Impact of Trade Liberalization on the Performance of Indian Manufacturing MSMEs:

A Cross Census Panel Analysis[1]

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ABSTRACT

This paper examines the effects of tariff and non-tariff reductions on firm-level growth of Gross Value of Output (GVO) and productivity for various types of Micro, Small and Medium Enterprises (MSMEs) in India's manufacturing sector over the 2002 to 2007 period. We calculate input and final goods tariffs, effective rates of protection and non-tariff barriers for broad product groups based on information from India's Export-Import (EXIM) Policy of 1997-2003 and 2004-09 and examine the impact of trade liberalization on the aforementioned performance measures. We create a new firm-level balanced panel dataset for this purpose by merging the 3rd and 4th All India Census data on Indian MSMEs for 2001-02 and 2006-07, taking into account firm, industry and time-specific factors. Our results show that trade liberalization is associated with improved firm-level GVO growth but a relatively insignificant impact on firm-level productivity of Indian manufacturing MSMEs. We also find that due to various disadvantages that Indian MSMEs face in terms of operational, financial, technological and other constraints, trade liberalization benefits only those MSME firms which are technologically upgraded and quality certified. Further, the gains to GVO and productivity from sourcing of imported inputs following input tariff reductions are found to be greater than gains arising from increased product competition following final goods tariff reductions.

Key words: Manufacturing; Small Scale Industry; Total factor Productivity; Trade Liberalization

JEL Classifications: L6, D2, L1, F1, O3

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[1] This paper was written as part of a doctoral (PhD) thesis at the Indian Institute of Management Bangalore and has benefited from comments and suggestions from the dissertation committee members.

Impact of Trade Liberalization on the Performance of Indian Manufacturing MSMEs: A Cross Census Panel Analysis

1.   Introduction

Micro, Small and Medium Enterprises (MSMEs) are seen as important engines of economic growth in developing countries. According to the World Bank's data on MSME indicators, there are 125 million formal MSMEs across 132 economies, including 89 million in emerging economies and account for at least 95 percent of all registered firms around the world (Kushnir et. al, 2010).[2] MSMEs also contribute a large share of manufactured exports, especially in regions such as East Asia. For instance, the MSME export share was estimated at around 56 percent and over 40 percent in Taiwan and the Republic of Korea, respectively in 2009 (Singh et. al, 2010b). In the manufacturing sector, MSMEs also play the role of specialized suppliers of intermediate inputs to larger companies, as they are able to produce these components much more cheaply than large firms.

For emerging countries like India, the MSME segment plays a significant role in mitigating poverty as it absorbs a large part of the low and semi-skilled workforce. In 2007, MSMEs covered 95 percent (3.4 million) of industrial units (Singh et. al., 2010a). The latest Annual Report of the Ministry of MSMEs estimates the MSMEs' contribution to total manufacturing output at 38.5 percent and its share of GDP at 7.4 percent in 2010-11. The segment is also important as it manufactures a diverse range of products (estimated at over 8000 distinct products) and also supplies the vast local market at reasonable prices (Das, 2008). MSMEs contributed to 31 percent of the country's exports in 2008. Sectors such as textiles, leather and food products are dominated by MSMEs in India. These products have consistently constituted an important part of India's export basket (Singh et. al., 2010b).

Until 1991, India's MSME segment remained protected by high levels of tariff and non-tariff protection (Das, 2008). However, since the initiation of economic reforms in 1991, Indian industry, including the MSME segment, has faced extensive trade liberalization with a significant reduction in import tariffs on final as well as intermediate products and removal of quantitative restrictions (QRs) on a large number of import items (Singh et al., 2010b). Average

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[2] There is, however, variation across countries in defining MSMEs. Countries define MSMEs in terms of assets, turnover or employment.

tariffs (MFN applied rates) declined from 86.82 percent to 14.57 percent between 1990 and 2009 and the non-tariff barrier coverage ratio, i.e., the share of imports subject to non-tariff restrictions fell from nearly 100 percent to 0 percent over this period. The erstwhile sheltered MSME segment has thus encountered increased competition from global brands and services (Javalgi and Ramsey, 2001). MSMEs have also faced increased competition from larger Indian firms in the domestic market with the removal of items that were previously reserved only for MSME production (Singh et al., 2010a) as well as from increased import competition following the lifting of import prohibitions on these de-reserved items.[3] At the same time, economic reforms and trade liberalization have created new opportunities for Indian MSMEs by enabling linkages with large firms which have increasingly outsourced their non-core operations to smaller firms (Abouzeedan and Bulser, 2005), through quality improvements and through a reduction in input costs (Prajogo, 2007).

It is widely held, however, that Indian MSMEs have found it difficult to confront the competitive challenges posed by the opening up of the economy and have failed to take advantage of the resulting opportunities due to various constraints such as scarcity of financial resources, outdated technology, poor quality of products and lack of modernization (Gyampah and Boye, 2001). The MSME segment's contribution to India' Gross Domestic product (GDP) and to its manufacturing output has declined over the years, although MSMEs continue to absorb the largest proportion of the labour force after the agricultural sector in India. Hence, ensuring the growth of MSMEs and enabling them to confront increased domestic as well as international competition have emerged as a major challenge for policy makers and for MSMEs in India (Government of India, 2013-14 and Pun et al., 2004). Understanding the impact of trade reforms on MSMEs and the factors mediating this relationship is important for formulating a wide range of development policies, including employment, skilling, fiscal, technology and credit policies, among others.

This paper examines the impact of trade liberalization on the performance of Indian manufacturing firms and examines how this impact varies across different types of MSMEs, as characterized by features such as whether they use modern power sources, whether they have advanced technological knowledge and whether they maintain product quality standards. The analysis focuses on two key performance measures, namely, growth in the Gross value of

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[3] See, Press Information Bureau Government of India, Ministry of Commerce & Industry, http://pib.nic.in/newsite/PrintRelease.aspx?relid=118222 for discussion on removal of the last 20 items from the MSME list.

Output (GVO) and growth in total factor productivity (TFP). We examine the impact of a reduction in both tariff and non-tariff barriers (NTB) on both these performance measures, in the context of India's trade policy (EXIM Policy) of 1997-2003 and 2004-09.[4] We also analyze the factors that might explain the differential effects of trade liberalization on firm performance for different kinds of MSMEs.

This paper is placed within the broader literature on new-new trade theory by Melitz (2003), Costantini and Melitz (2008) and Bernard et. al. (2003) and other studies, which highlights the importance of firm-heterogeneity in shaping the impact of trade and trade policy.[5] This paper builds on the existing literature on trade liberalization and firm and industry level performance in India in four ways.

Firstly, it confirms the findings of several earlier studies such as Goldar and Kumari (2003), Das (2004), Balakrishnan et. al. (2006), Sivadasan (2009), Topalova and Khandelwal (2011), Loecker et. al. (2012), Hasan (2002), Bas and Berthou (2011), Ahsan (2013), Kato (2009), Goldberg et. al. (2010a), Kathuria (2002) and Parameswaran (2010) that firm, industry and time-specific factors such as the level of technology, extent of modernization and access to credit are important in shaping the impact of trade liberalization at the industry or firm level. This paper specifically shows this result to hold in the context of different types of MSMEs and thus confirms the importance of firm-heterogeneity as outlined in new-new trade theory. Secondly, this paper extends the findings of studies such as Nataraj (2011) and Kathuria et. al. (2012) on trade liberalization and TFP productivity in Indian manufacturing by showing that tariff liberalization has had a differential impact on MSMEs depending on their firm-level characteristics. The third contribution of this paper is that it goes beyond tariff liberalization to highlight the importance of non-tariff liberalization by specifically calculating the incidence of non-tariff barriers for different industries and examining the direct effect of the level of non-tariff protection on firm performance, including for MSMEs. Earlier studies such as Topalova and Khandelwal (2011) have examined the role of non-tariff protection by grouping industries broadly as high or low non-tariff protection sectors but have not incorporated the specific incidence of non-tariff barriers nor examined the same for MSME firms in particular. Finally,

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[4] The Export-Import or Exim Policy consists of guidelines and instructions established by the Director General of Foreign Trade (DGFT) on matters related to the import and export of goods in India. The Foreign Trade Policy of India is guided by the EXIM Policy and is regulated by the Foreign Trade Development and Regulation Act, 1992. See, http://www.exim-policy.com/

[5] See also, Hasan (2002), Balakrishnan et.al (2006), Topalova and Khandelwal (2011)

and most importantly, this paper undertakes analysis based on a new dataset that has been created by the authors by merging the 3rd and 4th All India Census data on Indian MSMEs for the years 2001-02 and 2006-07.[6] This merged dataset which is being used for the first time in such empirical analysis contains information on a panel of close to 10,000 unique MSME firms for the two census years, including information on financial variables as well as product and industry characteristics at the firm-level.[7] This dataset thus enables one to track the performance of a large number of MSMEs, including micro firms, over a time period that has witnessed significant trade liberalization in India. This dataset also enables us to include a wide range of industries as well as control for many firm characteristics such as firm-level employment and access to credit, which are available in the Census dataset.[8] Thus, this paper contributes to the relatively thin literature on trade liberalization and Indian MSMEs in all these respects.

We examine the impact of trade liberalization in terms of tariff and non-tariff reductions on firm-level growth in GVO and TFP using a merged Census data on Indian MSMEs. We also try to identify different firm-specific characteristics which can play a significant role in shaping the relationship between trade liberalization and firm-level performance of Indian manufacturing MSMEs. The plan of the paper is as follows. Section 2 discusses the data sources and some important descriptive statistics. Section 3 outlines the methodology used for the empirical analysis and highlights key measurement issues. Section 4 presents the estimation strategy and analysis of the results. It also summarizes the key findings. Section 5 concludes the paper with some policy recommendations and possible future extensions of this research.

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[6] Apart from small and medium enterprises, we are also able to incorporate micro enterprises in this merged data set for our analysis. The process followed to merge the two rounds of census data is explained in Section 2 and illustrated in Appendix A.

[7] Mukherjee (2014) studies the impact of trade liberalization on Indian manufacturing firms, based on the Centre for Monitoring of the Indian Economy (CMIE) Prowess dataset for the 1999-2009 period. However, its coverage of the MSME segment is limited by the low share of MSME firms in the Prowess dataset. (Prowess is a database which provides time-series information from 1989-90 onwards on the financial performance of Indian companies based on the Annual Reports of individual companies. The database covers listed and unlisted companies. See, https://prowess.cmie.com/kommon/bin/sr.php?kall=wprowstat&sectcode=010) for the dataset).

[8] Mukherjee (2014) discusses a set of 5 broad industries while the Census dataset enables a more disaggregated industry level analysis.

2. Data Sources and Descriptive Statistics

2.1 Data Sources

We merge the All India 3rd Census Survey data on MSME registered firms (2001-02) with the All India 4th Census Survey data on MSME registered firms (2006-07). This gives us a set of unique Indian MSME firms over the 2002 to 2007 period with useful firm-level information for this period. Firm-level information for different variables such as GVO, total inputs used, total fixed assets, age, total employment, institutional loan outstanding, etc., are taken from this merged MSME Census dataset. This exercise enables us to comprehensively examine the performance of these MSME firms in the context of trade liberalization and the various mediating firm and industry level factors.

In addition to the firm-level data, we also extract information on industries and trade restrictions from other sources. Industry-level information for different variables is extracted from the Industry Analysis Service and the Economic Outlook, the two online databases provided by the CMIE. Tariff related information is obtained from the TRAINS-WITS online database provided by the World Bank. We measure the NTB index data by using the import conditions data from the Director General of Foreign Trade (DGFT) database, and the import data from the Ministry of Commerce and Industry, Department of Commerce, Government of India.[9]

2.1.1 Overview of the merged Census dataset

We discuss next the creation of this merged dataset and summarize the key firm-level features revealed by this collated census data. For merging and identifying the unique firms from these two censuses, we take the following steps. Firstly, we observe that each firm has a permanent registration number. These permanent registration numbers repeat within a specific state, district, tehsil, taluk or mandal and even town or village.[10] Thus, we create a combination number by considering all these varying area level subcategories, starting from a sector code (i.e., rural or urban) to a town or village code, and the permanent registration number assigned to each firm. We repeat this procedure for both the 3rd and 4th Census MSME firm-level data sets to arrive at a set of unique firms which are present in both the survey rounds. Finally, we

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[9] The Detailed Calculation of Tariff and Non-Tariff Barriers is given in the Appendices B and C of this paper.

[10] A *tehsil* or *tahsil/tahasil*, also known as *taluka* (or *taluq/taluk*) or *mandal*, is an administrative division. It is an area with a city or town that serves as its administrative centre. It may contain additional towns and a number of villages. See, http://en.wikipedia.org/wiki/Tehsil

merge these two firm-level data sets based on the unique firm code that we generate based on the aforementioned combination number. This exercise is mainly done to track firm-level performance of Indian registered MSME firms over the 2002 to 2007 period, through a comprehensive examination of different firm-level performance indicators for this unique set of MSME registered Indian firms. We confirm the accuracy of this merging procedure and the uniqueness of the firms across both survey rounds by checking the uniqueness in a firm's permanent registration year and 5-digit NIC code across the two Census datasets.[11] We finally arrived at 9,918 unique MSME firms in our merged dataset.[12] The accuracy of this merging procedure was validated by the Indian Ministry of Micro, Small & Medium Enterprises.[13]

We provide here some of the descriptive statistics based on the aforementioned merged census data in order to provide an overview of some key characteristics of the registered MSME firms covered in this dataset as well as their distribution across various dimensions of performance and operation. The latter not only helps provide a context to the overall discussion by defining the kinds of firms that are being studied but also helps motivate the empirical analysis later in this paper by highlighting the potential role of various firm-level characteristics in determining the impact of trade liberalization within the MSME segment. An important point to note here is that this dataset captures registered MSMEs as opposed to unorganized firms which are captured in the National Sample Survey Organization (NSSO) data. The latter dataset has been used to analyze the impact of trade liberalization on Indian manufacturing firms in other studies, such as Nataraj (2011). By focusing on registered MSMEs, we are able to capture that segment of firms for which data has been systematically captured across a range of industries and firm-level characteristics and which is directly used in policy formulation. Table 2.1 provides the average values for the MSME firms for various firm features.

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[11] The National Industrial Classification-2004 (NIC-2004) plays an important role in maintaining standards of data collection, processing and presentation as well as applications in policy formulation and policy analysis. This classification is used in all types of censuses and sample surveys conducted in India. The latest and fifth Industrial Classification, NIC-2004 was developed and released by CSO in November, 2004. See, http://mospi.nic.in/Mospi_New/upload/nic_2004_index.htm

[12] See Appendix A, Tables A.1 and A.2 for a description of the variables in the 3rd and 4th All India Census of MSMEs and an illustration of the merger procedure.

[13] Although, in both the censuses the authority had collected data for previous two periods as well (for instance, collected data for 2000 and 2001 as well in census 2002), but the informations are limited to some key performance indicators, such as GOP. Thus, our results are only confined to the years 2002 and 2003. However, while estimating Productivity using LP methods we have utilized those additional informations for some major key variables.

Table 2.1: Average firm-level characteristics for 3rd and 4th Census data on Registered MSMEs, (in 100,000 unless otherwise specified)

Sl. No.	Characteristics	3rd Census (2001-02) (Registered SSI Segment)	4th Census (2006-07) (Registered Micro and Small Enterprises)	4th Census (2006-07) (Registered Micro, Small and Medium Enterprises)
1	Size of sector	13.75	15.61	15.64
2	Employment	61.63	88.77	93.09
3	Share of Rural Enterprises (%)	44.33%	45.26%	45.23%
4	Per unit employment (no.)	4.48	5.69	5.95
5	Per unit Fixed Investment	6.68	25.17	28.72
6	Per unit original Value of Plant and machinery	2.21	5.35	6.72
7	Per unit gross output	14.78	40.46	45.24
8	Value of Gross Output per one hundred thousand investment in fixed asset	2.21	1.61	1.58
9	No of units found permanently closed	8.87	NA	4.96
10	Total no. of units			19,866

Note:—. Column 2 excludes Medium enterprises
Source: Final report on 4th Census- Registered (Reproduced from the Source)

As revealed by the descriptive statistics for the registered MSMEs in Table 2.1, the average size of these firms, in value terms was very small at a mere Rs. 15,64,000 as per the 4th Census, with a total employment of 9.3 million or around 6 employees per enterprise and a plant and machinery value of a meager Rs. 600,000 per unit. An interesting feature is the sizeable number of these enterprises that were permanently closed in both the 3rd and 4th census. The main reasons reported by sick or incipient sick units include lack of demand, shortage of working capital, marketing problems and several other factors pertaining to inputs, labour, infrastructure, technology and management. [14] The latter problems highlight the presence of a wide range of operational challenges faced by Indian MSMEs and thus the need to focus specifically on the impact of policy changes such as trade liberalization on such firms.

