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Firm Heterogeneity and India's Manufacturing Exports: Lessons on Protection and Trade Theory

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ABSTRACT

Empirical examinations of heterogeneity among Indian manufacturing firms provide helpful lessons for trade theories and policies. Using descriptive statistics of cross-section data for 2011, 2015, and 2019, the asymptotic Wilcoxon-Mann-Whitney test, and regression analysis, the study reveals that firms are heterogeneous within each 4-digit National Industrial Classification (NIC) category, exporting firms are more productive than non-exporters, and exporter premia decline with trading activities. The study concludes that recent protectionist policies reduced extensive trade margins, firm heterogeneity, and productivity in the Indian manufacturing sector.

KEYWORDS

Extensive trade margin; firm heterogeneity; Indian manufacturing firms; labor productivity; reallocation effects; total factor productivity

I. Introduction

Literature on international trade theories provides two broad strands based on firms' characteristics to explain gains from trade. Neoclassical trade theories (NCTs) and new trade theories (NTTs), which form the first strand, assume firms are homogenous, use the same technology, face the same demand conditions, and expand or contract together in response to trade reforms (Tybout 2001). NCTs explain the inter-industry effects of trade (Ricardian comparative advantage and Heckscher-Ohlin endowment differences), and NTTs highlight the role of intra-industry trade (see, e.g., P. R. Krugman (1979; 1980) and Helpman and Krugman (1987)). The second strand, the standard heterogeneous firm model of trade, highlights the role of firm heterogeneity on productivity and output through resource reallocation among firms within an industry. Here, the exporting firms are large, more productive, earn higher revenues, pay higher wages, use factors of production differently, and charge lower prices (Bernard et al. 2003, 2007, 2018; Davidson, Matusz, and Shevchenko 2008; Eaton, Kortum, and Kramarz 2011; Giordano and Lopez-Garcia 2021; Melitz 2003), and few superstar firms carry out a significant portion of production (Gaubert, Itskhoki, and Vogler 2021). Hence, there is limited potential to

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exploit economies of scale and gains from trade that come significantly from between-firm reallocation effects.

Both NCTs and NTTs can explain the scale effects, but they fail to describe the between-firm reallocation effects of trade. Using micro-level data, the heterogeneous firm trade models investigated the empirical critiques of NCTs and NTTs by explaining the between-firm reallocation effects of trade. Due to the structural differences between developing and developed economies, the studies using micro-level data from developed economies (Bernard et al. 2018; Eaton, Kortum, and Kramarz 2011; Giordano and Lopez-Garcia 2021; Mayer and Ottaviano 2008) give strikingly different empirical results compared to the limited studies conducted in the developing world (Lu 2010). Thus, the current study contributes to the critiques of NTTs and NCTs by analyzing the characteristics of exporting and non-exporting firms in the context of India. (Exporting firms are companies that engage in the export of goods and report their foreign exchange earnings from these exports in the year under consideration. In contrast, non-exporting firms do not report foreign exchange earnings from the export of goods for that year.) To the best of our knowledge, this is the first study which investigates most manufacturing firms in near-contemporary India by applying a classic Bernard-Jenkins case study to a developing country that has low-productive firms.

The current study aims to investigate: 1) Is the decrease in India's trade-to-GDP ratio attributed to a decline in the extensive or intensive trade margins? 2) Does India export from a particular subset of disaggregated manufacturing industries? 3) Do all manufacturing firms within a narrowly defined industry in India engage in exporting? 4) Is the mean export per sale (MES) positive in specific disaggregated manufacturing industries in India, and does it vary by industry? 5) Are exporting firms more productive than non-exporters? 6) Finally, do exporter premia exist?

In addition, the article provides a better approach for measuring the impact of trade facilitation/restriction on labor productivity (LP) and total factor productivity (TFP) by comparing the median LP and TFP of exporting and non-exporting firms simultaneously. When trade reforms are accompanied by other market and industrial reforms, which are common in India, using the ex-post/ex-ante approach introduced by (Melitz and Trefler 2012) for comparing the productivity of exporters and non-exporters is not a good choice.

