop the beginning year of the sample (1992). To undertake this analysis, we employ probit estimations for each of our dependent variables[9]. **Table 10** shows the results from these estimations. For firm-product entry, when the sample of firms is taken together as a homogeneous group (Column 1), we find statistically

[9] The estimating equations contained the same set of controls used for our earlier estimations.

significant evidence of import competition from China significantly increasing the probability of product entry. However, when we divide the sample of firms into four different quartiles (based on the total assets of the firm) in column (2), the evidence of product addition into the product mix of firms appears only for the first quartile of firms or small firms. This result is in complete sync with our earlier evidence of creative innovation by small firms as result of Chinese import competition.

With respect to firm-product exit, we do not find any evidence of product exit for the sample as a whole (Column 3). However, when exploring the effect on the firm-size distribution, our results show significant evidence of product exit in case of big firms (Column 4).

The results from our earlier estimations suggest support for the core competency hypothesis i.e. higher levels of import competition causes multi-product firms to drop their peripheral products and instead focus their production on their core products. We now directly test this hypothesis. In columns (5) and (6), we consider the likelihood of product exit based on the firms' core product. We define a core product as the product that has the highest sales ratio on average across all the products produced by a given firm. This variable takes a value of 1 in our estimating equations. As shown in column (6) there is some evidence that the core products of large Indian manufacturing firms are less likely be dropped in the presence of import competition from China. Thus, our results show support to our previous finding (based on product scope) that Chinese import competition leads big firms to drop their peripheral products and re-focus on core ones, thereby also providing additional evidence that increased import competition result in multiproduct firms retreating to their core products while dropping peripheral ones.

6 Additional Heterogeneity – Product Categories, Industry Exposure to Competition and Firm Characteristics

6.1 Product and Industry Categories

Next, we divide the entire manufacturing sector into different categories of goods utilizing the user-based classification of Nouroz (2001). To classify the manufacturing sector into different user-based categories, first, we match the NIC 2004 codes with the Input-Output classifications. We then arrange the matched NIC categories into the user-based products at the NIC 5-digit level. We categorize the manufacturing sectors into two major sub-sectors: (1) **Final goods**, which comprises of consumer durable and non-durable goods; and (2) **Intermediate goods**, which contain capital, intermediate and basic goods. We denote these two different categories by binary dummies. We do so in order to examine the compositional effect of import competition i.e. how the effect varies across different types of industrial products. In other words, this decomposition of the manufacturing sector would tell us the type of good, which has suffered the most in case of India as a result of the import competition from China. Results are shown in **Table 11**.

Columns (1) and (2) measure the effect of Chinese competition on the product variety of firms producing final goods. The coefficients show us that big firms drop products and small firms add new products to their product mix. In case of firms producing intermediate goods, the results show evidence of creative destruction both at the aggregate and big firms (firms of 4th Quartile). These results continue to provide ample amount of evidence in support of heterogeneity. Large firms drop products in case of both final and intermediate goods, with the effect significantly higher in case of intermediate goods. On the other

hand, small firms only add products, when belonging to final goods as their end-use category. Our findings, particularly in respect to intermediate goods, are largely consistent with Goldberg et al. (2009; 2010a; 2010b) who showed that the significant growth in India's domestic production in the decade of the 1990s and first decade of the 21st Century, are largely due to the greater access of cheaper and greater variety (as well as greater quality) of imported intermediate as a result of a reduction in output and input tariffs. We show additional evidence that unilateral liberalization policies adopted by one of the important trading partners of India also led to increase in the import of intermediate goods by the Indian manufacturing firms.

We then divide industries according to exposure from Chinese import competition in Columns (5) – (8). We classify industries as high-exposure, where the mean share of imports from China is greater than the median of the entire manufacturing sector and low-exposure, otherwise. The coefficients show us that the big firms drop products irrespective of these two different categories, whereas small-medium sized firms are marginally shown to add products in the low-exposure industries only.

6.2 Firm Characteristics

In this section, we utilize two important firm-level characteristics, namely export orientation and ownership to see how firms of these different categories are affected. We present our results in **Table 12**. We start with exporters and non-exporters. Columns (1) – (4) report that the big firms, both exporters and non-exporters, drop products in the face of rising import competition from China. Columns (5) – (10) divide firms according to their ownership - domestic private, domestic public and foreign. As the coefficients demonstrate, there is strong evidence that large domestic private firms drop their products in response to import competition from China. However, in case of domestic public firms, there is only some weak evidence of product drop by only the small-medium sized firms. Lastly, we find no effect of import competition on the product-mix of the foreign multinationals.