The distribution of these MSMEs in the Census dataset is revealing. A sizeable proportion of these MSMEs, around fifty percent are located in some of the backward and less industrialized states, such as Bihar (8.4 percent of the total), Madhya Pradesh (18.55 percent), Rajasthan (9.74 percent) while some of the leading industrialized states such as Gujarat and Maharashtra account for a very small share of the firms in this dataset.[15] Hence, the census dataset reflects the relative prevalence of smaller firms in the poorer states and the likely greater impact of policy changes such as trade liberalization on the less developed states given this distribution. The distribution of the MSMEs across industry groups is highly concentrated in a few industries, namely, the food products, beverages and tobacco industry (33.2 percent), the paper and paper products industry (29.8 percent), miscellaneous manufacturing industries (14.1 percent) and mineral and metal (12.6 percent) products industries. Once again, this industry-

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[14] Appendix Table A.3 shows the major reasons reported by sick or incipient sick units as per the final report on the 4th Census.

[15] Appendix Table A.4 shows the distribution of MSME firms across states.

wise distribution indicates the likely differential impact of policy changes like trade liberalization on MSMEs in different industries. [16]

The distribution of MSMEs in the Census dataset with respect to other firm-level features such as access to technological knowledge, type of power source used, quality certification status and credit status, also throws up interesting insights. Tables 2.2 through 2.4 provide these descriptive statistics.

Table 2.2: Distribution of the Status of MSME Firms with respect to Technological Knowledge

Whether Unit has obtained Technological Knowledge	Categories of Sources	KNOW_HOW	Freq.	Percent	Cum.
Having Technological Knowledge	Abroad	1	312	1.57	1.57
	Domestic Collaboration company	2	1,010	5.08	6.65
	Domestic R&D institution/ specialized	3	1,142	5.75	12.4
Not Having Technological Knowledge	None	4	17,402	87.6	100
		Total	19,866	100	

Source: Final report on 4th Census- Registered (Reproduced from the Source)

Table 2.3: Distribution of MSME Firms with respect to Various Power Sources

	Categories of Power Used	POWER_SRC	Freq.	Percent	Cum.
Not-Having Modern Power Source	No Power needed	1	6,720	33.83	33.83
	Coal	2	404	2.03	35.86
	Oil	3	832	4.19	40.05
	LPG/CNG	4	32	0.16	40.21
Having Modern Power Source	Electricity	5	10,976	55.25	95.46
Not-Having Modern Power Source	Non-Conventional energy	6	20	0.1	95.56
	Traditional energy/Firewood	7	460	2.32	97.88
	Others	8	422	2.12	100
		Total	19,866	100	

Source: Final report on 4th Census- Registered (Reproduced from the Source)

Table 2.4: Distribution of Quality Certified MSME Firms

Whether Unit has obtained Quality Certificate	Categories of Certification Obtained	QUA_CER	Freq.	Percent	Cum.
Maintains Product's Quality Standards	QMS-ISO:9000	1	52	0.26	0.26
	EMS-ISO:14001	2	124	0.62	0.89
	Both	3	38	0.19	1.08
	Others	4	334	1.68	2.76
Does not Maintain Product's Quality Standards	None	5	19,318	97.24	100
		Total	19,866	100	

Source: Final report on 4th Census- Registered (Reproduced from the Source)

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[16] Appendix Table A.5 provides the distribution of MSMEs across industry groups. The Census report provides other descriptive statistics, including employment, output and asset distribution across industries. These broadly mirror the industry-wise distribution of MSMEs although certain industries such as textiles, chemicals and machinery and equipment feature importantly.

**Table 2.5: Distribution of MSME Firms with respect to Institutional Loan Outstanding Status
between 2002 and 2007**

Institutional Loan Outstanding Status	Category	Freq. between 2002-07	Percent	Cum.	2002	2007
No	0	15,681	78.93	78.93	8,616	7,065
Yes	1	4,185	21.07	100	1,317	2,868
	Total	19,866	100		9,933	9,933

Source: Final report on 4th Census- Registered (Reproduced from the Source)

The tables above indicate clearly that the bulk of registered MSMEs are characterized by limited technological knowledge, poor access to credit and poor quality standards and a large number (around one-third) either do not use power sources or use traditional sources of power. These characteristics highlight the types of competitive challenges that confront registered Indian MSMEs (and also unorganized/informal MSMEs) underscoring the need to focus separately on this segment of firms to assess the impact of trade reforms.

2.1.2   Overview of the Trends in Tariffs

The tariff data extracted from the TRAINS-WITS online database is presented in Table 2.6 below. It highlights the fact that there has been significant reduction in final goods tariffs in many industries between 2002 and 2007, i.e., the period under study. It further reveals the varying degree of tariff liberalization that has taken place across different industries, with highly protected industries experiencing much less liberalization and remaining at double digit levels of tariffs compared to low protection industries which have seen sharp reductions in tariffs from around 30 percent to single digit in some cases. In general, we find that agriculture and agro-based industries such as food products have remained relatively more protected than the majority of non-food, non-agro based manufacturing industries.

Table 2.6: Final Goods Tariff (Percent) for Different Product Groups over 2002 to 2007 Period

Final Goods Tariffs for Various Industries	2002	2007
Agriculture, hunting, forestry and fishing	32.613	27.813
Food products, beverages and tobacco	39.89	35.585
High-Protection Industries	**36.251**	**31.699**
Motor vehicles, trailers and semi-trailers	46.45	27.64
Other transport equipment	34.73	18.35
Medium-Protection Industries	**40.59**	**22.995**
Textiles, textile products, leather and footwear	32.193	12.693
Wood and products of wood and cork	32.1	12.03
Pulp, paper, paper products, printing and publishing	27.36	10.47
Coke, refined petroleum products and nuclear fuel	23.75	10.76
Chemicals and chemical products	32.83	12.94
Rubber and plastics products	34.66	12.43
Other non-metallic mineral products	34.05	12.48
Basic metals	32.91	15.92
Fabricated metal products except machinery and equipment	34.04	12.5
Machinery and equipment n.e.c	26.78	12.45
Office, accounting and computing machinery	21.49	3.13
Electrical machinery and apparatus n.e.c	30.22	12.28
Radio, television and communication equipment	22.82	6.57
Medical, precision and optical instruments	27.5	11.75
Manufacturing n.e.c; recycling	33.83	12.5
Low-Protection Industries	**29.76887**	**11.39353**

Source: WITS database, data extracted on 11/26/2013 1:50:18 A.M from WITS-TRAINS,
http://wits.worldbank.org/WITS/WITS/Default A.aspx?Page=Default

The asymmetric nature of tariff liberalization seen across industries with very different levels of protection coupled with the broad overall trend towards tariff reductions validates the choice of the study period and also indicates the likely differential impact of trade reforms on MSMEs based in different industries. Overall, the above overview of the descriptive statistics for MSMEs and the tariff trends and variations across industries motivates the need to focus on firm and industry-specific characteristics of MSMEs in examining the impact of trade liberalization. It also highlights the significance of the trade policy environment in shaping the performance of Indian MSMEs in the post reform period.

3. Methodology and Measurement Issues

We undertake a fixed effect regression analysis of the impact of trade liberalization on firm-level performance indicators such as the growth of deflated GVO and productivity for 2001-

02 and 2006-07, after taking into account different firm-level unobserved heterogeneity.[17] We regress different industry-level trade liberalization indicators (such as, input and final goods tariffs, the effective rate of protection and non-tariff barriers). This approach is also helpful to identify the effects of tariff policy on the performance of different types of MSME firms, as characterized by features such as whether they are organized or not, whether they use electric or nonelectric sources of power, their access to credit, whether they are quality certified or not, etc.[18] This exercise also enables us to identify the effects of trade policy across two broad groups of MSME firms; i) the *non-food and non-agro based* industry group and ii) the *food and agro based* industry group. [19] This fixed effect methodology is firstly applied to all MSME firms and then repeated again for the different sub-groups based on important firm and industry-specific characteristics.

The empirical analysis requires the measurement of three key variables, namely, productivity, tariff and non-tariff barriers. The methodology involved in measuring these variables is discussed next.

3.1. *Productivity Measures*

In order to capture industry-level unobserved productivity shocks, we calculate firm-level Total Factor Productivity (TFP) for the 9,581 registered MSME firms in the merged dataset and examine how their productivity has been affected by trade liberalization. For this purpose, we follow the semi-parametric methodology of Levinsohn and Petrin (2003) for measuring firm-level TFP of different MSME firms. We take the value of deflated firm-level total intermediate inputs as a proxy for the unobservable productivity shock and correct for simultaneity in a firm's choice of output and input levels in its production function.

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[17] Although we should deflate the variables by using firm - specific price deflators (Loecker, 2011), due to the unavailability of proper firm-level price deflators, we follow the example of other studies such as, Topalova and Khandelwal (2011) and deflate by using the industry-level deflator.

[18] The unorganised sector is defined by the National Commission for Enterprises in the Unorganized Sector as "*consisting of all unincorporated private enterprises owned by individuals or households engaged in the sale or production of goods and services operated on a proprietary or partnership basis and with less than ten total workers*" See, *http://en.wikipedia.org/wiki/Unorganised_sector_%28India%29*

[19] These two industry groups are selected because of the divergent trends in tariff liberalization they have experienced during our study period. The 2004-09 EXIM Policy which was introduced in 2004, widened the gap in tariff rates between these two groups of industries. The final goods tariff rate for the *food and agro based* industry group declined only marginally from 39.89 percent in 2001-02 to 35.58 percent in 2006-07 while the final goods tariff for the *non-food and non-agro based* industry group declined to as low as 6.57% in 2006-07. See Appendix: Figures B.1 to B.3 for the differential trends in tariff rates for these two industry groups.

Following the assumption of a Cobb-Douglas production function, we represent below log linearized output function for firm i in industry j at time t as follows:

$$y_{ijt} = \propto + \beta_l \, l_{ijt} + \beta_m \, m_{ijt} + \beta_k \, k_{ijt} + w_{ijt} + \varepsilon_{ijt} \qquad (3.1)$$

where *y* denotes output (measured in terms of the firm's GVO), *l* denotes labour (measured in terms of the total number of labour employed), *m* denotes total input expenditures, and *k* denotes capital used (measured in terms of total fixed assets). In the above regression equation, all the variables are taken in natural log form. We calculate w_{ijt}, which is the firm-specific, time varying unobservable productivity shock based on Levinsohn and Petrin (2003).

We deflate the GVO, total fixed assets and total input expenditure as proxies for the physical quantities of output, capital and intermediate inputs, following the literature on productivity estimation.[20] We deflate GVO, capital employed and total input expenditure by using industry specific-wholesale price indices, collected from the Economic Adviser, Ministry of Commerce and Industry, Government of India, using 2004 as the base year.[21]

By using the firm-level panel data on deflated GVO and other input expenditures for the periods 2000-01, 2001-02 and 2006-07, we estimate their respective coefficients by using the methodology of Levinsohn and Petrin (2003). The above estimation result is given in Table 3.1 for all MSME firms:

Table 3.1: Productivity Estimation Using Levinshon-Petrin Methodology for All MSME Firms

Variables	Log (Gross Value of Output)
Log(Total Employment)	0.2103119*** (0.0114826)
Log(Deflated Market Value of Total Fixed Asset)	0.6554573*** (0.0364536)
Log(Total Input Expenditures)	0.0418015** (0.0194832)
Number of Observations	27610
Number of Firms	9581

Sources: Author's calculation for Total Factor Productivity based on the merged Census data of India's registered MSME firms

After getting all the estimated coefficients, we calculate TFP for the ith firm in the jth industry at time t by using the following equation:

$$\widehat{w_{ijt}} = e^{y_{ijt} - \widehat{\beta_l} \, l_{ijt} - \widehat{\beta_m} \, m_{ijt} - \widehat{\beta_k} \, k_{ijt}} \qquad (3.2)$$

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[20]See the gross revenue approach to productivity estimation discussed in Levinsohn and Petrin (2003)
[21] http://www.eaindustry.nic.in/wpi_revision_0405.asp

After getting the Hicks-neutral TFP, we also create the productivity index following the methodology of Aw, Chen and Roberts (2001).[22] This is done to make the estimated TFP comparable across industries. Table 3.2 gives the detailed calculation for the productivity index:

Table 3.2: Calculation of Productivity Index for All MSME Firms

Variable	Obs	Mean in 2002	Std. Dev. in 2002	Min in 2002	Max in 2002
Log (Gross Value of Output)	9581	6.494239	1.632335	0.7865232	16.17773
Log(Total Employment)	9581	0.7889351	0.7798006	0	6.579251
Log(Deflated Market Value of Total Fixed Asset)	9559	6.278767	1.769527	0.220654	15.98833
Log(Total Input Expenditures)	9159	5.08847	2.341916	-13.77549	15.61759
Mean Log Log (Gross Value of Output) in 2002 (Base Period)= 6.494239					
Mean Log (Input Expenses) in 2002= (0.7889351*0.2103119 + 6.278767*0.6554573 + 5.08847*0.0418015)					
Mean Productivity in 2002= Exponential [Mean Log (Sales Revenue in 2002) - Mean Log(Input Expenses in 2002)]					
Productivity Index = Productivity - Mean Productivity in 2002					

Sources: Author's calculation for Productivity Index based on the merged Census data of India's registered MSME firms

To make sure that the extreme outliers do not affect the analysis, we also trim the top and bottom 1% of the productivity index.[23]

3.2. *Various Tariff and Non-Tariff Barriers Measures*

We calculate the input tariff, the effective rate of protection (ERP) and non-tariff barriers (NTBs) for all the seventeen 2-digit broad industry groups (based on ISIC revision 3 or NIC-2004).[24] Thus, to analyse the effects of trade liberalization on firm-level performance for Indian MSME manufacturing firms, which belong to these 17 industry groups, we calculate the input tariff and ERP for all the 17 industries based on final goods tariff data and input-output data collected from the WITS database and the OECD-STAN database, respectively.[25] We also calculate NTBs for all these 17 industries based on the data for import conditions (import policy) for each 8-digit product group and the import data for each 2 and 8-digit product group,

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[22]The productivity index is calculated as the logarithmic deviation of a firm from a reference firm's Productivity in the particular industry in the base year. For the productivity index calculation, we have subtracted the productivity of a firm (mean log output and mean log input level) in 2001-02 (base year) from the estimated firm-level TFP to get the productivity index.

[23] However, the main results have remained robust after the inclusion of the outliers too.

[24]International Standard Industrial Classification of All Economic Activities, Revision.3 http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2 and National Industrial Classification, http://mospi.nic.in/Mospi_New/upload/nic_2004_index.htm

[25] The STAN database provides a comprehensive tool for analysing industrial performance at a relatively detailed level of activity across countries. It includes annual measures of output, labour input, investment and international trade which enable the construction of indicators pertaining to productivity growth, competitiveness and general structural change. http://www.oecd.org/industry/ind/stanstructuralanalysisdatabase.htm

collected from the Director General of Foreign Trade (DGFT) database, Government of India
and the Ministry of Commerce and Industry database, Department of Commerce, Government
of India, respectively.[26] The detailed calculation of all these aforementioned trade indicators is
given in Appendices B and C. Along with the aforementioned protection indicators, we also
calculate the industry-level export propensity for all these seventeen 2-digit industry groups
(NIC-2004) based on the industry-level export data collected from the WITS-UN
COMTRADE database (World Bank) and the GVO data from the Annual Survey of Industries
(ASI) database.[27]

4. The Estimation Strategy and Analysis

4.1 Model Specifications

As outlined earlier, the main objective of this study is to determine the differential effects of
trade liberalization on firm performance and to see how this differs across different types of
MSME firms. The final fixed effect (2N) models for the firm-level GVO are specified in the
following two equations (4.1) and (4.2).

$log\ of\ Gross\ value\ of\ Output_{ijt} = \propto + \tau\ input\ or, final\ goods\ tariff\ or, ERP_{jt-1} +$
$\beta\ Total\ Fixed\ Asset_{ijt} + \gamma Age_{ijt} + \delta Age^2{}_{ijt} + \mu\ Total\ Employment_{ijt} +$
$\nu\ Institutional\ Loan\ Outstanding_{ijt} + \theta Export\ Propensity_{jt} + c_i + \lambda_t +$
ε_{ijt} (4.1)

$log\ of\ Gross\ value\ of\ Output_{ijt} = \propto + \tau\ NTB\ Index_{jt} + \beta\ Total\ Fixed\ Asset_{ijt} +$
$\gamma Age_{ijt} + \delta Age^2{}_{ijt} + \mu\ Total\ Employment_{ijt} + \nu\ Institutional\ Loan\ Outstanding_{ijt} +$
$\theta Export\ Propensity_{jt} + c_i + \lambda_t +$
ε_{ijt} (4.2)

Equations 4.1 and 4.2 determine the differential effects of industry-level tariffs and NTBs,
respectively, on firm-level GVO. In both these models, the firm-level GVO is deflated by using

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[26] http://dgft.gov.in/ and http://commerce.nic.in/eidb/default.asp

[27] "The World Integrated Trade Solution (WITS) database provides access to international merchandise trade,
tariff and non-tariff measures (NTM) data. See, http://wits.worldbank.org/. The ASI is the main source of
industrial statistics in India. It enables analysis of the growth, composition and structure of organised
manufacturing sector across a wide range of activities.
 http://mospi.nic.in/mospi_new/upload/asi/ASI_main.htm?status=1&menu_id=88

the industry-level WPI deflator. We take the dependent variable in natural log form and also control for firm and year effects.