II. Literature review

Both NCTs and NTTs assume firms are homogeneous within an industry, and because of this restrictive assumption, they fail to explain the between-firm reallocation effects of trade. Further, several studies have demonstrated that within a given industry, firms are heterogeneous (Bernard et al. 2003, 2007, 2018; Eaton, Kortum, and Kramarz 2011; Giordano and Lopez-Garcia 2021; Melitz 2003), and this heterogeneity arises from technologies with different

characteristics, labor with heterogeneous skills (Yeaple 2005), and entrepreneurs' skill differences (Manasse and Turrini 2001).

There is a vast and growing literature investigating the role of firm heterogeneity in international trade, and analyzing the between-firm reallocation effects of trade is one of the essential takeaways of the heterogeneous trade model from NCTs and NTTs. In a seminal work, Melitz (2003) theorized that due to firm heterogeneity within an industry, some domestically producing firms will exit the market, more productive firms will survive, and new highly productive plants will enter the market because the domestic cutoff productivity threshold increases after trade liberalization. This firm dynamic in the market will reallocate resources from less productive firms to more productive ones (Melitz 2003). The intra-industry reallocation of resources is likely to be higher in industries where a country has a comparative advantage than in industries where a country has a comparative disadvantage. Therefore, trade facilitation strengthens ex-ante cross-country disparities by triggering inherent Ricardian productivity differences at the industry level, which are directly related to the Heckscher-Ohlin-based comparative advantage theory (Bernard, Redding, and Schott 2007). Furthermore, intra-industry reallocations are the most crucial source of growth in TFP, spurred by the productivity growth of large existing firms and the entry of new firms (Lewrick, Mohler, and Weder 2018). Moreover, Melitz and Polanec (2015) concluded that in the presence of trade, TFP could change because of composition changes between firms due to changes in the market share among surviving firms, the entry of new producers, and the exit of old ones.

A growing body of literature addresses the empirical critiques of NCTs and NTTs, revealing that firms are heterogeneous and all disaggregated manufacturing industries export, but not all firms within the same industries, and exporters export only a small portion of their products. Using the 1992 U.S. Census of Manufactures, Bernard et al. (2003) illustrated that less than 5% of U.S. manufacturing plants export more than 60% of their products, 95% of firms export less than 50% of their total products, and 66% export less than 10% of their products. Using European firm-level data, Mayer and Ottaviano (2008) discovered that European firms had a higher fraction of exporting firms (FEFs), and around 55% (40%) of firms exported a portion of their turnover among countries with restricted data (exhaustive data). Lu (2010) utilized firm-level data from the Chinese manufacturing industry and found that, on average, around 30% of Chinese manufacturers are exporting a fraction of their turnover. Lu's (2010) findings differ significantly from those investigations that utilized firm-level data from the U.S., France, and other European nations in terms of export intensity. Lu (2010) reported that the Chinese export intensity distribution is U-shaped, with less than 20% of exporters selling less than 10% of their production overseas and around 40% exporting more than 90% of their output. Lu (2010) further explained that Chinese firms'

export behaviors correlated with factor abundance. Since China is a labor-abundant country, labor-intensive exporting firms are less productive and sell a large portion of their output overseas because exporting markets are less competitive than the domestic market for Chinese firms. Alternatively, in capital-intensive sectors, exporting firms are rare, are more productive, and ship a small proportion of their output.

Moreover, Eaton, Kortum, and Kramarz (2011) examined the sales of French manufacturing firms in 113 destinations, including France. They observed that around 15% of French manufacturing firms (34,558 out of 230,423) are selling abroad, and only 0.23% of these firms (523 out of 230,423) do not sell in France. Their analysis demonstrates that productive firms are likely to penetrate more export markets, and the number of French firms selling to a market (relative to the French market share) increases with market size according to an approximately log-linear relationship. Additionally, Bernard et al. (2018), using data from the 2007 U.S. Census of Manufactures, found that exporting occurred in all 3-digit North American Industry Classification System (NAICS) manufacturing industries, but not all firms within an industry export. They show that, on average, 35% of firms in the U.S. manufacturing industry export. Moreover, they demonstrate that exporting is much more prevalent and intense in more skill-intensive industries, such as the computer industry, where 75% of firms export, than in more labor-intensive ones, such as the apparel industry, where only 22% of firms export.