7 Robustness Checks

We perform a number of robustness checks to test whether our findings hold across different indices of import competition, time period and method of estimation. The results are reported in **Table 13**. Column (1) uses the measure employed by Iacovone et al. (2013) - change (first difference) in the share of imports from China. The results remain consistent with our findings: big firms drop products, whereas small firms add them. Next, we adopt the import competition index used in case of Belgian firms by Mion and Zhu (2013) in column (2), while estimating the effect of Chinese competition on the product variety of Indian firms. They used the following ratio:

$$IMPSHARE_{jt}^{China} = \frac{IM_{jt}^{China}}{IM_{jt} + DP_{jt}}$$

where $IMPSHARE_{jt}^{China}$ denotes the import share of China of the goods produced by industry j in year t. IM_{jt}^{China} and IM_{jt} represent (respectively) the value of imports from China and all countries for industry j in year t. DP_{jt} is Indian domestic production of industry j in year t and comes from the **Annual Survery of Industries** (ASI) dataset. As the coefficients demonstrate, we continue to find strong evidence in support of small firms (firms in the 1st Quartile) adding new products and big firms (firms in the 4th Quartile) dropping products in response to Chinese import competition.

Column (3) exploits a measure highlighted by Alvarez and Claro (2013) while estimating the effect of Chinese competition on developing countries, especially Chile. The import penetration ratio in this case is calculated in the following manner:

$$IMPSHARE_{jt}^{China} = \frac{IM_{jt}^{China}}{(IM_{jt} + DP_{jt} - X_{jt})}$$

X_{jt} represents India's exports of goods of industry j in year t. We continue to find the same effect as in the two previous columns. Column (4) adapts the methodology of Liu and Rosell (2013) in case of India:

$$IMPSHARE_{jt}^{China} = \sum_{j} s_{ijt} \frac{IM_{jt}^{China}}{(IM_{jt} + DP_{jt} - X_{jt})}$$

s_{ijt} is the share of firm i's revenues earned in industry j in year t. IM_{jt}, DP_{jt}, and X_{jt} are the same as defined before. The coefficients continue to exhibit heterogeneity across the firm size distribution. In Column (5), we use import share from China at period $(t-1)$ as the import competition index purported by Liu (2010) and Iacavone et al. (2013). The results do not differ. Interestingly, the magnitude of the coefficients is almost identical to those shown in Column (1) which is based on the import competition measure adopted by Iacavone et al. (2013).

We use a different time period in columns (6) and (7): 1992-2011. Column (6) uses $AvgM02_j * WTO_t$ as the import competition index, whereas column (7) exploits one-period lag import share. As the coefficients demonstrate, using a different time period does little to change the results. The main difference with results in the previous columns is that the smallest firms are shown not to add to their product-mix. Lastly, column (8) exercises a different estimation method. Since our dependent variable is discrete, therefore, using traditional OLS estimation would bias the results if it is not converted into a continuous variable using logs. Therefore, we use a Poisson regression without transforming our dependent variable using log. The estimates vary slightly - we find a greater proportion of firms (upper-half of the firm-size distribution) dropping products, with no effect on small firms. In conclusion, our results from the various empirical exercises undertaken to evaluate the heterogeneous effects of import competition from China on the manufacturing firms of India are robust across different measures of import competition; time period and estimation method.

8 Conclusion

Using detailed firm-level data, which reports product-level information for firms across all manufacturing sectors in India spanning over two decades, and exploiting the exogenous nature of China's entry into the WTO, we find no effect of Chinese competition on the product variety of the Indian manufacturing firms at the aggregate level. However, dividing the firms by size, we find consistent evidence of small firms broadening their product scope, whereas big firms seem to drop products. This is a result of higher expenditure by small firms on process innovation and re-focusing on core products (dropping peripheral products) by the big multiproduct firms. This is consistent with Liu (2010), Lopresti (2014) and others. These patterns are observed among both exporters and non-exporters, and domestic private firms. We also find that higher Chinese competition forces firms to drop intermediate goods, with no effect on final goods at the aggregate. Further, our results are consistent across a battery of robustness checks and also when we control for endogeneity using third country (US and EU) imports share from China as an instrument.