Similarly, the fixed effect (2N) models for firm-level total factor productivity (TFP) are specified in the following two equations (4.3) and (4.4). These equations determine the differential effects of industry-level tariffs and NTBs, respectively, on firm-level productivity.

$$Productivity_{ijt} = \propto +\tau\ input\ or, final\ goods\ tariff\ or, ERP_{jt-1} + \gamma \text{Age}_{ijt} + \delta Age^2_{ijt} +$$
$$\nu\ Institutional\ Loan\ Outstanding_{ijt} + \theta Export\ Propensity_{jt} + c_i + \lambda_t +$$
$$\varepsilon_{ijt} \tag{4.3}$$

$$Productivity_{ijt} = \propto +\tau\ NTB\ Index_{jt} + \beta\ Total\ Asset_{ijt} + \gamma \text{Age}_{ijt} + \delta Age^2_{ijt} +$$
$$\nu\ Institutional\ Loan\ Outstanding_{ijt} + \theta Export\ Propensity_{jt} + c_i + \lambda_t +$$
$$\varepsilon_{ijt} \tag{4.4}$$

As seen above, in our fixed effect models for the GVO, we control for firm age, age square, firm size (proxied by a firm's total fixed assets), total employment, institutional loans outstanding and industry-level export propensity, apart from the main variables of interest which are the lagged tariffs and the NTB Index. In the fixed effect models for productivity, we control for firm age, age square, institutional loans outstanding and industry-level export propensity, apart from the main variables of interest.[28]

In order to validate the robustness of our specification, we also test for possible endogeneity between performance measures such as GVO and productivity and trade policy (captured by the input, final goods and ERP tariff measures), which could arise from the industry's previous period GVO and productivity status affecting the level of trade protection. We find that trade policy is not affected by past period firm-level output or productivity. [29]

4.2   Results and Interpretations of the Fixed Effect Models

This section discusses the results of the fixed effect models on firm-level GVO and productivity. As discussed earlier, we use these models to first assess the impact of trade

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[28] While estimating the total factor productivity (TFP) index we have taken care of the effects of firm size and total employment, hence we have not taken these as control variables in the fixed effect models specification.

[29] See Appendix Table B.3 for the results showing the absence of trade policy endogeneity with firm level performance measures. It should be noted that Topalova and Khandelwal (2011) find trade policy endogeneity between 1997 to 2001, however they did not find it for 1989 to 1996 period. Similarly, in our study we also did not find any trade policy endogeneity between 2002 to 2007 period. Thus, it gives an evidence of systematic process of presence and absence of trade policy endogeneity with an interval of five years.

liberalization on these performance measures for all MSME firms, and then to assess the impact on these same performance measures for subgroups of MSME firms which differ in terms of their production and operating structure. This section presents the results of these various models as given in equations 4.1 to 4.4. The results for all MSME firms and for their sub-groups are given in separate columns in each of the following tables.

4.2.1 Tariff Liberalization and Firm-Level Gross Value of Output

This subsection discusses the results for the above models for measuring the impact of tariff liberalization on firm-level GVO. Tables 4.1 and 4.2 show the effects of a reduction in lagged input tariffs and lagged final goods tariffs, respectively, on firm-level GVO. The panel and column-wise contents and comparisons for each of these tables are as outlined below.

In each table, Panel 0 (column 1) represents the results of the fixed effect (2N) models for all MSME firms. Panel 1 (column 2) shows the results for those MSME firms which belong to the *non-food and non-agro based* industries. A comparison of the results in columns 1 and 2 indicates the difference in the effects of trade liberalization on MSME firms as a whole as opposed to MSME firms which belong to the *non-food and non-agro based* industries (i.e., more liberalized after 2004). The results presented in panel 2 (columns 3 and 4) compare the effects of trade liberalization between the group of MSME firms, which use modern power source (electric) and those MSME firms, which either do not use any power or use traditional power sources (non-electric) in their production process. The results presented in panel 3 (columns 5 and 6) show the differential effects of trade liberalization between those MSME firms, which maintain their product quality standards and those which do not. The results presented in panel 4 (columns 7 and 8) indicate the differential effects of trade liberalization between those MSME firms, which have technological knowledge and those which do not.

All the fixed effect models include firm age, age square, total fixed assets (as a proxy for firm size), firms' total employment, their institutional loan outstanding and industry-level export propensity. It should be noted that in each of the regressions (columns 1-8), the standard errors are clustered at the firm level.

Table 4.1: Firm-Level GVO and Final Goods Tariff (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	*Non-Food and Non-Agro based MSMEs*	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Log (Gross Value of Output)							
Lagged Final Goods Tariff Industry Wise	0.002 (0.002)	0.023 (0.015)	0.000 (0.003)	0.003 (0.004)	-0.020 (0.013)	0.002 (0.002)	-0.023*** (0.007)	0.006** (0.002)
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000** (0.000)	0.000* (0.000)
Age	0.130*** (0.008)	0.204*** (0.055)	0.127*** (0.011)	0.128*** (0.015)	0.082 (0.055)	0.131*** (0.008)	0.092*** (0.029)	0.138*** (0.009)
Age Square	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Total Employment	0.021** (0.009)	0.035*** (0.008)	0.021** (0.010)	0.018*** (0.005)	0.003*** (0.001)	0.039*** (0.006)	0.026*** (0.008)	0.020** (0.010)
Firm's Institutional Loan Outstanding	0.102*** (0.025)	0.069** (0.028)	0.106*** (0.036)	0.074** (0.030)	-0.082 (0.162)	0.096*** (0.024)	0.073 (0.088)	0.103*** (0.026)
Export Propensity Industry Wise	-0.006*** (0.000)	-0.006*** (0.000)	-0.007*** (0.001)	-0.004*** (0.000)	-0.006 (0.004)	-0.005*** (0.000)	-0.001* (0.002)	-0.006*** (0.000)
Constant	5.140*** (0.147)	3.618*** (1.057)	5.624*** (0.191)	4.668*** (0.202)	7.310*** (0.955)	5.028*** (0.148)	6.508*** (0.526)	4.926*** (0.149)
R Square	0.2564	0.2951	0.2362	0.275	0.2156	0.2740	0.2604	0.2594
No of Observation	19836	13248	10956	8880	548	19288	2464	17372
No of MSMEs	9918	6624	5478	4440	274	9644	1232	8686
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 4.2: Firm-Level GVO and Input Tariff (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	*Non-Food and Non-Agro based MSMEs*	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Log (Gross Value of Output)							
Lagged Input Tariff Industry Wise	-0.003 (0.002)	-0.012*** (0.003)	-0.022*** (0.005)	0.005 (0.003)	-0.056*** (0.020)	-0.003 (0.002)	-0.032*** (0.009)	0.000 (0.002)
Deflated MKT Value Fixed Asset	0.000*** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000** (0.000)	0.000* (0.000)
Age	0.116*** (0.008)	0.093*** (0.127)	0.090*** (0.011)	0.132*** (0.011)	0.046 (0.051)	0.117*** (0.008)	0.090*** (0.027)	0.123*** (0.008)
Age Square	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Total Employment	0.021** (0.009)	0.035*** (0.009)	0.021** (0.010)	0.018*** (0.005)	0.003*** (0.001)	0.039*** (0.006)	0.025*** (0.008)	0.020** (0.010)
Firm's Institutional Loan Outstanding	0.108*** (0.025)	0.075*** (0.028)	0.121*** (0.036)	0.070** (0.029)	-0.078 (0.161)	0.101*** (0.024)	0.078 (0.088)	0.107*** (0.026)
Export Propensity Industry Wise	-0.005*** (0.000)	-0.006*** (0.000)	-0.006*** (0.001)	-0.004*** (0.000)	-0.006 (0.004)	-0.005*** (0.000)	-0.003 (0.002)	-0.005*** (0.000)
Constant	5.436*** (0.134)	5.777*** (0.219)	6.503*** (0.210)	4.581*** (0.202)	8.279*** (0.904)	5.317*** (0.134)	6.630*** (0.485)	5.242*** (0.135)
R Square	0.2564	0.2958	0.2393	0.3092	0.2304	0.2740	0.2625	0.2588
No of Observation	19836	13248	10956	8880	548	19288	2464	17372
No of MSMEs	9918	6624	5478	4440	274	9644	1232	8686
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

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

We discuss next the results for final goods as well as input tariff reductions presented in Tables 4.1 and 4.2 above across three dimensions: (a) the impact observed for all MSME firms and for the sub group of MSME firms in *non-food non-agro based* industries; (b) the role of selected firm-level characteristics (modern or traditional, quality certification and technological upgradation) which influence the impact of tariff reductions on firm-level GVO including the relative importance of these firm-specific characteristics; and (c) the role of selected control variables in mediating the relationship between tariff reductions and GVO growth. The differences in the relative magnitudes, significance levels and direction of the results obtained for final goods versus input tariffs are also highlighted for all these three dimensions. Following the discussion across these three aforementioned dimensions, the combined regression analysis results for input and final goods tariffs are presented and analysed. We next highlight the results for the net effect of liberalizing final goods and input tariffs, i.e., the effect of changes in the ERP on growth in firm-level GVO in subsection (e). We conclude the section by showing the combined effect of all the tariff measures on firm-level GVO against firm and industry-level characteristics along with interaction effects.

(a) Impact on All MSME firms and their Sub-Groups

Table 4.1 shows that a reduction in the final goods tariff has failed to improve the growth rate of firm-level GVO for all MSME firms. This result is consistent with those obtained by Mukherjee (2014) using the CMIE Prowess dataset. The coefficients of the lagged final goods tariff in columns 1 and 2 are insignificant. The same is true for *non-food and non-agro based* MSME firms.

The results presented in Column 1 of Table 4.2 indicate that a reduction in the input tariff has had an insignificant impact on firm-level GVO across all MSMEs. However, for the industry sub group of *non-food and non-agro based* MSMEs, as shown in Column 2 of Table 4.2, there is a positive and significant impact. This is likely to be due to the fact that MSME firms which belong to *non-food and non-agro based* industries have experienced greater tariff reductions following the EXIM policy of 2004-09 and have thus benefited through intermediate imports.[30] For this group of MSME firms, a 1 percent decline in the lagged input tariff is associated with a 1.2 percent increase in the growth rate of GVO. Thus trade liberalization appears to have particularly benefited *non-food and non-agro based* MSME firms through the input channel.

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[30] This result is consistent with the results obtained from a Difference-in-Difference analysis undertaken for SME firms belonging to these two industry groups in Mukherjee and Chanda (2016)

A comparison of the coefficients in column 2 of Tables 4.1 and 4.2 for the sub-group of *non-food, non-agro based* MSME firms further suggests that the input channel has been stronger than the final goods competition channel.

The latter results can in part be explained by examining the share of imported inputs of the food and agro-based versus non-food, non-agro based segments against the trends in tariffs for different industries which are presented in Appendix B. Table B.2 shows that *non-food, non-agro based* MSMEs use a larger share of inputs from this same industry group, which has experienced a large reduction in tariffs (see Figures B.1 and B.2). In contrast, MSMEs in *food and agro based* industries use a higher proportion of inputs from within their own industry group, which have experienced stagnant rates of protection (and in some cases a slight increase) over this study period. The significance of the input channel and the stronger results observed for the *non-food and non-agro* segment of MSMEs is thus probably explained by this combination of the differential reliance on imported inputs across the two broad industry groups and their differential tariff trends.

We can also infer that the above positive impact may be explained by the improved access to a larger scale, variety, range, possibly better quality and reduced costs of imported intermediate inputs, the associated transfer of technology and R&D spillovers that input tariff liberalization can make possible. These sources of gains have been highlighted in the endogenous growth literature by Grossman and Helpman (1991), Ethier (1979, 1982), Rivera-Batiz and Romer (1991) regarding the role of foreign intermediate inputs in enhancing growth and have also been highlighted in several theoretical and empirical studies by Lee (1995), Eaton and Kortum (2001), Goh and Olivier (2002), Xu and Wang (1999) and Alfaro and Hammel (2007) which specify the influence of trade liberalization of intermediate and capital goods sectors on firm level performance. Our results also confirm empirical analysis along similar lines for Indian manufacturing firms as a whole by Topalova and Khandelwal (2011), Goldberg et. al. (2010a and 2010b), Loecker et. al. (2012) and by the authors on the significance of input liberalization for firms in the textile industry.[31] These latter studies find an increased probability of importing capital goods for the average firm, a positive effect of input tariff cuts on the intensive margin of imports of capital goods, and a positive effect of input-trade liberalization on firms' sales, firm productivity growth as well as firms' ability to introduce new products.

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[31] Mukherjee and Chanda (2016)

(b) Importance of firm-specific characteristics

We obtain interesting results regarding the influence of the selected firm-specific characteristics on the relationship between tariff reductions and firm-level growth in GVO. In Table 4.1, although the coefficients for some of these firm characteristics (Panels 2 to 4) are not always significant, an interesting pattern can be observed. Consistently across these characteristics we find that firms which are more technologically upgraded, which use modern (electric) power sources, or which obtain quality certification tend to benefit marginally or significantly, from final goods tariff liberalization, while their less modern, less technologically upgraded, and lower quality counterpart MSMEs are systematically adversely impacted by final goods tariff reductions and thus increased competition. In particular, technology adoption appears to play an important role with significant beneficial effects observed for the technologically upgraded MSME firms and significant adverse effects for their non-upgraded counterpart MSMEs (Panel 4). A one percent decrease in the final goods tariff increases the growth rate of firm-level GVO by 2.3 percent for technologically advanced MSME firms while this same tariff reduction is associated with a decrease of 0.6 percent in the case of technologically backward MSME firms. The broad inference that can be made from the above results is that firms which have modernized and become technologically more efficient have been better able to cope with increased product competition following tariff liberalization.

Drawing upon the earlier discussion of the stronger input as opposed to final goods channel, one can interpret these results regarding the significance of technology as possibly reflecting the ability of firms with upgraded technology in benefiting from imported inputs and thus technology diffusion and associated productivity and output gains that can arise through the imported inputs channel. These results are in line with the findings of Nataraj (2011) where productivity gains are observed for large-formal firms following trade liberalization. The Government of India (2013-14) Annual Report of the Ministry of MSMEs specifically notes the importance of technology for the MSME segment. It highlights the difficulties faced by MSMEs in acquiring technologies due to the restrictions on size, thereby preventing them from exploiting economies of scale and in facing competition from imported items.

Similar and stronger results are observed for these same firm-specific features in the case of input tariff liberalization across all firms as well as specific sub-groups of firms based on industry grouping or firm-specific features, as shown in Table 4.2. MSME firms which use modern power sources, which are technologically upgraded and which are quality certified are associated with a positive and significant impact on their growth in GVO. As seen in Panels 3

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and 4, a one percent reduction in the lagged input tariff is associated with improved GVO growth rates of 5.6 percent and 3.2 percent, respectively for those MSME firms, which have maintained their product quality standards and which are technologically advanced. Their less modernized, less technologically adept and less quality conscious counterpart MSMEs are associated with adverse or insignificant effects of input tariff liberalization on GVO growth. Overall, it appears that those MSME firms, which are more organised and more modern in their operation and production structures, have been better placed to benefit from trade liberalization through the input channel. Many previous studies, such as, Singh, Garg and Deshmukh (2010b) have also highlighted the importance of these characteristics in shaping the performance of Indian MSME firms. [32]

(c) Role of selected control variables

We next comment on the results obtained for the several control variables in our final goods and input tariff regression models. We find that firm size, age, total employment and institutional loan outstanding (which proxies a firm's access to credit) are associated positively with the growth rate of firm-level GVO for all MSMEs and for the various sub-groups of MSMEs captured in Tables 4.1 and 4.2.[33] In contrast, higher export propensity in an industry is consistently associated with an adverse effect on GVO growth for all MSMEs and sub-groups of MSMEs, probably indicating the fact that firms in more export-oriented industries are likely to face greater competition than in those industries which are inward oriented. Consistently, the results are stronger for the more modern, technologically upgraded and quality conscious MSMEs.

Our results regarding the importance of firm-size in shaping the benefits of trade liberalization confirm the findings of earlier studies regarding the heterogeneous effect of trade liberalization on firms' technology and product choice. We can thus infer that larger firms are more likely to have captured the benefits of trade liberalization, reflecting the advantages large firms possess over small firms, in terms of technology, scale economies, quality, access to credit, among other factors. Studies on Indian manufacturing across industries have also highlighted

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[32] It would have been useful to examine the effects of input tariff liberalization on the import behavior of the MSME segments (sub-groups) for the study period to identify the significance of the input channel for different groups of firms. However, such analysis could not be undertaken as the census data did not provide information on firm-level imports.

[33] The Government of India has recently launched the Micro Units Development Refinance Agency (MUDRA) to extend credit to SMEs in recognition of the fact that lack of access to cheap credit is a major hurdle for this segment of Indian manufacturing.

the importance of credit conditions, technology, assets, among other firm-level characteristics in influencing firm-level performance and our findings confirm the same.