In addition to productivity differences, the heterogeneity across various aspects of firms' characteristics is another empirical critique that arises from NCTs and NTTs. Using micro-level data, Bernard et al. (2018) reported that exporting firms had 128% more employment, 172% more shipments, 33% more value added per worker, and 3% more total factor productivity. These differences become smaller when industry-fixed effects are included in their regression model to focus on within-industry differences between exporters and non-exporters. However, they remain statistically significant at the 1% level.

NTTs apply to differentiated products and explain intra-industry trade using product-level data as a unit of analysis. Intra-industry trade is the share of trade within industries/product groups rather than across sectors. The Grubel-Lloyd index (the share of intra-industry trade) increases as the level of aggregation increases. Using data on more than 39 million bilateral trade flows, Brülhart (2009) showed that in 2006, intra-industry trade accounted for 27% at the 5-digit level and 44% at the 3-digit level of statistical aggregation. Hence, these theories implicitly assume that firms within industries/product groups are homogeneous. The now-standard heterogeneous firm model of trade contributes to the critiques of NTTs by introducing the concept of firm heterogeneity. Only more productive firms export a fraction of

their products within industries/product groups that produce the same goods, and low-productive firms remain non-exporters. The previous research conducted in India to establish a connection between firm heterogeneity and trade liberalization concentrated on the within-firm reallocation effects of changes in tariffs (input tariffs and output tariffs) on firms' product varieties (Goldberg et al. 2010a, 2010b), the heterogeneous impacts of tariff adjustments on firms' domestic sales, capital usage, profits, and markups (Bas and Ledezma 2020), the relative impact of a fall in input tariffs compared to declining output tariffs (Topalova and Khandelwal 2011), and capital goods tariffs (Bas and Ledezma 2020). The present study attempts to analyze the export characteristics of Indian manufacturing firms.

Overall, there is a consensus that small (large) FEFs sell a large (small) share of their output in countries like the U.S., France, and other European countries, with the exception of Lu (2010) for China. Additionally, the article found that exporting firms in China are generally less productive and sell less in the domestic market than non-exporting firms. In contrast, previous investigations in developed economies have found that exporters are more productive and have a larger domestic market share. Owing to differences in the export intensity of exporters between China and other developed nations, the current study uses firm-level data from India to investigate this disparity in detail. India is a unique case as it is one of the fastest-growing developing countries in the world with a diverse economic structure.

III. Data and methodology

This study is based on firm-level data from the Indian manufacturing sector as defined by the NIC, Section C, Divisions 10–32 (MOSPI 2008), which has 130 4-digit Indian manufacturing industries (henceforth, 4-digit industries). The firm-level data is extracted from the ProwessIQ database provided by the Centre for Monitoring Indian Economy (CMIE),[1] a private research organization in India, which classified firms into 1-digit, 2-digit, 3-digit, 4-digit, and 5-digit NIC codes. The database uses information from companies' audited annual reports and data provided to the Government of India's Ministry of Company Affairs and provides a record of all listed and a large number of unlisted companies. We exclude industries with less than five firms to avoid outliers. For instance, if an industry has one exporting firm, then the fraction of exporters in the industry is 100%; if it is not exporting, then the fraction of exporters is 0. The study also excludes firms that export more than their sales revenue, which provides MES greater than 100% when the export revenue exceeds the sales revenue. Hence, the study considered only those firms that

[1]Centre for Monitoring Indian Economy (CMIE), *Prowess Database*, version 1.96, Accessed November 16, 2022. URL: https://prowessiq.cmie.com.

Table 1. Descriptive statistics of the variables (rupees million).