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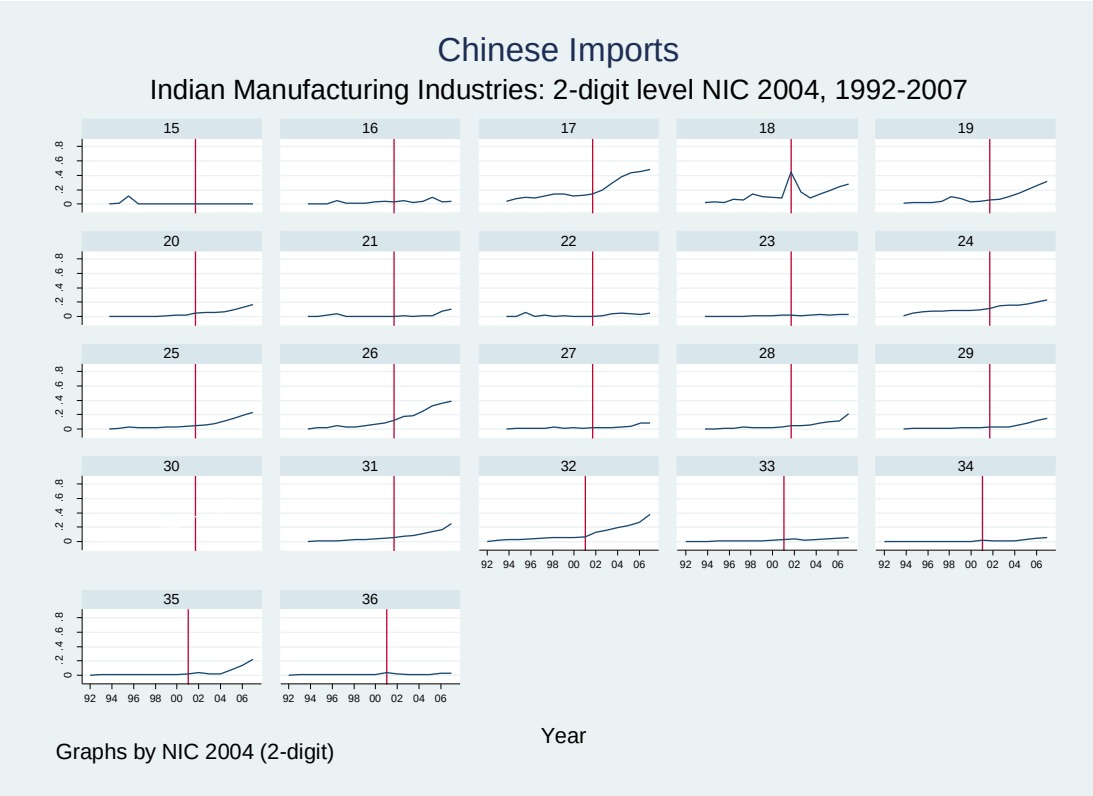
Figure 1: Imports from China by Indian Manufacturing Sector, 1992-2007

Notes: Figures represent the average share of Chinese imports in total imports across manufacturing industries in a given year.

Figure 2: India's Manufacturing Imports from China by Industry (NIC 2004 2-digit), 1992-2007



Notes: Figures represent the average share of Chinese imports in total imports across each manufacturing industry (at 2-digit, NIC 2004) in a given year.

Figure 3: Average Number of Products Produced by each Manufacturing Firm in India,1992-2007