(d) Combined effect of input and final goods tariffs and GVO

These results hold even when both input and final goods tariffs are included in a single regression. Table 4.3 confirms the earlier findings that the reduction in final goods tariffs has had a negative and significant impact while the reduction in input tariffs has a positive and significant impact on firm-level GVO. Further, non-food, non-agro MSMEs are fare better, for the reasons outlined earlier. Once again, MSMEs with access to technological knowhow, with quality certification and modern production methods benefit more from input tariff liberalization and also for the most part from final goods tariff liberalization, indicating that the more modern and technologically upgraded firms are in a position to realize the competition and sourcing related gains from trade liberalization.

Table 4.3: Firm-Level GVO and Final Goods Tariff and Input Tariff (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		**Maintaining Quality Standards**		**Technological Knowledge**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	All MSMEs	***Non-Food and Non-Agro based* MSMEs**	**Electric Sourced MSMEs**	**Non-Electric Sourced MSMEs**	**Obtained Quality Certification**	**Not Obtained Quality Certification**	**Having Technological Knowledge**	**Not Having Technological Knowledge**
	Log (Gross Value of Output)							
Lagged Final Goods Tariff Industry Wise	0.008*** (0.003)	0.001 (0.020)	0.018*** (0.004)	-0.000 (0.004)	-0.009 (0.016)	0.008*** (0.003)	-0.006 (0.010)	0.009*** (0.003)
Lagged Input Tariff Industry Wise	-0.010*** (0.003)	-0.012** (0.005)	-0.043*** (0.007)	0.005 (0.004)	-0.066*** (0.023)	-0.009*** (0.003)	-0.026** (0.012)	-0.007** (0.003)
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000** (0.000)	0.000* (0.000)
Age	0.125*** (0.008)	0.097 (0.081)	0.102*** (0.011)	0.132*** (0.015)	0.054 (0.056)	0.125*** (0.008)	0.085*** (0.029)	0.134*** (0.009)
Age Square	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Total Employment	0.021** (0.009)	0.035*** (0.008)	0.021* (0.011)	0.018*** (0.005)	0.003*** (0.001)	0.039*** (0.006)	0.026*** (0.008)	0.020* (0.010)
Firm's Institutional Loan Outstanding	0.109*** (0.025)	0.075*** (0.028)	0.129*** (0.036)	0.070** (0.030)	-0.076 (0.161)	0.103*** (0.025)	0.078 (0.088)	0.109*** (0.026)
Export Propensity Industry Wise	-0.006*** (0.000)	-0.006*** (0.000)	-0.008*** (0.001)	-0.004*** (0.000)	-0.007 (0.004)	-0.006*** (0.000)	-0.002* (0.002)	-0.006*** (0.000)
Constant	5.258*** (0.152)	5.700*** (1.578)	6.236*** (0.216)	4.583*** (0.282)	8.111*** (1.021)	5.139*** (0.152)	6.734*** (0.542)	5.014*** (0.153)
R Square	0.2570	0.2958	0.2420	0.3092	0.2311	0.2746	0.2627	0.2598
No of Observation	19836	13248	10956	8880	548	19288	2464	17372
No of MSMEs	9918	6624	5478	4440	274	9644	1232	8686
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

(e) Effective Rates of Protection and Gross Value of Output

As there appear to be differing effects on GVO growth in terms of magnitude and significance level of coefficients in the case of final goods versus input tariff reduction, we examine the net effect of tariff liberalization on MSMEs as a whole and by their various sub-groups. For this purpose, we use the lagged ERP as a measure to capture the net impact of tariff liberalization. The results of this exercise are provided in Table 4.4.

Table 4.4: Firm-Level GVO and Effective Rate of Protection (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	*Non-Food and Non-Agro based MSMEs*	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Log (Gross Value of Output)							
Lagged ERP Industry Wise	0.000 (0.001)	-0.006 (0.004)	-0.002 (0.002)	0.002 (0.002)	-0.014* (0.008)	0.000 (0.001)	-0.013*** (0.004)	0.002* (0.001)
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000** (0.000)	0.000* (0.000)
Age	0.125*** (0.008)	0.095*** (0.024)	0.122*** (0.011)	0.129*** (0.012)	0.088* (0.049)	0.125*** (0.008)	0.108*** (0.026)	0.131*** (0.008)
Age Square	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Total Employment	0.021** (0.009)	0.035*** (0.009)	0.021** (0.010)	0.018*** (0.005)	0.003*** (0.001)	0.039*** (0.006)	0.026*** (0.008)	0.020** (0.010)
Firm's Institutional Loan Outstanding	0.103*** (0.025)	0.065*** (0.028)	0.108*** (0.036)	0.073** (0.030)	-0.082 (0.162)	0.097*** (0.024)	0.074 (0.088)	0.104*** (0.026)
Export Propensity Industry Wise	-0.005*** (0.000)	-0.005*** (0.000)	-0.007*** (0.001)	-0.004*** (0.000)	-0.007* (0.004)	-0.005*** (0.000)	-0.002* (0.002)	-0.006*** (0.000)
Constant	5.246*** (0.117)	5.689*** (0.425)	5.740*** (0.153)	4.667*** (0.193)	7.072*** (0.729)	5.145*** (0.117)	6.063*** (0.395)	5.100*** (0.119)
R Square	0.2563	0.2950	0.2363	0.3090	0.2178	0.2739	0.2603	0.2591
No of Observation	19836	13248	10956	8880	548	19288	2464	17372
No of MSMEs	9918	6624	5478	4440	274	9644	1232	8686
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

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

We find that a reduction in ERP is associated with an insignificant effect on firm-level GVO growth, reflecting the opposing effects of final versus input tariff liberalization. However, as seen earlier, when we consider the results for different subgroups of MSMEs, i.e., non-*food and non-agro based* firms, or those which use electricity, are technologically upgraded and obtain quality certification, we observe a beneficial impact of a reduction in the ERP, which is in some cases significant. Technology adoption and quality certification again emerge as two important firm-specific characteristics which enable MSMEs to, on net, benefit from trade

liberalization. As shown in columns 5 and 7, a one percent reduction in lagged ERP increases firm-level GVO growth by 1.4 percent and 1.3 percent for MSME firms which have maintained their product quality standards and which are technologically upgraded, respectively. The results for the *non-food and non-agro based* industry subgroup and for power source, although insignificant, nevertheless indicate the role of industry heterogeneity (i.e., being placed in a more liberalized industry) and of a modern production structure in realizing the benefits from trade liberalization.

(f) Trade liberalization and GVO with interaction effects

We also examine the impact of the reduction in input, final and effective rates of protection on GVO in the presence of an interaction term for various firm-level characteristics and the trade policy indicators. The interaction term is included to assess if the impact of the different trade policy measures discussed above vary depending on different firm-level characteristics. These results are presented in Table 4.5.

Table 4.5: Firm-Level GVO, Final Goods Tariff, Input Tariff, ERP with Firm-Characteristics and Trade indicators Interaction Effect (2002 and 2007)

	1	2	3	4
	Log (Gross Value of Output)			
Lagged Final Goods Tariff Industry Wise	0.005*** (0.002)			0.014*** (0.003)
Lagged Input Tariff Industry Wise		0.000 (0.002)		-0.014*** (0.003)
Lagged ERP Industry Wise			0.004*** (0.001)	
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)
Age	0.130*** (0.011)	0.108*** (0.008)	0.127*** (0.007)	0.122*** (0.008)
Age Square	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Total Employment	0.021** (0.009)	0.021** (0.009)	0.021** (0.009)	0.021** (0.009)
Firm's Institutional Loan Outstanding	0.094*** (0.025)	0.100*** (0.025)	0.094*** (0.025)	0.103*** (0.025)
Export Propensity Industry Wise	-0.006*** (0.000)	-0.005*** (0.000)	-0.005*** (0.000)	-0.006*** (0.000)
Tariff*Modern Power Source Dummy	-0.004*** (0.001)	-0.013*** (0.002)	-0.004*** (0.001)	-0.006*** (0.001)
Tariff*Maintaining Quality Standard Dummy	-0.003 (0.005)	-0.009 (0.008)	-0.003 (0.003)	-0.003 (0.004)
Tariff*Maintaining Modern Technological Dummy	-0.009*** (0.002)	-0.013*** (0.003)	-0.007*** (0.001)	-0.009*** (0.004)
Constant	5.165*** (0.148)	5.658*** (0.144)	5.234*** (0.116)	5.340*** (0.155)
R Square	0.2587	0.2605	0.2591	0.2597
No of Observation	19836	19836	19836	19836
No of MSMEs	9918	9918	9918	9918
Fixed Effect	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The inclusion of the interaction term shows that while a reduction in final goods and input tariffs as well as the ERP either negatively or insignificantly impacts firm-level GOP (i.e., Columns 1-3) for MSMEs as a whole, among MSMEs, those firms which use modern power source and are technologically updated benefit from a reduction in input tariff and ERP as reflected by an improvement in their GOP by 1.3 and 0.3 percent, respectively.

Interestingly, the inclusion of the interaction term in the presence of a reduction in both final goods and input tariffs (i.e., Column 4) shows that while the reduction in final goods tariff negatively impacts the firm-level GOP (by 1.4%), the reduction in input tariff positively impacts the firm-level GOP (by 1.4%). The interaction variables further show that firms which use modern power source and which are technologically upgraded are able to improve their GOP by 2 percent and 2.3 percent, respectively following a reduction in input tariffs. Thus, we find once again that the results do not change when we examine all trade policy measures in a

combined regression and when we allow for firm-level characteristics to influence the impact of trade liberalization on GVO through the interaction term.

4.2.2   *Tariff Liberalization and Firm-Level Productivity*

There is extensive literature on firm-level productivity and its significance as a measure of firm performance which can be affected by trade liberalization. Many studies, such as Balakrishnan et.al. (2006), Aw, Chen and Roberts (2001), have measured firm-level productivity for different countries, including India, and have revisited this issue in the context of trade liberalization. Several studies have also examined trends in firm-level productivity over different phases of liberalization in India. Using the CMIE Prowess database, Mukherjee (2014) finds that productivity gains are mainly observed for large firms following trade liberalization. In this section we examine the firm-level productivity effects of trade liberalization for MSMEs using our merged dataset from the Census of Indian MSMEs, following the Levinsohn-Petrin (2003) procedure (discussed earlier in Section 3.1).

Tables 4.6 and 4.7 present the results for the effects of a reduction in lagged final goods tariffs and lagged input tariffs respectively, on firm-level productivity for 8,782 registered MSME manufacturing firms between 2001-02 and 2006-07. The discussion of these results covers the same dimensions as in the case of GVO in Section 4.2.1 earlier.

Table 4.6: Firm-Level Productivity and Final Goods Tariff (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	Non-Food and Non-Agro based MSMEs	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Productivity							
Lagged Final Goods Tariff Industry Wise	0.030 (0.040)	-0.014 (0.294)	-0.042 (0.052)	0.273*** (0.085)	-0.101 (0.279)	0.034 (0.040)	-0.141 (0.122)	0.051 (0.042)
Age	0.882*** (0.175)	0 .632 (1.004)	1.014*** (0.224)	1.271*** (0.308)	0.594 (1.243)	0.899*** (0.176)	0.577 (0.566)	0.929*** (0.183)
Age Square	0.005 (0.004)	0 .009* (0 .005)	-0.002 (0.005)	0.016*** (0.006)	0.014 (0.022)	0.005 (0.004)	0.003 (0.012)	0.005 (0.004)
Firm's Institutional Loan Outstanding	2.242*** (0.450)	2.164*** (0.545)	1.230** (0.628)	3.883*** (0.619)	-4.242 (3.206)	2.451*** (0.455)	0.383 (1.613)	2.433*** (0.466)
Export Propensity Industry Wise	-0.081*** (0.015)	-0.080*** (0.017)	-0.015 (0.020)	-0.138*** (0.022)	0.003 (0.072)	-0.083*** (0.015)	-0.000 (0.043)	-0.093*** (0.016)
Constant	-5.035* (2.720)	1.174 (19.964)	-6.514* (3.425)	-13.928** (5.556)	0.838 (19.942)	-5.303* (2.729)	2.267 (9.030)	-5.966** (2.836)
R Square	0.0805	0.0858	0.0657	0.1087	0.0511	0.0825	0.0599	0.0845
No of Observation	17564	11768	9614	7950	466	17098	2162	15402
No of MSMEs	8782	5884	4807	3975	233	8549	1081	7701
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 4.7: Firm-Level Productivity and Input Tariff (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	*Non-Food and Non-Agro based MSMEs*	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Productivity							
Lagged Input Tariff Industry Wise	0.028 (0.047)	-0.005 (0.083)	-0.114 (0.081)	0.186** (0.085)	-0.719* (0.393)	0.043 (0.047)	-0.048 (0.133)	0.034 (0.050)
Age	0.854*** (0.174)	0.669** (0.280)	0.931*** (0.229)	0.884*** (0.292)	-0.272 (1.118)	0.892*** (0.176)	0.836 (0.524)	0.856*** (0.185)
Age Square	0.005 (0.004)	0.009* (0.005)	-0.001 (0.005)	0.016** (0.006)	0.018 (0.021)	0.005 (0.004)	0.002 (0.012)	0.005 (0.004)
Firm's Institutional Loan Outstanding	2.231*** (0.456)	2.171*** (0.544)	1.293** (0.628)	3.888*** (0.632)	-4.270 (3.192)	2.426*** (0.460)	0.392 (1.620)	2.431*** (0.473)
Export Propensity Industry Wise	-0.078*** (0.014)	-0.080*** (0.015)	-0.014 (0.019)	-0.113*** (0.021)	0.031 (0.063)	-0.080*** (0.014)	-0.019 (0.040)	-0.087*** (0.015)
Constant	-4.469* (2.607)	0.450 (4.820)	-4.535 (3.599)	-6.238 (5.083)	22.894 (18.510)	-5.166** (2.627)	-3.719 (8.137)	-4.424 (2.758)
R Square	0.0804	0.0858	0.0659	0.1076	0.0651	0.0825	0.0587	0.0844
No of Observation	17564	11768	9614	7950	466	17098	2162	15402
No of MSMEs	8782	5884	4807	3975	233	8549	1081	7701
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

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

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(a) Impact on All MSME firms and their Sub-Groups

The results shown in Tables 4.6 and 4.7 are similar in nature to those obtained in the case of firm level GVO. A reduction in the lagged final goods as well as input tariff for all MSME firms (column 1) has an adverse, though insignificant effect on firm-level productivity. However, for MSMEs belonging to the *non-food and non-agro based* industries, we find a beneficial, though insignificant effect of such liberalization, indicating that MSMEs in industries which have experienced more tariff liberalization have fared relatively better with regard to productivity growth. The latter would suggest that tariff liberalization has forced firms in these less protected industries to become more competitive and efficient to face the increased competition. As in the case of the results for GVO earlier, we find that MSMEs which are more modern in their production (electric sourced), which obtain quality certification and which have technological knowledge are positively impacted by tariff liberalization, though the associated coefficients are insignificant. However, we find that firms with quality certification have experienced significant benefits from input tariff liberalization. A 1 percent reduction in input tariff raises the productivity of such firms by 7.2 percent. This suggests that maintaining quality helps firms to derive productivity improvements through imported intermediate inputs.

Thus, technology adoption, modernization and quality certification have enabled MSMEs to realize productivity gains in the wake of tariff reductions. Again, similar to the earlier results for the GVO analysis, we find that the magnitude of the impact is greater (though generally not significant) in the case of input tariff liberalization, indicating that productivity gains arising from the input sourcing channel have been larger than those resulting from increased competition caused by final goods tariff reductions.

(b) Role of firm-specific features and other control variables

We find that firm-specific factors such as access to credit and age of the firm play a significant and positive role in improving the productivity of Indian MSMEs in case of both final and input tariff liberalization, confirming the importance of firm-heterogeneity. Further, it is interesting to note that these firm-specific control variables have a smaller impact on firm-level productivity (though still significant for the most part) in case of MSMEs which are more modern and updated in terms of power source, technological knowledge and quality standards. The results presented in Tables 4.4 and 4.5 also indicate that MSME firms, which belong to more export-oriented industries, are associated with a reduction in their productivity level,

confirming the importance of industry characteristics in shaping the productivity effects of tariff liberalization. However, within export-oriented industries, the adverse effect on productivity is smaller in the case of modern, technology ready and quality certified firms compared to their counterparts.

(c) Combined effect of input and final goods tariffs on productivity

We combine input and final goods tariffs in a single regression and examine the impact of trade liberalization on firm-level productivity. These results are presented in Table 4.8. Although most of the results are insignificant and we do not find a difference in the results for the non-food, non-agro based MSMEs, the signs for most of the coefficients show a similar relationship between tariff reductions and productivity as seen earlier in the case of GVO. Firms which are able to maintain their product quality standards are associated with a positive impact on productivity due to a reduction in input tariffs. Further, it is interesting to note that credit-constraints, as proxied by institutional loans outstanding are associated with a negative impact on productivity, which can be explained by their likely inability to invest in productivity enhancing measures. Similarly, firms located in more export-oriented industries are associated with a negative impact on productivity, suggesting the likely effect of global competition in such industries.