Year	Statistic	N	Mean	Std. Dev.	Min.	Max.
2011	Sales	6,151	6,635.8	82,400.9	0.1	4,268,759.0
	Sales of goods	5,752	6,389.8	78,153.1	0.1	3,734,889.0
	Raw material expenses	5,524	3,957.9	50,537.0	0.1	2,748,140.0
	Compensation to employees	5,848	268.4	1,769.1	0.1	79,578.2
	Net fixed assets	6,093	1,874.6	18,868.9	0.1	1,137,230.0
	Export of goods	2,811	2,443.9	38,769.2	0.1	1,982,690.0
	Number of employees (a)	643	2,697.5	6,958.3	3	106,004
	Sales per compensation to employees	5,502	45.7	246.1	0.002	14,449.3
	Sales per Employee	627	10.3	30.8	0.01	381.4
2015	Sales	9,094	6,047.2	62,974.8	0.1	4,002,578.0
	Sales of goods	8,620	5,876.2	63,930.7	0.1	3,990,842.0
	Raw material expenses	8,641	3,078.4	26,983.1	0.1	1,527,690.0
	Compensation to employees	9,015	316.1	1,906.1	0.1	96,608.2
	Net fixed assets	9,036	2,328.0	24,625.9	0.1	1,475,430.0
	Export of goods	3,951	1,902.0	23,663.9	0.1	1,376,340.0
	Number of employees (a)	1,482	1,979.2	6,538.3	1	144,710
	Sales per compensation to employees	8,571	33.6	130.0	0.003	7,028.4
	Sales per Employee	1,446	14.8	112.7	0.001	4,011.7
2019	Sales	8,958	7,793.8	90,953.8	0.1	5,779,234.0
	Sales of goods	8,577	7,585.2	91,535.7	0.1	5,739,242.0
	Raw material expenses	8,594	4,258.4	43,542.8	0.1	2,462,406.0
	Compensation to employees	8,894	438.6	2,259.0	0.1	87,783.1
	Net fixed assets	8,909	2,996.7	40,816.0	0.1	3,064,780.0
	Export of goods	2,600	2,162.7	39,211.4	0.1	1,907,430.0
	Number of employees (a)	1,569	2,420.5	6,907.6	1	133,571
	Sales per compensation to employees	8,529	28.3	182.9	0.002	9,075.3
	Sales per Employee	1,537	14.0	139.1	0.001	5,225.8

Notes: N represents the number of observations; Mean represents the mean value; Std. Dev. represents the standard deviation; Min. represents the minimum value; and Max. represents the maximum value. (a) Employee headcount.

reported positive values in the variables identified for the study, as listed in Table 1. Out of the total 17,516 manufacturing firms 14,994 firms of the 4-digit NIC code were extracted for the study. The study utilizes cross-section data from three years, namely 2011, 2015, and 2019, to get robust results. The study period is selected to avoid the impact of the 2008 financial crisis and the 2020 COVID-19 pandemic.

This study employed multiple tools, such as descriptive statistics, hypothesis testing, and regression analysis, to explore the research questions. First, the study uses the FEFs within each industry, the industry-level MES, and a frequency distribution table of exporting firms to examine the firm heterogeneity among Indian manufacturing firms empirically. Then, an asymptotic Wilcoxon-Mann-Whitney test was used to examine whether exporting firms' median LP and TFP are greater than those of non-exporting firms. Next, the study uses regression analysis to calculate the exporters' premia. After that, the article employs the Ackerberg, Caves, and Frazer (2015) estimation algorithm to estimate firm-level TFP, and finally, the LP is computed as sales of goods per employee and sales of goods per employee's compensation, which is an improvement over the existing methodology in the existing literature. Following OECD (2001), the study uses employee compensation as the labor input instead of the number of employees reported by Prowess and imputed

measures of employment reported by the existing literature for two reasons. 1) Table 1 indicates that Prowess provides data on the number of employees for only a small subset of firms (i.e., 643, 1,482, and 1,569 in 2011, 2015, and 2019, respectively); nonetheless, it offers data on employee compensation for most firms across various periods (i.e., 5,848, 9,015, and 8,894 in 2011, 2015, and 2019, respectively). 2) Using the imputed measures of employment (i.e., wage bill obtained from the Prowess database divided by industry-level computed average wage from the Annual Survey of Industries (ASI) summary) as labor inputs reduces the heterogeneity of labor inputs.