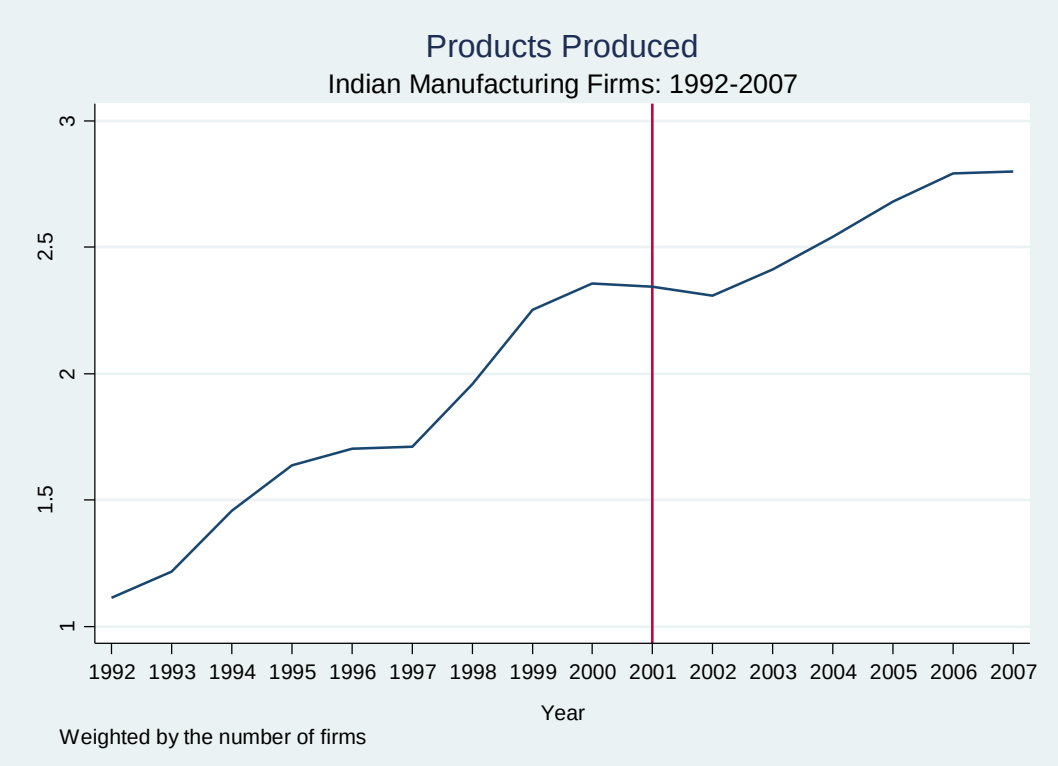


Table 1: Summary Statistics

	Mean	Median	Std. Dev	Min	Max
Product Scope	4.45	3	4.35	1	84
Chinese Competition	8.39	3.17	11.45	0	93.25
Skill Intensity	0.26	0.25	0.07	0.05	0.71
Factories	3994.10	3352	3105.05	15	14486
Domestic Production	345609.1	204438.2	381651.7	0	3662028
Management Technology	2	2.43	1.07	0	3.17
Sales	1840.41	268.8	21579.36	0	2000000
Export Share	0.48	0.003	51.51	0	11982.5
Productivity	0.21	0	1.14	0	309.85
Herfindahl Index	0.03	0.01	0.06	0	1
Technology Adoption/GVA	0.02	0	6.34	0	2163
Gross Value-Added (GVA)	383.84	0	8383.51	0	1200000
Assets	1786.19	240.1	14497.15	0	1200000
Age	17.12	13	18.81	5	128

Notes: Annual data at the firm-level, covering the period 1992-2007. Monetary values are in real INR (Indian Rupees) Millions. 'Product Scope' is the number of products manufactured by each firm in a single year. 'Chinese Competition' is the share of Chinese imports in total imports by an industry. 'Skill Intensity' is the ratio of non-production workers to total employees at 3-digit level of National Industrial Classification (NIC) 2004. 'Factories' is the number of factories at 3-digit level of NIC 2004. 'Domestic Production' is the total output produced by an industry at 3-digit level of NIC 2004. 'Management Technology' is the management quality score obtained from Bloom and Van Reenen (2010) at 2-digit level of NIC 2004. 'Sales' is the total sales (domestic + exports) by a firm. 'Export Share' is the share of exports of a firm in its total sales. 'Productivity' is a measure of firm productivity computed following the Levinsohn and Petrin (2003) methodology. 'Herfindahl Index' (also known as Herfindahl--Hirschman Index, or HHI) is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is measured as $H = \sum_{i=1}^{N} s_i^2$, where s_i is the market share of firm i in the market, and N is the number of firms. 'Technology Adoption/GVA' is the total amount of technological adoption share of gross value-added (GVA) of a firm. Technology Adoption = R&D expenditure + Royalty payments for technical knowhow. 'Assets' is the total assets of a firm. 'Age' is the age of a firm.

Table 2: Stylized Fact: Technological Similarity with China

	Technological Similarity with China (Top Ten)
India	0.928
Turkey	0.907
Indonesia	0.904
Hungary	0.897
Brazil	0.896
Philippines	0.889
Mexico	0.879
Egypt, Arab Rep.	0.873
Vietnam	0.868
Korea, Rep.	0.862

Notes: The table reports the top ten countries in terms of technological similarity with China.
Source: Julian di Giovanni et al. (2014).

Table 3 Stylized Facts: Trade with China and Others

	Trade with China		Imports from other countries			
	Imports from China	Exports to China	ASEAN excluding China	US	EU27	Imports from the World
1992	140.8	157.8	1151.3	2325.5	7558.8	24452.4
2001	1827.5	922.5	4355.5	3226.7	10345.7	50671.1
2007	24575.8	9492	21031	14206.4	32394.7	218645.3
Growth (1992-2007)	17353.6%	5913.4%	1726.6%	510.9%	328.6%	794.2%

Notes: Values in USD Million. The table reports trade values of India with respect to different destinations.

Table 4: Stylized Facts: Chinese Import Competition and Product Variety (NIC 2004 2-digit)

Industry Code NIC 2004 2-digit	Industry Name	Share of Imports From China (%)			Product Variety	
		1992-1997	1998-2002	2003-2007	1992-1997	1998-2007
		(1)	(2)	(3)	(4)	(5)
15	Foods Products and Beverages	2.21	0.25	0.28	4.01	4.31
16	Tobacco Products	1.24	2.91	4.41	5.45	4.40
17	Textiles	8.98	13.92	40.76	3.06	3.43
18	Wearing Apparel	5.71	18.03	18.52	2.87	2.81
19	Leather	3.71	5.46	20.10	3.84	3.37
20	Wood and Wood Products	0.32	3.37	10.32	5.17	4.91
21	Paper and Paper Products	1.15	0.43	3.87	2.28	2.48
22	Recorded Media	1.36	0.60	4.09	3.50	2.22
23	Coke, Refined Petroleum, Nuclear Fuel	0.62	1.46	2.48	3.78	4.74
24	Chemical and Chemical Products	5.93	10.39	18.41	5.06	4.99
25	Rubber and Plastics	1.72	3.92	15.42	3.03	3.81
26	Non-metallic Mineral Products	2.45	9.94	29.92	2.70	3.32
27	Basic Metals	1.28	1.62	5.01	3.70	4.16
28	Fabricated Metal Products	1.14	3.35	11.24	3.12	3.98
29	Machinery and Equipment	1.05	2.41	9.13	4.52	4.35
30	Office, Accounting & Computing Machinery	5.21	26.79	56.33	5.53	5.51
31	Electrical Machinery and Apparatus	1.63	4.82	15.02	5.88	5.77
32	Communication Equipment	2.82	7.49	24.46	6.28	6.32
33	Medical, Precision and Optical Instruments	0.57	2.02	3.87	4.76	5.06
34	Motor vehicles, Trailers and Semi-Trailers	0.05	0.76	3.13	5.19	6.34
35	Other transport equipment	0.74	1.62	8.89	4.28	4.71
36	Furniture; Manufacturing n.e.c.	0.95	1.69	1.55	3.08	3.58