Table 4.8: Firm-Level Productivity and Final Goods and Input Tariffs (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	*Non-Food and Non-Agro based* MSMEs	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Productivity							
Lagged Final Goods Tariff Industry Wise	0.027 (0.062)	-0.034 (0.347)	-0.011 (0.073)	0.230* (0.119)	0.457 (0.335)	0.019 (0.063)	-0.265 (0.190)	0.059 (0.065)
Lagged Input Tariff Industry Wise	0.004 (0.074)	-0.010 (0.098)	-0.127 (0.112)	0.076 (0.116)	-1.186** (0.464)	0.027 (0.075)	0.202 (0.207)	-0.014 (0.079)
Age	0.884*** (0.179)	0.536 (1.356)	0.939*** (0.234)	1.320*** (0.312)	0.123 (1.258)	0.913*** (0.180)	0.624 (0.566)	0.921*** (0.189)
Age Square	0.005 (0.004)	0 .009* (0 .005)	-0.001 (0.005)	0.016*** (0.006)	0.016 (0.022)	0.005 (0.004)	0.003 (0.012)	0.005 (0.004)
Firm's Institutional Loan Outstanding	2.238*** (0.458)	2.170*** (0.547)	1.299** (0.633)	3.832*** (0.628)	-4.332 (3.191)	2.431*** (0.463)	0.338 (1.618)	2.445*** (0.475)
Export Propensity Industry Wise	-0.081*** (0.016)	-0.080*** (0.017)	-0.016 (0.021)	-0.133*** (0.024)	0.011 (0.072)	-0.082*** (0.016)	-0.009 (0.046)	-0.093*** (0.017)
Constant	-5.090* (2.786)	3.092 (26.870)	-4.705 (3.753)	-15.085*** (5.594)	14.625 (21.018)	-5.611** (2.791)	0.612 (9.093)	-5.795** (2.915)
R Square	0.0805	0.0858	0.0659	0.1088	0.0718	0.0825	0.0607	0.0845
No of Observation	17564	11768	9614	7950	466	17098	2162	15402
No of MSMEs	8782	5884	4807	3975	233	8549	1081	7701
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

(d) Effective Rates of Protection and Productivity

We examine the net effect of tariff liberalization, as measured by the ERP, on firm-level productivity. Table 4.6 provides these results for all Indian MSME firms and for specific MSME sub- groups.

The results indicate a negative and insignificant effect of lagged ERP reduction on firm-level productivity for all MSME firms, which can be interpreted as reflecting the net adverse effect of a reduction in both input and final goods tariffs on MSME firms' productivity over the study period. However, for the more liberalized *non-food and non-agro based* MSME firms, we find a positive though marginally insignificant effect of trade liberalization on firm-level productivity. Similar to the previous cases of final goods and input tariff liberalization, we find that firms which are modern in their production structure, technologically ready and quality conscious are on net positively (even if insignificantly) affected by tariff liberalization on MSME while their counterparts experience an adverse impact on their productivity.

Overall, our results suggest that Indian MSMEs as a whole have not benefited much from tariff liberalization in terms of output or productivity growth. However, among MSMEs, those which are characterized by modern operating and production structures have fared better and have been able to withstand competitive pressures arising from tariff liberalization. Both firm and industry characteristics emerge as important in mediating the impact of tariff liberalization.

Table 4.9: Firm-Level Productivity and ERP (2002 and 2007)

	Panel 0	Panel 1	Panel 2		Panel 3		Panel 4	
			Power Source		Maintaining Quality Standards		Technological Knowledge	
	1	2	3	4	5	6	7	8
	All MSMEs	*Non-Food and Non-Agro based MSMEs*	Electric Sourced MSMEs	Non-Electric Sourced MSMEs	Obtained Quality Certification	Not Obtained Quality Certification	Having Technological Knowledge	Not Having Technological Knowledge
	Productivity							
Lagged ERP Industry Wise	0.001 (0.024)	-0.136 (0.087)	-0.039 (0.033)	0.111** (0.047)	-0.058 (0.167)	0.003 (0.024)	-0.082 (0.068)	0.012 (0.026)
Age	0.804*** (0.158)	0.034 (0.431)	0.999*** (0.205)	0.889*** (0.266)	0.667 (1.080)	0.816*** (0.160)	0.675 (0.504)	0.830*** (0.167)
Age Square	0.005 (0.004)	0.009* (0.005)	-0.002 (0.005)	0.016*** (0.006)	0.014 (0.022)	0.005 (0.004)	0.002 (0.012)	0.005 (0.004)
Firm's Institutional Loan Outstanding	2.260*** (0.450)	2.175*** (0.532)	1.243** (0.627)	3.935*** (0.619)	-4.246 (3.201)	2.470*** (0.454)	0.386 (1.613)	2.454*** (0.465)
Export Propensity Industry Wise	-0.077*** (0.014)	-0.085*** (0.015)	-0.015 (0.020)	-0.121*** (0.021)	0.003 (0.064)	-0.078*** (0.015)	-0.009 (0.041)	-0.087*** (0.015)
Constant	-3.366 (2.106)	11.892 (7.597)	-6.465** (2.649)	-5.150 (4.110)	-1.182 (15.100)	-3.507* (2.118)	-0.467 (6.825)	-3.760* (2.208)
R Square	0.0804	0.0864	0.0658	0.1075	0.0511	0.0824	0.0599	0.0844
No of Observation	17564	11768	9614	7950	466	17098	2162	15402
No of MSMEs	8782	5884	4807	3975	233	8549	1081	7701
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

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

(e) Trade liberalization and Productivity with interaction effects

We also examine the impact of the reduction in input, final and effective rates of protection on productivity in the presence of an interaction term for various firm-level characteristics and the trade policy indicators. The interaction term is included to assess if the impact of the different trade policy measures on productivity discussed above vary depending on different firm-level characteristics. These results are presented in Table 4.10.

Table 4.10: Firm-Level Productivity, Final Goods Tariff, Input Tariff, ERP with Firm-Characteristics and Trade indicators Interaction Effect (2002 and 2007)

	1	2	3	4
	Log (Productivity)			
Lagged Final Goods Tariff Industry Wise	0.014 (0.042)			0.001 (0.069)
Lagged Input Tariff Industry Wise		0.018 (0.048)		0.022 (0.081)
Lagged ERP Industry Wise			-0.004 (0.026)	
Age	0.884*** (0.174)	0.857*** (0.176)	0.799*** (0.159)	0.897*** (0.180)
Age Square	0.005 (0.004)	0.005 (0.004)	0.005 (0.004)	0.005 (0.004)
Firm's Institutional Loan Outstanding	2.288*** (0.455)	2.241*** (0.459)	2.280*** (0.454)	2.275*** (0.460)
Export Propensity Industry Wise	-0.081*** (0.015)	-0.078*** (0.014)	-0.077*** (0.015)	-0.080*** (0.016)
Tariff*Modern Power Source Dummy	0.026 (0.027)	0.015 (0.042)	0.005 (0.021)	0.028 (0.030)
Tariff*Maintaining Quality Standard Dummy	0.041 (0.097)	0.062 (0.167)	0.027 (0.077)	0.041 (0.097)
Tariff*Maintaining Modern Technological Dummy	0.029 (0.038)	0.054 (0.049)	0.017 (0.028)	0.028 (0.038)
Constant	-5.222* (2.727)	-4.601* (2.749)	-3.325 (2.112)	-5.506* (2.843)
R Square	0.0807	0.0806	0.0805	0.0807
No of Observation	17564	17564	17564	17564
No of MSMEs	8782	8782	8782	8782
Fixed Effect	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES

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

As with the preceding analysis of the impact of tariff reductions on productivity for different types of MSMEs, we again get insignificant results with the inclusion of an interaction term. Thus, the results do not change when we examine all trade policy measures in a combined regression and when we allow for firm-level characteristics to influence the impact of trade liberalization on productivity through the interaction term. However, again we find that credit constraints and greater global competition as captured by a firm's presence in a more export-oriented industry exert a significant negative effect on productivity across all types of MSMEs.

4.2.5 *Impact of liberalizing NTBs versus tariff barriers*

We also examine the effects of a reduction in NTB barriers, as measured by an NTB liberalization index, on the growth of firm-level GVO and productivity for all MSMEs. The measurement of this index is as outlined earlier in Section 3.2 and illustrated in Appendix C. We observe that there is an upward trend in this index, i.e., liberalization trend, over our study period.[34] Although we do not assess the effects for different MSME subgroups, the results for all MSMEs presented in Tables 4.11 and 4.12 highlight two important features regarding the impact of non-tariff liberalization.

First, we observe that NTB liberalization, unlike tariff liberalization, impacts both output and productivity growth positively at the firm-level across all MSMEs (see Table 4.8). When the effects of both tariff and non-tariff liberalization are considered simultaneously in the same regression, we again observe that the latter is more significant (see Table 4.9). Second, we observe that firm-level characteristics such as age, employment, access to credit and industry features such as export propensity remain equally important (in magnitude and significance levels) for NTB liberalization. Hence, the role of these firm features remains similar regardless of the nature of trade liberalization.

Overall, although we only present an aggregate analysis for NTB liberalization and do not find much variability in the index values calculated, our results confirm the fact that NTB liberalization has played an important role in enabling MSMEs to improve their output and productivity growth. [35] The stronger results for NTBs compared to tariffs across all MSMEs is possibly due to the significant NTB liberalization observed across all industry groups following the dismantling of quantitative restrictions and import licensing across a wide range of industries. This is in contrast to the case of tariff liberalization where, as shown earlier, there remain large differences in liberalization trends between different industry groups.

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[34] A higher NTB index value represents a more liberalized regime. This is because in contrast to earlier studies which construct NTB indices by giving a value of 0 for freely imported products and 1 for products prohibited from imports, we invert the scale by assigning a value of 0 for prohibited products and 1 for the freely imported products. Hence, a higher value of this index represents a more liberalized NTB regime.

[35] The NTB index values exceeds 90 (i.e., mostly free from any import restrictions) for almost 99 percentile of our sample observations. It is important to note that the variation in growth rates of firm-level GVO across various kinds of Indian manufacturing MSME firms could be better explained by calculating the NTB index at a more disaggregated level (i.e., for 4-digit industry groups). However, our construction of this index, as outlined in Appendix C, is at the 2 digit level as the purpose is to understand the broad overall trend in NTBs over our study period and to compare the results against those obtained for tariff liberalization. Disaggregated analysis of the trends in NTBs is left for future research.

Table 4.11: Relative Importance of Tariff vs Non-Tariff Liberalization for Firm-Level Gross Output and Productivity (2002 and 2007)

Independent Variables	Panel 1				Panel 2			
	Log (Gross Value of Output)				Productivity			
	1	2	3	4	5	6	7	8
Lagged Final Goods Tariff Industry Wise	0.002 (0.002)				0.030 (0.040)			
Lagged Input Tariff Industry Wise		-0.003 (0.002)				0.028 (0.047)		
Lagged ERP Industry Wise			0.000 (0.001)				0.001 (0.024)	
NTB Industry Wise				0.030*** (0.009)				0.336* (0.179)
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000** (0.000)				
Age	0.130*** (0.008)	0.116*** (0.008)	0.125*** (0.008)	0.122*** (0.006)	0.882*** (0.175)	0.854*** (0.174)	0.804*** (0.158)	0.777*** (0.125)
Age Square	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.005 (0.004)	0.005 (0.004)	0.005 (0.004)	0.005 (0.003)
Total Employment	0.021** (0.009)	0.021** (0.009)	0.021** (0.009)	0.021** (0.009)				
Firm's Institutional Loan Outstanding	0.102*** (0.025)	0.108*** (0.025)	0.103*** (0.025)	0.105*** (0.025)	2.242*** (0.450)	2.231*** (0.456)	2.260*** (0.450)	2.274*** (0.451)
Export Propensity Industry Wise	-0.006*** (0.000)	-0.005*** (0.000)	-0.005*** (0.000)	-0.006*** (0.000)	-0.081*** (0.015)	-0.078*** (0.014)	-0.077*** (0.014)	-0.086*** (0.015)
Constant	5.140*** (0.147)	5.436*** (0.134)	5.246*** (0.117)	2.368*** (0.898)	-5.035* (2.720)	-4.469* (2.607)	-3.366 (2.106)	-35.370** (17.095)
R Square	0.2564	0.2564	0.2563	0.2573	0.0805	0.0804	0.0804	0.0810
No of Observation	19836	19836	19836	19836	17564	17564	17564	17564
No of MSMEs	9918	9918	9918	9918	8782	8782	8782	8782
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 4.12: Combined Effects of Tariffs and Non-Tariff Barriers on Firm-Level GOP and Productivity (2002 and 2007)

	Panel 1			Panel 2		
	Log (Gross Value of Output)			Productivity		
Independent Variables	1	2	3	4	5	6
Lagged Final Goods Tariff Industry Wise	-0.007** (0.003)			-0.069 (0.058)		
Lagged Input Tariff Industry Wise		-0.004* (0.002)			0.018 (0.048)	
Lagged ERP Industry Wise			-0.003** (0.001)			-0.042 (0.030)
NTB Industry Wise	0.049*** (0.014)	0.031*** (0.009)	0.042*** (0.011)	0.521** (0.258)	0.331* (0.182)	0.487** (0.223)
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)			
Age	0.101*** (0.011)	0.112*** (0.008)	0.109*** (0.008)	0.576 ** (0.228)	0.813*** (0.177)	0.617*** (0.182)
Age Square	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.005 (0.004)	0.005 (0.004)	0.005 (0.004)
Total Employment	0.021** (0.009)	0.021** (0.009)	0.021** (0.009)			
Firm's Institutional Loan Outstanding	0.110*** (0.025)	0.110*** (0.025)	0.110*** (0.025)	2.328*** (0.453)	2.254*** (0.457)	2.337*** (0.452)
Export Propensity Industry Wise	-0.006*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)	-0.082*** (0.015)	-0.087*** (0.015)	-0.084*** (0.015)
Constant	0.974 (1.245)	2.448** (0.899)	1.454 (1.046)	-48.991** (22.129)	-35.669** (16.996)	-46.879** (20.003)
R Square	0.2577	0.2576	0.2577	0.0811	0.0810	0.0812
No of Observation	19836	19836	19836	17564	17564	17564
No of MSMEs	9918	9918	9918	8782	8782	8782
Fixed Effect	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES

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

Although this study does not examine the role of state-specific factors, given differences in the level of development, infrastructure and policies across states, we attempt to avoid the possible endogeneity problem that may arise due to correlation between firm-level performance and other non-trade related changes across states. Hence, we include a state-year interaction effect in our GVO and productivity regressions. We also include all tariff and non-tariff measures in a single regression for both GVO and productivity to see if our earlier findings still hold. These results are presented in Tables 4.13 and 4.14, respectively.