Notes: The numbers represent average across all firms belonging to each industrial category according to National Industrial Classification (NIC) 2004 2-digit level. 'Share of Imports from China' is the share of Chinese imports in total imports. 'Product Variety' is the number of products produced by an average manufacturing firm in each of these industrial categories.

Table 5: Stylized Facts: Chinese Import Competition and Product Variety (Product Categories)

	Share of Imports from China (%)			Product Variety	
	1997	2002	2007	1997	2007
	(1)	(2)	(3)	(4)	(5)
Intermediate Goods	2.59	6.31	18.15	4.60	4.51
Final Goods	3.71	6.96	17.54	4.26	4.50

Notes: The numbers represent average across all firms belonging to each industrial category according to National Industrial Classification (NIC) 2004 2-digit level. 'Share of Imports from China' is the share of Chinese imports in total imports. 'Product Variety' is the number of products produced by an average manufacturing firm in each of these product categories.

Table 6: Effect of Chinese Import Competition on Product Variety: Benchmark Results

	Log (Product Scope + 1)						
	Benchmark Results (1992-2007)						
		Time Trend* Industry FE	Year FE* Industry FE (2-digit)	Year FE* Industry FE (3-digit)	Input tariffs	Export Markets	
						Share of Chinese Imports by US	Share of Chinese Imports by EU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$MC_{Chinese}$	–0.002	–0.002	0.001	0.001	–0.002	0.001	0.004
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.000)	(0.003)
$ln(input\ tariffs)$					0.010		
					(0.018)		
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Sq.	0.20	0.20	0.21	0.22	0.20	0.20	0.20
N	48882	48882	48882	48882	48882	48467	48467
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE (2-digit)*Year FE	No	No	Yes	No	No	No	No
Industry FE (3-digit)*Year FE	No	No	No	Yes	No	No	No

Notes: The dependent variable in columns (1) - (7) is the natural logarithm of number of products manufactured by a firm in each year plus 1. '$MC_{Chinese}$' is defined as an index of product market competition. Columns (1) – (5) use the share of Chinese Imports by India, whereas column s (6) and (7) uses the share of Chinese imports by US and EU as the index of product market competition respectively. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. 'Input tariffs' is at the 4-digit NIC. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the individual terms of the interaction. *,**,*** denotes 10%, 5% and 1% level of significance.

Table 7: Effect of Chinese Import Competition on the Product Variety: Disaggregating by Firm Size

	Log (Product Scope + 1)						
	Size Heterogeneity (1992-2007)						
		Time Trend* Industry FE	Year FE* Industry FE (2-digit)	Year FE* Industry FE (3-digit)	Input tariffs	Export Markets	
						Share of Chinese Imports by US	Share of Chinese Imports by EU
	(1)	(2)	(3)	(4)	(5)	(6)	
$MC_{Chinese}$*1st Qr	0.002	0.002	0.005*	0.005	0.002	0.003***	0.013***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.001)	(0.004)
$MC_{Chinese}$*2nd Qr	0.003	0.003	0.006**	0.006**	0.003	0.004***	0.012***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.001)	(0.004)
$MC_{Chinese}$*3rd Qr	–0.003	–0.004	–0.001	–0.001	–0.003	0.001	0.001
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.004)
$MC_{Chinese}$*4th Qr	–0.010***	–0.010***	–0.007**	–0.007*	–0.010***	–0.002**	–0.010***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.001)	(0.002)
$ln(input\ tariffs)$					–0.009		
					(0.018)		
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.21	0.21	0.21	0.22	0.21	0.21	0.21
N	48882	48882	48882	48882	48882	48467	48467
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE (2-digit)*Year FE	No	No	Yes	No	No	No	No
Industry FE (3-digit)*Year FE	No	No	No	Yes	No	No	No

Notes: The dependent variable in columns (1) - (7) is the natural logarithm of number of products manufactured by a firm in each year plus 1. '$MC_{Chinese}$' is defined as an index of import competition from China. Columns (1) – (5) use the share of Chinese Imports by India, whereas column (6) and (7) uses the share of Chinese imports by the US and EU as the index of product market competition, respectively. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. 'Input tariffs' is at the 4-digit NIC. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned),'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *,**,*** denotes 10%, 5% and 1% level of significance.