Table 4.13: Firm-Level GVO, Final Goods Tariff, Input Tariff, ERP and NTB with State Year Effect (2002 and 2007)

	1	2	3	4	5	6	7	8
	Log (Gross Value of Output)							
Lagged Final Goods Tariff Industry Wise	-0.001 (0.002)			0.005* (0.002)		-0.011** (0.003)		
Lagged Input Tariff Industry Wise		-0.008*** (0.002)		-0.013*** (0.003)			-0.009*** (0.002)	
Lagged ERP Industry Wise			-0.001 (0.001)					-0.005*** (0.001)
Inverted NTB Industry Wise					0.019** (0.008)	0.047*** (0.011)	0.021*** (0.008)	0.036*** (0.009)
Deflated MKT Value Fixed Asset	0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Age	-0.271*** (0.011)	-0.282*** (0.010)	-0.272*** (0.010)	-0.276*** (0.011)	-0.269*** (0.010)	-0.298*** (0.013)	-0.284*** (0.011)	-0.285*** (0.011)
Age Square	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Total Employment	0.018*** (0.008)	0.018** (0.008)	0.018** (0.008)	0.018*** (0.008)	0.018** (0.008)	0.018*** (0.008)	0.018** (0.008)	0.018** (0.008)
Firm's Institutional Loan Outstanding	0.081*** (0.025)	0.083*** (0.025)	0.081*** (0.025)	0.084*** (0.025)	0.082*** (0.025)	0.085*** (0.025)	0.085*** (0.025)	0.084*** (0.025)
Export Propensity Industry Wise	-0.004*** (0.000)	-0.003*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Constant	11.258*** (0.203)	11.516*** (0.192)	11.276*** (0.180)	11.408*** (0.205)	9.390*** (0.809)	7.219*** (1.031)	9.712*** (0.812)	11.258*** (0.203)
R Square	0.3206	0.3213	0.3207	0.3215	0.3210	0.3219	0.3218	0.3217
No of Observation	19836	19836	19836	19836	19836	19836	19836	19836
No of MSMEs	9918	9918	9918	9918	9918	9918	9918	9918
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES	YES	YES	YES	YES
State Year Effect	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 4.14: Firm-Level Productivity, Final Goods Tariff, Input Tariff, ERP and NTB with State Year Effect (2002 and 2007)

	1	2	3	4	5	6	7	8
	Log (Productivity)							
Lagged Final Goods Tariff Industry Wise	-0.083** (0.039)			0.013 (0.062)		-0.223*** (0.058)		
Lagged Input Tariff Industry Wise		-0.185*** (0.051)		-0.197** (0.080)			-0.191*** (0.052)	
Lagged ERP Industry Wise			-0.068*** (0.024)					-0.119*** (0.031)
Inverted NTB Industry Wise					0.101 (0.174)	0.697*** (0.257)	0.150 (0.178)	0.521** (0.222)
Age	-2.299*** (0.196)	-2.383*** (0.191)	-2.293*** (0.183)	-2.368*** (0.196)	-2.111*** (0.169)	0.556 (0.858)	-2.404*** (0.195)	-2.479*** (0.199)
Age Square	0.003 (0.004)	0.004 (0.004)	0.004 (0.004)	0.004 (0.004)	0.002 (0.004)	0.003 (0.004)	0.003 (0.004)	0.003 (0.004)
Firm's Institutional Loan Outstanding	1.170** (0.466)	1.214*** (0.467)	1.181** (0.466)	1.216*** (0.468)	1.168** (0.467)	1.225*** (0.467)	1.224*** (0.468)	1.226*** (0.467)
Export Propensity Industry Wise	-0.036** (0.014)	-0.040*** (0.013)	-0.038*** (0.014)	-0.042*** (0.015)	-0.051*** (0.014)	-0.037*** (0.014)	-0.044*** (0.014)	-0.046*** (0.014)
Constant	47.047*** (3.387)	47.418*** (3.251)	45.578*** (2.942)	47.286*** (3.358)	29.423* (16.708)	-62.869** (25.237)	33.672** (16.534)	-1.385 (20.107)
R Square	0.1257	0.1265	0.1261	0.1265	0.1253	0.1268	0.1266	0.1269
No of Observation	17564	17564	17564	17564	17564	17564	17564	17564
No of MSMEs	8782	8782	8782	8782	8782	8782	8782	8782
Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES	YES	YES	YES	YES
State Year Effect	YES	YES	YES	YES	YES	YES	YES	YES

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

The results presented in Tables 4.13 and 4.14 show that reductions in input tariffs and ERP have a positive and significant impact on both GVO and productivity while final goods tariff reductions have a negative, though less significant impact on these performance measures. Column 4 in Tables 4.13 and 4.14 clearly indicates that while a 1 percent reduction in lagged final goods tariff decreases the growth rates of firm-level GVO and productivity by 0.5 and 0.13 percent (low significance too), respectively, for all registered MSME firms, a 1 percent reduction in the lagged input tariff significantly increases the growth rates of firm-level GVO and productivity by 1.3 and 1.9 percent, respectively. A reduction in NTBs has a positive impact on firm-level GVO and productivity. Overall, the combined effect of a reduction in tariff and non-tariff barriers is positive on both GVO and productivity for all MSMEs. Column 8 in Tables 4.13 and 4.14 clearly indicate that a 1 percent reduction in the lagged ERP, which represent the net effect of final goods and input tariffs, and a 1 percent reduction in NTB, increases the growth rates of firm-level GVO by 0.5 and 3.6 percent, respectively and increases firm-level productivity by 1.2 and 5.2 percent, respectively. As seen earlier, credit constraints and export-orientation have a significant and negative impact on firm-level performance, for the reasons highlighted earlier.

5.   Summary of Findings: Policy Inferences and Extensions

The census analysis for the performance of MSME firms between 2001-02 and 2006-07 shows a varied effect of trade liberalization on MSME firms depending on firm and industry-specific factors. While the impact on output growth and productivity for the overall MSME segment is mostly negative, we find that certain sub-groups of MSME firms, namely, those in less protected industries and those which use modern power techniques in their production process, which are technologically upgraded and which maintain their product quality standards, have performed better in both output and productivity terms. We also find that input channel effects resulting from liberalization of input tariffs are consistently larger and more significant than competition effects resulting from the liberalization of final goods tariffs. Firm-specific characteristics such as access to institutional credit, age and total employment play a positive and often significant role in enabling growth in firm-level output and productivity of Indian MSMEs. Industry-specific characteristics such as the export-propensity of the industry to which an MSME firm belongs also emerge as important in that firms which are exposed to greater trade liberalization are also associated with a more adverse impact on output and productivity. However, in all cases, technology readiness, quality standards and modernization mitigate such adverse effects or enable MSMEs to derive benefits from tariff liberalization. Non-tariff liberalization emerges as more significant than tariff liberalization in terms of improving firm productivity and output growth, probably reflecting the much greater and uniform (across industries) import liberalization through NTB reductions compared to tariff liberalization where significant differences remain across industries in protection levels.

These findings provide several useful takeaways for policy makers. First, they indicate that MSME firms face constraints that prevent them from taking advantage of trade liberalization, both on the output and input fronts. As highlighted in other studies and in policy discussions, Indian MSMEs face operational, structural, financial and technological constraints. This study confirms the importance of these factors in shaping the performance of Indian manufacturing MSMEs following trade liberalization and indicates the need to focus on the MSME segment separately so as specifically address these various constraints under India's overall trade and industrial policy framework. Such a focused approach towards the MSME segment, for instance, through measures to improve access to credit, to incentivize the adoption of technology, and to provide more reliable access to electricity can enable Indian MSMEs to benefit from or mitigate adverse effects resulting from trade liberalization. In this context, a

recent Government of India scheme which provides a corpus fund for SMEs and small entrepreneurs under the MUDRA scheme is an important step. Second, our analysis indicates that while much of the focus of studies on trade liberalization is on the competition creating effects in final product markets, the potential gains to firms due to the sourcing of a greater variety and scale of imported intermediate inputs can be important. Hence, from a policy standpoint, liberalization of tariff and non-tariff barriers on imported intermediates requires attention. Such an understanding would also help address an issue often raised by some sectors of Indian industry, namely, the disincentive to value addition that arises from an anomalous reduction in final goods tariffs while intermediate tariffs remain high. This issue assumes importance in the context of preferential trade agreements where one of the main sources of gains could arise from input liberalization and an appropriate balancing of final goods versus intermediate liberalization vis-à-vis trading partners is required. A third important policy inference that emerges from the results is the significance of firm and industry-specific characteristics in shaping the effects of trade liberalization and thus the need for policies that recognize these differences across firms and industry groups when framing policy, so as to ensure a more balanced outcome for the MSME segment at large.

Two immediate extensions are possible to this study. First is the possibility of undertaking more disaggregated empirical analysis of trade barriers and their impact. In this study, we have examined the effects of a reduction in both tariff and non-tariff barriers on the performance of Indian MSME firms by using tariff and NTB data at the broad 2-digit industry level. This does not permit us to capture the effects of the variation in these aforementioned trade indicators at the sub-sectoral level, such as at the 3-digit industry-level.[36] It would thus be useful to undertake industry-specific studies and disaggregated sub-sectoral analysis within individual industries as the adjustment costs and benefits from trade liberalization are likely to vary across industries and across product categories in a given industry. This latter approach would enable us to examine the effects of trade liberalization on the performance of MSME firms within a broad industry group itself, for instance the subsectors of cotton, readymade garments, synthetics, etc. within the textile industry. Similarly, the NTB index, which has been constructed at the 2-digit level in this study could also be constructed at the 4-digit level. The latter may enable us to observe greater variation in NTB liberalization at a disaggregated level

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[36] A separate study by Mukherjee and Chanda (2016) has confirmed the greater importance of the impact of NTB relative to tariff liberalization on firm-level performance for different sub-groups of the textile industry over the 1999-2009 period.

within an industry group than is visible at the broad 2-digit industry level. This could also enable us to understand better why NTB liberalization has had a stronger and more significant impact than tariff liberalization and to assess differences across industry groups and firm-level characteristics. Another important factor that could be incorporated in future research on this subject is the role of state and regional factors. As the performance of MSMEs varies across states and regions in India, it would be useful to extend the analysis by incorporating various state-specific indicators and to assess to what extent state policies, level of development and infrastructure, factor market conditions and other parameters have influenced the impact of trade liberalization on Indian manufacturing MSMEs.

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Appendix A

Methodology for Merging of 3rd and 4th Census Data for Registered MSME Firms

Table A.1: Third All India Censuses of Small Scale Industries 2001-2002 Database Variable
Description: Registered Sector

Sl. No.	Variable Name	Data Type	Data Description	Schedule Block Reference	Item Reference
1	SECTOR_CODE	nvarchar(1)	Sector Code	1	5
2	ST_CODE	nvarchar(2)	New State Code	1	2
3	DIST_CODE	nvarchar(2)	New District Code	1	3
4	TTM_CODE	nvarchar(4)	Tehsil/Taluk/Mandal code for rural unit	1	4
5	VT_CODE	nvarchar(6)	Village/Town Code	1	6
6	DIR_REG_NO	Nvarchar (MAX)	Permanent Registration Number	2	3
Validating Variables					
7	NIC_CODE	nvarchar(5)	NIC Code of major activity	2	1
8	PERM_REG_Y	nvarchar(4)	Permanent registration Year	2	2

Table A.2: Fourth All India Census of Micro Small and Medium Enterprises 2006-2007 Database
Variable Description: Registered Sector

Sl. No.	Variable Name	Data Type	Data Description	Schedule Block Reference	Item Reference
1	SECTOR_CODE	nvarchar(1)	Sector Code	1	5
2	ST_CODE	nvarchar(2)	State Code	1	6
3	DIST_CODE	nvarchar(2)	District Code	1	7
4	TTM_CODE (CD Block)	nvarchar(4)	CD Block/ Tehsil/Taluk/Mandal code for rural unit	1	8
5	VT_CODE	nvarchar(8)	Village/Town Code	1	9/10
6	PERM_REG_NO	nvarchar(MAX)	Permanent Registeration Number/ EM-II Number	1	2
Validating Variables					
7	MAJOR_ACTIVE	nvarchar(5)	Major Activity Code (NIC Code)	3	2
8	PERM_REG_Y	nvarchar(4)	Permanent Registration Year	1	3

Note: We have merged the 3rd (2001-02) and the 4th (2006-07) census data for registered MSME firms based on the combination number created by using all above 6 rows items code and after merging we have validated the uniqueness of the firms existence in both the aforementioned censuses by checking the last two rows item codes of the two tables (Table A.1 and Table A.2).

Table A.3: Major Reasons Reported by Sick/Incipient Sick Units

Ranking	Reason for Sickness/ Incipient Sickness	Proportion of Sick/ Incipient Sick Units (in Percent)
1	Lack of demand	41.94 %
2	Shortage of working capital	20.49 %
3	Non-availability of raw material	5.11 %
4	Power shortage	5.71 %
5	Labour problems	5.64 %
6	Marketing problems	11.48 %
7	Equipment problems	3.17 %
8	Management problems	6.46 %

Source: Final Report on 4th Census- Registered (Reproduced from the source)

Table A.4: Distribution of MSME Firms across Industry Groups

Industry Name	Sector Dummy	Freq.	Percent	Cum.
Wood and products of wood and cork	20	1,082	5.45	5.45
Coke, refined petroleum products and nuclear fuel	23	24	0.12	5.57
Chemicals and chemical products	24	234	1.18	6.75
Rubber and plastics products	25	248	1.25	7.99
Other non-metallic mineral products	26	1,292	6.5	14.5
Basic metals	27	36	0.18	14.68
Fabricated metal products except machinery and equipment	28	1,218	6.13	20.81
Machinery and equipment n.e.c	29	140	0.7	21.51
Electrical machinery and apparatus n.e.c	31	82	0.41	21.93
Radio, television and communication equipment	32	2	0.01	21.94
Medical, precision and optical instruments	33	6	0.03	21.97
Motor vehicles, trailers and semi-trailers	34	4	0.02	21.99
Other transport equipment	35	18	0.09	22.08
Manufacturing n.e.c; recycling	3637	2,806	14.12	36.2
Food products, beverages and tobacco	1516	6,602	33.23	69.44
Textiles, textile products, leather and footwear	2122	154	0.78	70.21
Pulp, paper, paper products, printing and publishing	171819	5,918	29.79	100
	Total	19,866	100	

Source: Final Report on 4th Census- Registered (Reproduced from the source)

Appendix B

Tariff Measures: Final Goods, Inputs and Effective Rate of Protection (ERP)

We calculate the industry-level effective rate of protection (ERP) by following Topalova and Khandelwal (2011) to measure the net effect of tariff liberalization accounting for both final goods and input tariff reductions. The exact formulation of input tariff and ERP for the jth industry at time t, as defined by Corden (1966) is given below:

Input tariff$_{jt}$ = $\sum_s \alpha_{js}$ final goods tariff$_{st}$ (B.1)

ERP$_{jt}$ = (final goods tariff$_{jt}$ – input tariff$_{jt}$) / 1- $\sum_s \alpha_{js}$ (B.2)

Where, α_{js} is the share of imported input s used in the value of output j,

The above calculation is done for all the 2-digit Industry groups (NIC-2004) based on the industry level final goods tariff (average MFN rate) data collected from the WITS database and the Input-Output data collected from the Input-Output table (2004-05) of the OECD-STAN database.[37]

From the Input-Output table, we calculate the share of each ith imported input used in the value of output for the jth industry at the 2-digit Industry groups (NIC-2004). Then by using equation (B.1), we have calculated the input tariff for each 2-digit Industry group over the 1999 to 2009 period. After calculating the input tariffs, we also calculate their ERP by using the formulation given in equation (B.2).

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[37] Data extracted on 24 Mar 2014 10:18 UTC (GMT) from OECD. Stat,
http://stats.oecd.org/Index.aspx?DataSetCode=STAN_IO_TOT_DOM_IMP

Table B.1: Input Tariff Calculation for Textiles & Leather Industry for the Year 1999

Final Product (Final Goods Industry)	Inputs used (Input Industries)	Weightage of Input used (α_{js}) (Percentage)*	Final Goods Tariff for Different Input Industries in 1999 (in Percentage)	Input Tariff of Leather Industry in 1999
Textiles, textile products, leather and footwear	10-14 Mining and quarrying	0.000227	12.958	33.02894
	15-16 Food products, beverages and tobacco	0.017608	37.225	
	17-19 Textiles, textile products, leather and footwear	0.743941	37.75	
	15-20 Wood and products of wood and cork	0.000199	33.33	
	21-22 Pulp, paper, paper products, printing and publishing	0.003619	29.605	
	23 Coke, refined petroleum products and nuclear fuel	0.000519	25	
	24 Chemicals and chemical products	0.025116	34	
	25 Rubber and plastics products	0.013008	37.25	
	26 Other non-metallic mineral products	0.004548	38.45	
	27 Basic metals	0.000977	33.3	
	28 Fabricated metal products except machinery and equipment	0.002142	32.28	
	29 Machinery and equipment n.e.c	0.010169	27.28	
	30 Office, accounting and computing machinery	0.00671	28.78	
	31 Electrical machinery and apparatus n.e.c	0.012258	32.72	
	32 Radio, television and communication equipment	0.005235	28.22	
	33 Medical, precision and optical instruments	0.002805	30.78	
	34 Motor vehicles, trailers and semi-trailers	0.010456	39.36	
	35 Other transport equipment	0.001465	34.11	
	36-37 Manufacturing n.e.c; recycling	0.009242	35.8	
	40-41 Electricity, gas and water supply	0.00015	23.33	
	$\sum_s \alpha_{js}$	0.899351		

Source: Author's Calculation based on the data from ASI and OECD

Figure B.1: Trends in Final Goods Tariff for Different Industries
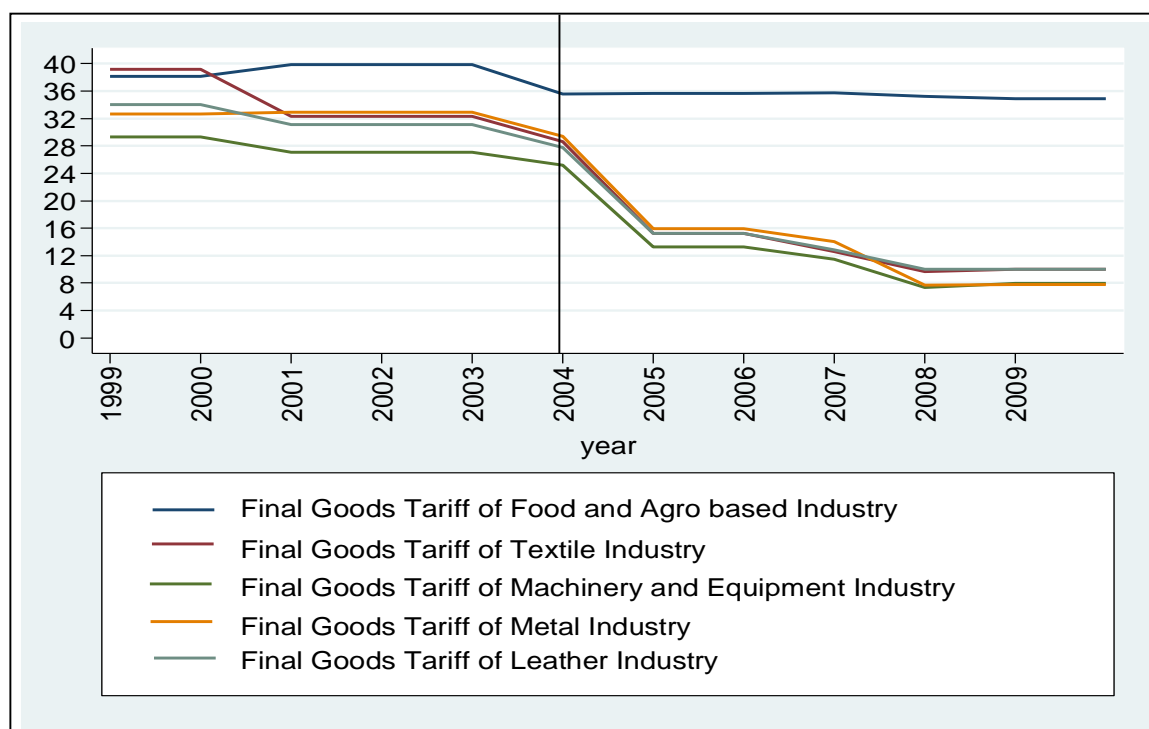
Source: WITS database, data of final goods tariff extracted on 11/26/2013 1:50:18 A.M from WITS-TRAINS, http://wits.worldbank.org/WITS/WITS/Default-A.aspx?Page=Default.