Table 8: Effect of Chinese Competition on Product Variety: Other Possible Channels of Influence

	Log (Product Scope + 1)							
	Other Channels (1992-2007)							
	Industry Channels				Firm Channels			
	Skill Share	Factories	Domestic Production	Management Technology	Sales	Export Share	Productivity	Herfindahl Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$MC_{Chinese}$*1st Qr	0.002	0.002	0.003	0.001	0.002	0.002	0.001	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$MC_{Chinese}$*2nd Qr	0.003	0.003	0.004**	0.002	0.005*	0.004	0.002	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
$MC_{Chinese}$*3rd Qr	–0.004	–0.004	–0.003	–0.004	–0.002	–0.004	–0.004	–0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$MC_{Chinese}$*4th Qr	–0.011***	–0.010***	–0.011***	–0.011***	–0.010***	–0.012***	–0.009***	–0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Channel*1st Qr	0.274	0.007	0.039*	–0.514	0.005	0.095	0.014	0.039**
	(0.282)	(0.032)	(0.021)	(1.471)	(0.006)	(0.065)	(0.017)	(0.017)
Channel*2nd Qr	0.130	0.024	0.043**	–0.935	0.019***	0.108**	0.010	–0.009
	(0.265)	(0.032)	(0.021)	(1.479)	(0.005)	(0.055)	(0.017)	(0.017)
Channel*3rd Qr	–0.330	0.028	0.044**	–1.199	0.022***	0.043	–0.001	0.007
	(0.260)	(0.031)	(0.024)	(1.473)	(0.006)	(0.039)	(0.019)	(0.018)
Channel*4th Qr	–0.474*	0.046	0.077***	–1.561	0.064***	0.004	–0.044*	–0.038*
	(0.283)	(0.031)	(0.022)	(1.490)	(0.006)	(0.057)	(0.026)	(0.021)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.21	0.21	0.21	0.20	0.22	0.22	0.21	0.21
N	48882	48882	48882	47593	48882	44711	48882	48867
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the natural logarithm of number of products manufactured by a firm in each year. '$MC_{Chinese}$' is defined as index of import competition from China. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. Each 'Channel' refers to the channel at the top of each column. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *, **, *** denotes 10%, 5% and 1% level of significance.

Table 9: Effect of Chinese Competition on Product Variety: Untangling the Puzzle (Process Innovation, Core Competency and Product Composition)

	Process Innovation		Core Competency		Product Composition	
	Log (Technology Adoption +1)		Log (Product Scope + 1)		ΔSales Share	
	1992-2007		1992-2007		1992-2007	
	(1)	(2)	(3)	(4)	(5)	(6)
$MC_{Chinese}$	0.0001					
	(0.000)					
$MC_{Chinese}$*1st Qr		0.0003***				
		(0.000)				
$MC_{Chinese}$*2nd Qr		–0.0002				
		(0.000)				
$MC_{Chinese}$*3rd Qr		–0.0002				
		(0.001)				
$MC_{Chinese}$*4th Qr		0.0005				
		(0.000)				
$MC_{Chinese}$*Core			–0.005*		0.002**	
			(0.003)		(0.001)	
$MC_{Chinese}$*1st Qr*Core				–0.001		0.002
				(0.004)		(0.001)
$MC_{Chinese}$*2nd Qr*Core				–0.005		–0.0004
				(0.005)		(0.001)
$MC_{Chinese}$*3rd Qr*Core				–0.003		0.004**
				(0.005)		(0.002)
$MC_{Chinese}$*4th Qr*Core				–0.011*		0.007***
				(0.006)		(0.002)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.02	0.02	0.44	0.45	0.70	0.71
N	45595	45595	286926	286926	235943	235943
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable in columns (1) and (2) is the natural logarithm of technology adoption plus 1. By technology adoption, we mean the sum of R&D expenditure and royalty payments for technical knowhow. The dependent variable in columns (3) - (4) is the natural logarithm of number of products manufactured by a firm in each year plus 1. Columns (5) and (6) use the change in the sales share of a firm per product. '$MC_{Chinese}$' is defined as index of import competition from China. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. 'Core' is defined as the core product of a firm. It takes a value 1 for that product, which has the highest sales ratio on average across all the products produced by that firm. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *,**,*** denotes 10%, 5% and 1% level of significance.

Table 10: Effect of Chinese Import Competition on the Product Variety: Product Entry and Product Exit

	Baseline Results (1992-2007)					
	Product Entry		Product Exit			
	(1)	(2)	(3)	(4)	(5)	(6)
$MC_{Chinese}$	0.004*		0.002			
	(0.002)		(0.002)			
$MC_{Chinese}$*1st Qr		0.009**		0.012***		
		(0.004)		(0.005)		
$MC_{Chinese}$*2nd Qr		0.005		0.003		
		(0.005)		(0.005)		
$MC_{Chinese}$*3rd Qr		–0.0002		–0.007		
		(0.005)		(0.007)		
$MC_{Chinese}$*4th Qr		0.004		–0.007*		
		(0.005)		(0.004)		
$MC_{Chinese}$*Core					–0.005	
					(0.004)	
$MC_{Chinese}$*1st Qr*Core						–0.006
						(0.006)
$MC_{Chinese}$*2nd Qr*Core						–0.002
						(0.008)
$MC_{Chinese}$*3rd Qr*Core						–0.005
						(0.009)
$MC_{Chinese}$*4th Qr*Core						–0.019*
						(0.011)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.07	0.07	0.02	0.02	0.03	0.03
N	277186	277186	262820	262820	262820	262820
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1) and (2) use 'Product Entry' as the dependent variable. It takes a value 1 or 0. The dependent variable in columns (3) - (6) is the 'Product Exit'. It takes a value 1 or 0. We use Probit regressions to estimate. '$MC_{Chinese}$' is defined as index of import competition of China. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. 'Core' is defined as the core product of a firm. It takes a value 1 for that product, which has the highest sales ratio on average across all the products produced by that firm. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the industry level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *,**,*** denotes 10%, 5% and 1% level of significance.

Table 11: Effects of Chinese Competition on Product Variety: Product Categories and Industry Exposure to Competition

	Log (Product Scope + 1)							
	Product Categories				Exposure Categories			
	Final Goods		Intermediate Goods		High-Exposure Industries		Low-Exposure Industries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$MC_{Chinese}$	–0.0001		–0.006**		–0.001		0.002	
	(0.002)		(0.003)		(0.003)		(0.011)	
$MC_{Chinese}$*1st Qr		0.006**		–0.003		0.003		0.009
		(0.003)		(0.004)		(0.004)		(0.015)
$MC_{Chinese}$*2nd Qr		0.004		0.001		0.004		0.026*
		(0.003)		(0.004)		(0.004)		(0.015)
$MC_{Chinese}$*3rd Qr		–0.004		–0.003		–0.002		0.006
		(0.003)		(0.004)		(0.004)		(0.016)
$MC_{Chinese}$*4th Qr		–0.008**		–0.012***		–0.008**		–0.033**
		(0.004)		(0.005)		(0.004)		(0.016)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.20	0.21	0.21	0.21	0.17	0.18	0.23	0.23
N	21341	21341	24181	24181	19471	19471	29411	29411
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the natural logarithm of number of products manufactured by a firm in each year plus 1. 'Final Goods' refer to consumer durable and non-durable goods, whereas, 'Intermediate Inputs' is a combination of intermediates, basic and capital goods. 'High-Exposure' industries are defined as when the average import share of any industry is greater than the median import share of all the industries put together and vice-versa for 'Low-Exposure' industries'. '$MC_{Chinese}$' is defined as index of import competition from China. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *, **, *** denotes 10%, 5% and 1% level of significance.

Table 12: Effect of Chinese Competition on Product Variety: Firm Characteristics – Export Orientation and Ownership

	Log (Product Scope)									
	Firm Characteristics (1992-2007)									
	Export Orientation				Ownership					
	Exporters		Non-Exporters		Domestic Private		Domestic Public		Foreign	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$MC_{Chinese}$	–0.004		–0.004*		–0.003		–0.016*		0.004	
	(0.002)		(0.002)		(0.002)		(0.009)		(0.007)	
$MC_{Chinese}$*1st Qr		0.002		–0.003		0.002		–0.006		–0.009
		(0.005)		(0.003)		(0.003)		(0.017)		(0.018)
$MC_{Chinese}$*2nd Qr		0.007**		–0.001		0.002		–0.029*		–0.010
		(0.004)		(0.003)		(0.002)		(0.017)		(0.018)
$MC_{Chinese}$*3rd Qr		–0.004		–0.005		–0.005*		–0.014		0.002
		(0.003)		(0.004)		(0.003)		(0.010)		(0.010)
$MC_{Chinese}$*4th Qr		–0.010***		–0.017***		–0.012***		–0.009		–0.001
		(0.003)		(0.006)		(0.003)		(0.010)		(0.010)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.21	0.21	0.20	0.20	0.20	0.21	0.48	0.51	0.27	0.29
N	23881	23881	25001	25001	44510	44510	1849	1849	2523	2523
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the natural logarithm of number of products manufactured by a firm in each year plus 1. '$MC_{Chinese}$' is defined as index from import competition from China. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *,**,*** denotes 10%, 5% and 1% level of significance.