Figure B.2: Trends in Input Tariff for Different Industries
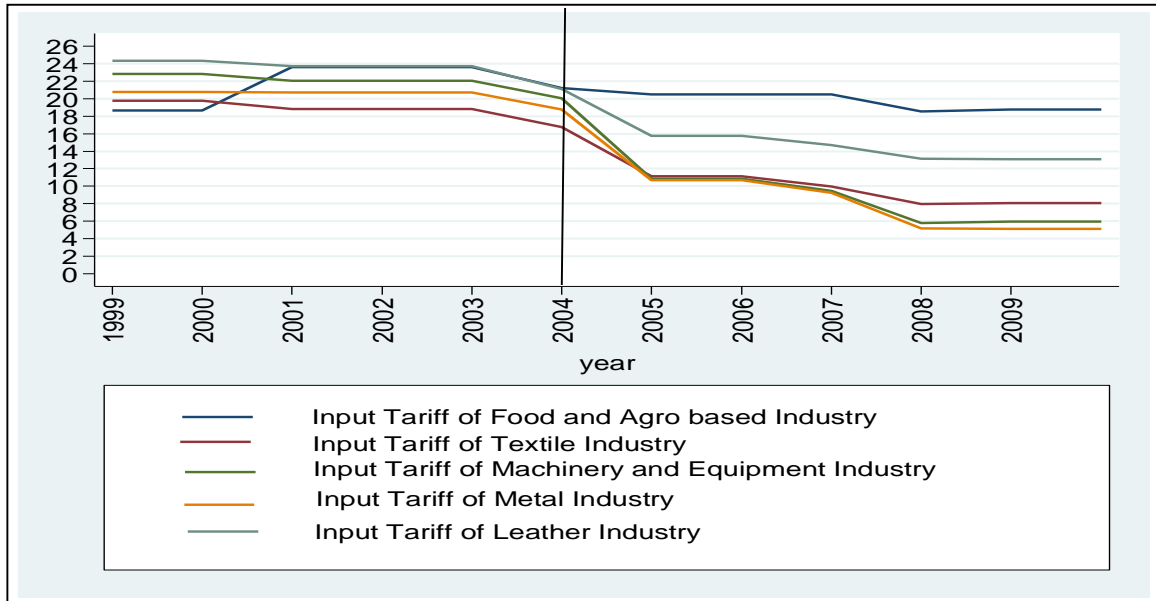
Source: Author's calculation based on the WITS database, data of final goods tariff extracted on 11/26/2013 1:50:18 A.M from WITS-TRAINS, http://wits.worldbank.org/WITS/WITS/Default-A.aspx?Page=Default

Figure B.3: Trends in Effective rate of Protection for Different Industries
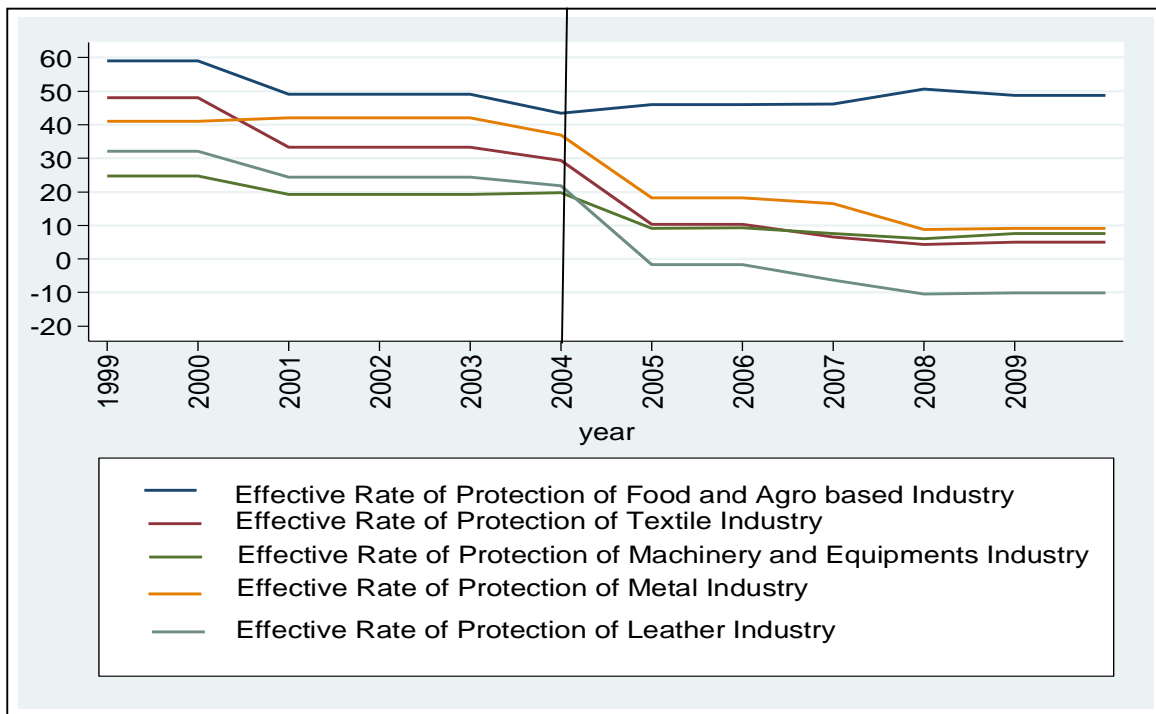
Source: Author's calculation based on the WITS database, data of final goods tariff extracted on 11/26/2013 1:50:18 A.M from WITS-TRAINS, http://wits.worldbank.org/WITS/WITS/Default-A.aspx?Page=Default.

Table B.2: Imported inputs in the *Food and Agro based* vs *Non-Food and Non-Agro based*
Industries (% Shares of Total Imported Inputs Used), 1999 to 2009

	Food and Agro based Vs *Non-Food and Non-Agro based* Groups Imported Input Sourcing (Share)	Imported Inputs used (Input Industries)	Waightage of Input used(2003-04)	Industry Wise Tariff Trends over 1999 to 2009 Period				
				1999	2001	2004	2007	2009
(15-16) Food products, beverages and tobacco	*Food and Agro based (0.67)*	**(01-05) Agriculture, hunting, forestry and fishing**	0.094009	22.22	32.61	28.96	27.81	25.88
		(15-16) Food products, beverages and tobacco	0.575847	37.23	39.89	35.36	35.59	34.73
	Non-Food and Non-Agro based (0.04)	**(17-19) Textiles, textile products, leather and footwear**	0.000886	37.75	32.19	28.44	12.69	9.97
		24 Chemicals and chemical products	0.038447	34.00	32.83	28.56	12.94	8.43
		27 Basic metals	0.000337	33.30	32.91	31.23	15.92	5.91
		29 Machinery and equipment n.e.c	1.28E-05	27.28	26.78	25.85	12.45	8.23
		(36-37) Manufacturing n.e.c; recycling	0.000306	35.80	33.83	29.41	12.50	9.69
17-19 Textiles, textile products, leather and footwear	*Food and Agro based (0.046)*	**(01-05) Agriculture, hunting, forestry and fishing**	0.028957	22.22	32.61	28.96	27.81	25.88
		(15-16) Food products, beverages and tobacco	0.017608	37.23	39.89	35.36	35.59	34.73
	Non-Food and Non-Agro based (0.802)	**(17-19) Textiles, textile products, leather and footwear**	0.743941	37.75	32.19	28.44	12.69	9.97
		24 Chemicals and chemical products	0.025116	34.00	32.83	28.56	12.94	8.43
		25 Rubber and plastics products	0.013008	37.25	34.66	29.76	12.43	9.93
		27 Basic metals	0.000977	33.30	32.91	31.23	15.92	5.91
		29 Machinery and equipment n.e.c	0.010169	27.28	26.78	25.85	12.45	8.23
		(36-37) Manufacturing n.e.c; recycling	0.009242	35.80	33.83	29.41	12.50	9.69
24 Chemicals and chemical products	*Food and Agro based (0.087)*	**(01-05) Agriculture, hunting, forestry and fishing**	0.06264	22.22	32.61	28.96	27.81	25.88
		(15-16) Food products, beverages and tobacco	0.0242	37.23	39.89	35.36	35.59	34.73
	Non-Food and Non-Agro based (0.755)	**(17-19) Textiles, textile products, leather and footwear**	0.061909	37.75	32.19	28.44	12.69	9.97
		24 Chemicals and chemical products	0.504878	34.00	32.83	28.56	12.94	8.43
		25 Rubber and plastics products	0.102198	37.25	34.66	29.76	12.43	9.93
		27 Basic metals	0.019288	33.30	32.91	31.23	15.92	5.91
		29 Machinery and equipment n.e.c	0.010449	27.28	26.78	25.85	12.45	8.23
		31 Electrical machinery and apparatus n.e.c	0.02829	32.72	30.22	27.35	12.28	8.57
		32 Radio, television and communication equipment	0.014456	28.22	22.82	21.11	6.57	5.21
		(36-37) Manufacturing n.e.c; recycling	0.013584	35.80	33.83	29.41	12.50	9.69
27 Basic metals	*Food and Agro based (0.000)*	**(01-05) Agriculture, hunting, forestry and fishing**	0.000116	22.22	32.61	28.96	27.81	25.88
		(15-16) Food products, beverages and tobacco	0.000145	37.23	39.89	35.36	35.59	34.73
	Non-Food and Non-Agro based (0.852)	**(17-19) Textiles, textile products, leather and footwear**	0.00015	37.75	32.19	28.44	12.69	9.97
		24 Chemicals and chemical products	0.007519	34.00	32.83	28.56	12.94	8.43
		27 Basic metals	0.356945	33.30	32.91	31.23	15.92	5.91
		28 Fabricated metal products except machinery and equipment	0.105225	32.28	34.04	28.44	12.50	9.83
		29 Machinery and equipment n.e.c	0.13852	27.28	26.78	25.85	12.45	8.23
		30 Office, accounting and computing machinery	0.037858	28.78	21.49	20.25	3.13	2.02
		31 Electrical machinery and apparatus n.e.c	0.169234	32.72	30.22	27.35	12.28	8.57
		34 Motor vehicles, trailers and semi-trailers	0.022075	39.36	46.45	42.27	27.64	25.31
		35 Other transport equipment	0.014961	34.11	34.73	31.90	18.35	15.71
29 Machinery and equipment n.e.c	*Food and Agro based (0.065)*	**(01-05) Agriculture, hunting, forestry and fishing**	0.017774	22.22	32.61	28.96	27.81	25.88
		(15-16) Food products, beverages and tobacco	0.047792	37.23	39.89	35.36	35.59	34.73
	Non-Food and Non-Agro based (0.726)	**(17-19) Textiles, textile products, leather and footwear**	0.093072	37.75	32.19	28.44	12.69	9.97
		24 Chemicals and chemical products	0.027751	34.00	32.83	28.56	12.94	8.43
		27 Basic metals	0.01785	33.30	32.91	31.23	15.92	5.91
		28 Fabricated metal products except machinery and equipment	0.030093	32.28	34.04	28.44	12.50	9.83
		29 Machinery and equipment n.e.c	0.261702	27.28	26.78	25.85	12.45	8.23
		30 Office, accounting and computing machinery	0.037627	28.78	21.49	20.25	3.13	2.02
		31 Electrical machinery and apparatus n.e.c	0.069382	32.72	30.22	27.35	12.28	8.57
		32 Radio, television and communication equipment	0.048415	28.22	22.82	21.11	6.57	5.21
		34 Motor vehicles, trailers and semi-trailers	0.090927	39.36	46.45	42.27	27.64	25.31
		35 Other transport equipment	0.023601	34.11	34.73	31.90	18.35	15.71
		(36-37) Manufacturing n.e.c; recycling	0.025735	35.80	33.83	29.41	12.50	9.69

Source: Author's Calculation based on the data from ASI and OECD

Table B.3: Trade Policy Endogeneity-Current Industry Performance and Subsequent Trade Protection, 1999-2009 Period

	Industry-Level Final Goods Tariff at t Period	Industry-Level Input Tariff at t Period	Industry-Level ERP at t Period
Panel 1			
Industry-Level Log(GOP) at t-1 period	0.322 (2.128)	1.655 (2.333)	-0.026 (7.961)
Constant	29.703* (16.049)	8.509 (17.408)	30.766 (58.865)
R-squared	0.9464	0.8541	0.7658
No of Industries	17	17	17
Observations	34	34	34
Panel 2			
Industry-Level Productivity at t-1 period	0.018 (0.036)	-0.051 (0.051)	-0.061 (0.094)
Constant	31.922*** (0.946)	21.512*** (1.048)	31.241*** (2.309)
R-squared	0.9464	0.8511	0.7664
No of Industries	17	17	17
Observations	34	34	34

The table gives the results of the regressions of industry-level Log (GOP) (Panel 1), Productivity (Panel 3) in period t-1 on industry-level Final Goods Tariff (Column 1), Input Tariff (Column 2), and ERP (Column 3) in period t. Industry-level productivity is calculated as average of firm-level TFP industry wise. All regressions include industry and year fixed effects. Standard errors are clustered at the industry-level. Significance: * 10 percent; ** 5 percent; *** 1 percent.

Appendix C

Measurement of Non-Tariff Barriers (NTB)

Non-tariff barriers (NTB) have assumed a lot of importance in India in the last two decades with the decline in tariff protection. Thus, it becomes important to use tariff as well as non-tariff barriers to measure trade protection in the Indian context. Although it is very hard to find a good dataset to measure NTBs, there are few studies (Das (2003), Pandey (1999)), which have attempted to measure NTBs for the period 1980-2000, using the import coverage ratio. This measurement of NTB captures the relative restrictiveness of imports for different industries. The import coverage ratios are defined as the percentage of a product's imports within a category that are affected by an NTB. The formulation of the NTB coverage ratio is given as follows:

Define $w_i = m_i / \sum m_i$ as the import weight, where m_i = imports of the ith commodity where $\sum m_i$ is the total imports.

Let n_i = (1 if there are NTB's

(0 if there are no NTB's.

Then, the NTB coverage ratio is defined as $\sum n_i\, w_i$. An alternative is to calculate simple averages for the coverage ratios.

The coverage ratio for each input-output sector has been calculated according to the following weighting scheme for each 8-digit tariff line and has been assigned a number:

0% if no NTB applies to the tariff line (i.e. if no licensing is required)

50% if imports are subject to special import licenses (SIL)

100% if imports are otherwise restricted or prohibited.

In our study, we use a similar idea but the construction of the variable differs. As the main objective is to examine the impact of the reduction in non-tariff barriers for various industries (both partial as well as full) on firm performance, instead of constructing the NTB coverage ratio, we have taken an inverted version of the NTB measure by reversing the weighting scheme for each 8-digit tariff line used by Pandey (1999) and Das (2003).[38] This is mainly done to

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[38] The usual NTB index would give 0's for import free products, hence the reverse formulation.

capture both the effects of partial and full liberalization policies across industries for the period 1999-2009. We use the following weighting scheme for each 8-digit tariff line:

100% if no NTB applies to the tariff line (i.e. if no licensing is required) (n_i=1)

50% if imports are restricted by different import licensing policies (n_i=0.5)

0% if imports are fully prohibited only (n_i=0)

Then, the Industry-level Inverted NTB coverage ratio is defined as,

Industry Inverted NTB $_j$ = $\sum n_i w_i$ (C.1)

Where, j stands for a particular 2-digit Industry and i represents a product line within that particular industry, $w_i = m_i / \sum m_i$ as the import weight, where m_i = imports of the ith 8 digit level commodity where $\sum m_i$ is the total import of the jth industry.

This above scheme has enabled us to take into account the effects of those imported items (8-digit HS commodities) whose imports are either free or partially free. This is a value addition to the other previously constructed NTB measures, which do not take into account the effects of those imported items, whose imports are partially restricted.[39]

Based on the above weighting scheme, we have firstly assigned an appropriate value to each 8-digit product for every year from 1999 to 2009. We have next also calculated their import share at the 2-digit industry level for each of the years. Then, we have applied these values to equation (C.1) to get the NTB index for the entire 2-digit industry as classified by the HS system and NIC 2004 (ISIC revision 3) for the study period 1999 to 2009.

We have collected the data for import conditions (import policy) for each 8-digit product for the period 1999-2009 from the Director General of Foreign Trade (DGFT), Government of India.[40] The import data for each 2 and 8 digit industry for the period 1999-2009 has been collected from the Ministry of Commerce and Industry, Department of Commerce, Government of India.

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[39] This is due to the fact that, in other previously constructed NTB measures, both prohibited and restricted imported items were considered to be fully protected and was assumed to have no imports happening over the years.

[40] http://www.eximkey.com/Sec/DGFT/ImportPolicy

Table C.1: Inverted NTB Calculation for Leather Industry for the year 1999

HS Code	Import value in 1998-1999 (in Rs Lacks)	Weight on 2 digit Industries	Inverted NTB Weight for each 8 digit commodity	Inverted NTB Effect in Import of each 8 digit commodity	Inverted NTB Effect in 2 Digit Import	Inverted NTB Leather Industry in 1999
42010000	14.55	0.016380892	1	0.016381		
42021101	3.78	0.004255655	1	0.004256		
42021102		0	1	0		
42021103	0.61	0.000686759	0.5	0.000343		
42021201		0	1	0		
42021209	1.57	0.00176756	1	0.001768		
42021901	0.15	0.000168875	0.5	8.44E-05		
42021902	0.35	0.000394042	0.5	0.000197		
42021903	0.47	0.000529142	0.5	0.000265		
42022101	1.48	0.001666235	0.5	0.000833		
42022109	11.26	0.012676897	0.5	0.006338		
42022209	2.75	0.003096045	1	0.003096		
42022901	3.13	0.003523862	0.5	0.001762		
42022909	18.5	0.020827939	1	0.020828		
42023101	7.43	0.008364951	1	0.008365		
42023102	59.42	0.066897087	0.5	0.033449		
42023109	7.72	0.008691443	0.5	0.004346		
42023201	0.51	0.000574176	1	0.000574		
42023209	1.12	0.001260935	1	0.001261		
42023901	7.51	0.008455017	1	0.008455		
42023909	7.03	0.007914617	1	0.007915	0.921997	0.960999
42029100	1.8	0.002026502	0.5	0.001013		
42029200	1.28	0.001441068	1	0.001441		
42029900	43.24	0.048681085	1	0.048681		
42031001	95.88	0.107945014	1	0.107945		
42031009	32.42	0.036499555	1	0.0365		
42032101	2.91	0.003276178	1	0.003276		
42032901	0.82	0.000923184	1	0.000923		
42032902		0	1	0		
42033000	12.37	0.013926573	1	0.013927		
42034000	118.56	0.133478941	1	0.133479		
42040001	0.6	0.000675501	1	0.000676		
42040003	5.09	0.005730498	1	0.00573		
42040004	1.58	0.001778819	1	0.001779		
42040005	5.98	0.00673249	1	0.006732		
42040006		0	0.5	0		
42040007	0.32	0.000360267	1	0.00036		
42040009	115.44	0.129966338	1	0.129966		
42050001	52.18	0.058746046	0.5	0.029373		
42050002	1.04	0.001170868	1	0.001171		
42050009	237.13	0.266969141	1	0.266969		
42061009	0.9	0.001013251	1	0.001013		

HS Code	Import value in 1998-1999 (in Rs Lacks)	Weight on 2 digit Industries	Inverted NTB Weight for each 8 digit commodity	Inverted NTB Effect in Import of each 8 digit commodity		
42069000	9.35	0.010526553	1	0.010527		
64011001	5.05	0.000463805	1	0.000464		
64011009	5.32	0.000488603	1	0.000489		
64019101		0	1	0		
64019109	0.09	8.26584E-06	1	8.27E-06		
64019201	1.98	0.000181848	1	0.000182		
64019209	1.17	0.000107456	1	0.000107		
64019901	0.05	4.59213E-06	1	4.59E-06		
64019909	50.06	0.004597642	1	0.004598		
64021209	29.02	0.002665273	1	0.002665		
64021909	66.54	0.006111209	1	0.006111		
64022001	1.91	0.000175419	1	0.000175		
64022009	97.09	0.008917001	1	0.008917		
64023009	90.03	0.008268592	1	0.008269		
64029109	0.77	7.07188E-05	1	7.07E-05		
64029901		0	1	0		
64029909	106.58	0.009788587	1	0.009789		
64031200	0.17	1.56132E-05	1	1.56E-05		
64031901	0.49	4.50029E-05	1	4.5E-05		
64031902	72.39	0.006648488	1	0.006648		
64031909	325.1	0.029858039	1	0.029858		
64032001	6.36	0.000584119	1	0.000584		
64032003	11.23	0.001031393	1	0.001031		
64032004	0.06	5.51056E-06	1	5.51E-06		
64034000	0.22	2.02054E-05	1	2.02E-05	1.00000	
64035109	6.76	0.000620856	1	0.000621		
64035900	0.22	2.02054E-05	1	2.02E-05		
64039101		0	1	0		
64039102	47.43	0.004356096	1	0.004356		
64039901	104.78	0.009623271	1	0.009623		
64039902	28.97	0.002660681	1	0.002661		
64041101	32.25	0.002961925	1	0.002962		
64041102	15.69	0.001441011	1	0.001441		
64041109	680.89	0.062534728	1	0.062535		
64041901	12.62	0.001159054	1	0.001159		
64041902	2.66	0.000244301	1	0.000244		
64041909	27.26	0.00250363	1	0.002504		
64042000	19.22	0.001765215	1	0.001765		
64051000	60.88	0.005591379	1	0.005591		
64052000	0.63	5.78609E-05	1	5.79E-05		
64059000	50.18	0.004608663	1	0.004609		
64061001	59.99	0.005509639	1	0.00551		
64061002	123.55	0.011347157	1	0.011347		
64061009	167.51	0.015384559	1	0.015385		
64062000	3,850.57	0.353646474	1	0.353646		
64069100	23.83	0.00218861	1	0.002189		
64069901	1,571.51	0.144331611	1	0.144332		
64069902	15.27	0.001402437	1	0.001402		
64069903	181.77	0.016694235	1	0.016694		
64069904	1.26	0.000115722	1	0.000116		
64069909	2,930.84	0.269176052	1	0.269176		

Source: Author's Calculation based on the data of Import Conditions and import share for each 8-digit HS product lines

Table C.2: An Example of Import Restriction Condition

S#	Import Policy Code	Item Description	Policy
1	01011000	Live horses, asses, mules and hinnies: - Pure-bred breeding animals Horses: Pure-bred breeding animals	Restricted
2	01011010	Live horses, asses, mules and hinnies: - Pure-bred breeding animals Live horses, asses, mules and hinnies: - Pure-bred breeding animals: Horses	Restricted
3	01011020	Live horses, asses, mules and hinnies: - Pure-bred breeding animals Live horses, asses, mules and hinnies: - Pure-bred breeding animals:	Restricted
4	01011090	Live horses, asses, mules and hinnies: - Pure-bred breeding animals Live horses, asses, mules and hinnies: - Pure-bred breeding animals: Other	Restricted
5	01019000	Horses - Other Horses - Other	Restricted
6	01021000	Live bovine animals - Pure-bred breeding animals Pure-bred breeding animals	Free
7	01021001	Live bovine animals - Pure-bred breeding animals Bulls, adult, pure-bred breeding	Restricted
8	01021002	Live bovine animals - Pure-bred breeding animals Cows, adult, pure-bred breeding	Restricted
9	01021003	Live bovine animals - Pure-bred breeding animals Buffaloes, adult & calves, pure-bred breeding	Restricted
10	01021009	Live bovine animals - Pure-bred breeding animals Other pure-bred breeding bovine animals	Restricted
11	01029000	Live bovine animals - Other Other	Free
12	01029001	Live bovine animals - Other Bulls, adult other than pure-bred breeding	Restricted
13	01029002	Live bovine animals - Other Buffaloes, adults calves other than pure-bred breeding	Restricted
14	01029009	Live bovine animals - Other Others (excluding bulls & buffaloes) other than pure-bred breeding	Restricted
15	01031000	Live swine - Pure-bred breeding animals Pure-bred breeding animals	Restricted
16	01039100	Live swine - Other: Weighing less than 50 kg. Other: Weighing less than 50 kg.	Restricted
17	01039200	Live swine -Other: Weighing 50 kg. or more Other: Weighing 50 kg. or more	Restricted
18	01041000	Live sheep and Goats - Sheep Sheep	Free
19	01041001	Live sheep and Goats - Sheep Live sheep & lamb for breeding purpose	Restricted
20	01041002	Live sheep and Goats - Sheep Live sheep & lamb - other than breeding purpose	Restricted
89	02089000	Other meat and edible meat offals, fresh, chilled or frozen - other Other meat and edible meat offals, fresh, chilled or frozen - other	Prohibited
90	0208900090	Other meat and edible meat offals, fresh, chilled or frozen - other Other meat and edible meat offal, fresh, chilled or frozen	Free
91	02090000	Pig fat, free of lean meat, and poultry fat, not rendered or otherwise extracted, fresh, chilled, frozen, salted, in brine, dried or smoked Pig fat free of lean meat and poultry fat (not rendered), fresh, chilled, frozen, salted, in brine, dried or smoked	Prohibited
92	02101100	Meat and edible meat offal of, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal -Meat of swine : Hams, shoulders and cuts thereof, with bone in Meat of swine: Hams, shoulders and cuts thereof, with bone in	Free

| S#	Import Policy Code	Item Description	Policy
93	02101200	Meat and edible meat offal of, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal -Meat of swine : Bellies (streaky) and cuts thereof Meat of swine: Bellies (streaky) and cuts thereof	Free
94	02101900	Meat and edible meat offal of, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal -Meat of swine : Other Meat of swine: Other	Free
95	02102000	Meat and edible meat offal of, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal -Meat of bovine animals Meat of swine: Meat of bovine animals	Restricted

Source: http://www.eximkey.com/IP/ImportPolicyupto31032002/

Table C.3: Inverted NTB (% Share) for Different 2-Digit NIC Product Groups over time

ISIC_code_2digit (NIC-2004)	Commodity Name	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1-5	Agriculture, hunting, forestry and fishing	0.801	0.800	0.807	0.813	0.805	0.834	0.815	0.876	0.857	0.866	0.858
10-14	Mining and quarrying	0.930	0.946	0.972	0.970	0.964	0.962	0.965	0.964	0.970	0.969	0.976
15-16	Food products, beverages and tobacco	0.942	0.948	0.965	0.975	0.981	0.992	0.993	0.994	0.994	0.995	0.993
17-19	Textiles, textile products, leather and footwear	0.937	0.947	0.966	0.970	0.969	0.966	0.962	0.969	0.973	0.981	0.984
20	Wood and products of wood and cork	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.999	1.000	1.000	1.000
21-22	Pulp, paper, paper products, printing and publishing	0.872	0.888	0.852	0.862	0.873	0.883	0.891	0.897	0.892	0.895	0.878
23	Coke, refined petroleum products and nuclear fuel	0.823	0.889	0.966	0.965	0.960	0.962	0.952	0.950	0.948	0.941	0.951
24	Chemicals and chemical products	0.932	0.934	0.947	0.949	0.951	0.952	0.947	0.944	0.939	0.935	0.946
25	Rubber and plastics products	0.992	0.990	0.998	0.999	0.994	0.994	0.994	0.995	0.996	0.985	0.983
26	Other non-metallic mineral products	0.998	0.996	1.000	1.000	1.000	0.959	0.951	0.951	0.958	0.941	0.947
27	Basic metals	0.939	0.934	0.936	0.932	0.936	0.991	0.993	0.993	0.992	0.974	0.964
28	Fabricated metal products except machinery and equipment	0.968	0.892	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
29	Machinery and equipment n.e.c	0.986	0.984	1.000	1.000	1.000	1.000	1.000	0.996	0.997	0.997	0.996
30	Office, accounting and computing machinery	0.992	0.994	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
31	Electrical machinery and apparatus n.e.c	0.942	0.935	0.932	0.973	0.969	0.960	0.954	0.963	0.970	0.969	0.986
32	Radio, television and communication equipment	0.942	0.935	0.932	0.973	0.969	0.960	0.954	0.963	0.970	0.969	0.986
33	Medical, precision and optical instruments	0.986	0.980	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
34	Motor vehicles, trailers and semi-trailers	0.999	0.998	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
35	Other transport equipment	0.833	0.834	0.851	0.924	0.892	0.833	0.832	0.833	0.834	0.833	0.834
36-37	Manufacturing n.e.c; recycling	0.955	0.968	0.969	0.969	0.974	0.968	0.966	0.965	0.959	0.957	0.943

Source: Author's Calculation based on the data of Import Conditions and import share for each 8-digit HS product lines

Figure C.1: Trend in NTB Index (Percentage Share)
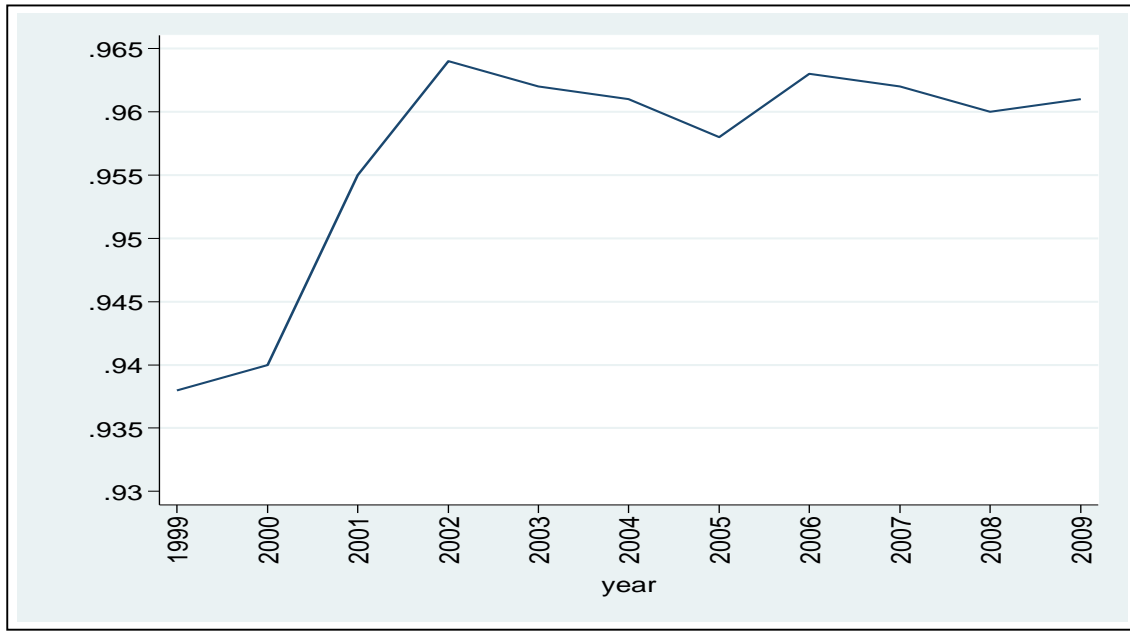
Source: Author's Calculation based on the data of Import Conditions and import share for each 8-digit HS product lines

Table C.4: NTB Index for Selected 4-digit Product Groups, 1999-2009

HS Code 2-digit	HS Code 4-digit	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
01	0101						0.5	0.5	0.5	0.499	0.5	0.5
	0102	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0		
	0103	0.5000	0.5	0.5	0.5	0.5	0.500	0				
	0104	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0			
	0105	1	1	0		0.5	0.5	0.5	0.5	0.499	0.5	0.499
	0106				1	1	0.5	0.499	0.5	0.5	0.499	0.5
02	0201		0.5	0							0.5	0
	0202		0.5	0	0.5	0		0.5	0	0.5	0	
	0203			0.994	1	1.000	1	1	1	1	1	1
	0204	1	1	0.99	1	1	1	1	1	1	1	0.999
	0206	1	0.925	1	1.000	0.5	1	0	1	1	1	0
	0207	1	1	1	1.000	1.00	1	1	0.999	1	1	0.999
	0208		0.5	0		0.5	0.5	0				
	0209				0.5	0.5	0					0
	0210		1	0	1.00	0.994	0.851	1	1.000	0.999	1	1.000

Source: Author's Calculation based on the data of Import Conditions and import share for each 8-digit HS product lines
Note that the blank cells means in that particular year that particular 4-digit product was not imported at all.

Note: These are done for broad 2 digit product groups 01 and 02 (animal and animal products).