Table 13: Effect of Chinese Competition on Product Variety: Robustness Checks

	Log (Product Scope + 1)							Product Scope
	Robustness Checks (1992-2007)					Robustness Checks (1992-2011)		Robustness Checks (1992-2007)
	Iacovone et al. (2013)	Mion & Zhu (2013)	Alvarez & Claro (2013)	Liu & Rosell (2013)	Lag (t-1) Import Share	AvgM02* WTO	Lag (t-1) Import Share	Poisson AvgM02*WTO
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$MC_{Chinese}$*1st Qr	0.005***	0.272***	0.308***	3.008**	0.003***	0.004	0.004***	0.002
	(0.001)	(0.066)	(0.071)	(1.330)	(0.001)	(0.003)	(0.001)	(0.002)
$MC_{Chinese}$*2nd Qr	0.002*	0.040	0.059	–0.920	0.001	0.004	0.001	0.001
	(0.001)	(0.073)	(0.073)	(1.984)	(0.001)	(0.003)	(0.001)	(0.002)
$MC_{Chinese}$*3rd Qr	–0.0001	–0.106	–0.067	–1.951	–0.001	–0.002	–0.001	–0.004**
	(0.001)	(0.070)	(0.070)	(1.233)	(0.001)	(0.003)	(0.001)	(0.002)
$MC_{Chinese}$*4th Qr	–0.004***	–0.317***	–0.281***	–5.391**	–0.004***	–0.015***	–0.003***	–0.007***
	(0.001)	(0.069)	(0.064)	(2.350)	(0.001)	(0.004)	(0.001)	(0.002)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.21	0.21	0.24	0.21	0.21	0.20	0.20	n/a
N	41970	48882	48882	48880	41970	59178	50842	48455
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE*Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable in columns (1) - (7) is the natural logarithm of number of products manufactured by a firm in each year. Column (8) uses number of products manufactured, therefore, using Poisson regression. '$MC_{Chinese}$' is defined as index of import competition from China. It is an interaction of two terms – 'AvgM02' and 'WTO'. 'AvgM02' is the average of imports at NIC 2004 4-digit level for the years before 2002 (1992-2001) and 'WTO' is a year dummy, which takes a value 1 if the year is greater than or equal to 2002. Quartiles are defined according to the total assets of a firm. Columns (1) - (5) and (8) use 1992-2007 as the time period, whereas, Columns (6) and (7) use 1992-2011 as the same. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the total asset of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. Firm controls include age of a firm, age squared, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. All the regressions contain the pairwise and individual terms of the interactions. *,**,*** denotes 10%, 5% and 1% level of significance.

Appendix

A Data

We use an annual-based panel of Indian manufacturing firms that covers up around 9000+ firms, across 105 industries, over the period of 1992-2007. Data is used from the PROWESS database of the Centre for Monitoring Indian Economy (CMIE). All monetary-based variables measured in Millions of Indian Rupees (INR), deflated by 2005 industry-specific Wholesale Price Index (WPI). We use 2004 National Industrial Classification (NIC). We use the import penetration data from the UN-COMTRADE. We match the HS 6-digit trade data with the industrial codes using Debroy and Santhanam (1993).

Variable definitions:

1. **Product Scope**: The number of products produced by a firm, which represents the product variety of a firm.
2. **Chinese Competition**: Share of Chinese imports in total imports.
3. **Skill intensity**: Ratio of non-production workers to total employees at the 3-digit level of 2004 NIC. This is obtained from two different sources - the years 1992-2000 has been generously shared by Dr. Sangeeta Ghosh; and for 2001-2007 from the various publications of ASI.
4. **Factories**: The number of factories at the 3-digit level of 2004 NIC.
5. **Domestic Production**: The value of output at the 3-digit level of 2004 NIC.
6. **Management technology**: Management Quality score for the year 2004 at 2-digit NIC, obtained from Bloom et al. (2010); the score is between 1 and 5, with 5 denoting the highest quality.
7. **Sales**: Total sales of a firm.
8. **Export Share**: (Total Exports/Total Sales) of a firm.
9. **Productivity**: Firm TFP computed using the Levinsohn and Petrin (2003) methodology.
10. **Herfindahl Index**: The Herfindahl index (also known as Herfindahl--Hirschman Index, or HHI) is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is measured as $H = \sum_{i=1}^{N} s_i^2$, where s_i is the market share of firm i in the market, and N is the number of firms.
11. **Intermediate goods**: The goods which are classified according to the I-O table as inputs by end-use. It combines intermediates, capital and basic goods.
12. **Final goods**: The goods which are classified according to the I-O table as final products by end-use. It combines consumer durable and consumer non-durable goods.
13. **TechAdop/GVA**: Share of R&D expenditure and Royalty Payments for Technical Knowhow in Gross Value-Added.
14. **GVA**: Gross Value-Added = Total Sales - Total Raw Material Expenditure.
15. **Assets**: Total assets of a firm.
16. **Ownership**: It indicates whether a firm is domestic-owned or foreign-owned.
17. **Age**: Age of a firm in years.