The FEFs in each industry are calculated based on Equation 1, and the industry-level MES is calculated according to Equation 2.

$$\gamma_j = \frac{NX_j}{A_j} \tag{1}$$

Where, γ_j is the FEFs in industry j, NX_j shows the number of firms that export a portion of their total product in industry j, and Aj represents overall firms in industry j.

$$\mu_j = \frac{\Sigma_{i=1}^{n} \phi_i}{n_j} \tag{2}$$

Where, μ_j represents the MES in industry j, ϕ_i is the export per total sales of firm i, and n_j is the number of exporting firms in industry j.

Sales revenue per employee is calculated according to Equation 3, and sales revenue per employee compensation is obtained using Equation 4.

$$LPW_i = \frac{SG_i}{NE_i} \tag{3}$$

Where, LPW_i represents the LP of firm i using the number of employees as labor input, SG_i is the sales of goods in company i, and NE_i is the number of workers employed by company i.

$$LPC_i = \frac{SG_i}{CE_i} \tag{4}$$

Where, LPC_i symbolizes the LP of firm i while using employees' compensation as labor input, SG_i represents the sales of goods in company i, and CE_i depicts the compensation to employees in company i.

Using an unbalanced panel dataset of 56,540 observations consisting of 8,743 firms from across different 4-digit industries, the authors report Equation 5 (the value-added log-linear production function) based on Ackerberg, Caves, and Frazer's (2015) estimation algorithm in a separate research work titled "Estimation and Decomposition of Indian

Manufacturing Sector's Total Factor Productivity: A Trade Theory-Based Analysis" to estimate the firm-level TFP in 2011, 2015, and 2019.

$$ln\left(TFP_{ijt}\right) = ln(VAO)_{ijt} - 0.504ln\left(L_{ijt}\right) - 0.398ln\left(K_{ijt}\right) \quad (5)$$

Where, $ln\left(TFP_{ijt}\right)$, $ln(VAO)_{ijt}$, $ln\left(L_{ijt}\right)$, and $ln\left(K_{ijt}\right)$ represent the natural log of TFP, value-added output, employee compensation, and capital inputs in firm i, industry j, at time t, respectively.

IV. Results

Descriptive statistics of the variables

Table 1 provides insights into the central tendency, dispersion, and range of various variables across three years. Except for the number of employees, which measures the employee headcount, all values are in rupees (Rs) million. Table 1 highlights that firms are strongly heterogeneous in terms of various factors; for instance, in 2011, the average revenues earned from sales of goods was around 63,898 times more than the minimum value and around 585 times less than the maximum value, while all other variables listed in Table 1, more or less, exhibit similar patterns.

Fraction of exporting firms

This section analyzes three important research questions: whether India exports from a specific set of disaggregated manufacturing industries, whether all firms within the same industry export, and which trade margins are responsible for the decline in India's trade-to-GDP ratio.

Figure 1 shows the scatter points of the FEFs in each 4-digit industry for three years, namely, 2011, 2015, and 2019. It is evident from Figure 1 that India has exporting firms in all 4-digit industries, though most manufacturing firms are not exporters. Figure 1 also shows that there are few disaggregated industries with extreme values (i.e., all firms either export their goods or do not export at all). In 2011, only one 4-digit industry (1080: Manufacture of prepared animal feeds) supplied solely to the domestic market, while in another disaggregated industry (2392: Manufacture of clay building materials), all firms exported a portion of their output. In 2015, in one 4-digit industry, 100% of firms exported a part of their products; in 2019, however, two industries did not sell abroad.

Tables 2 and 3, extracted from Figure 1, list the top and bottom 10 industries with the highest and lowest FEFs for the three years. Among the top 10, the FEFs are higher for 2011 and 2015, whereas 2019 is missing entirely. However, among the bottom 10, all three years appear, but 2019 appears more frequently than others. Combining the information from Tables

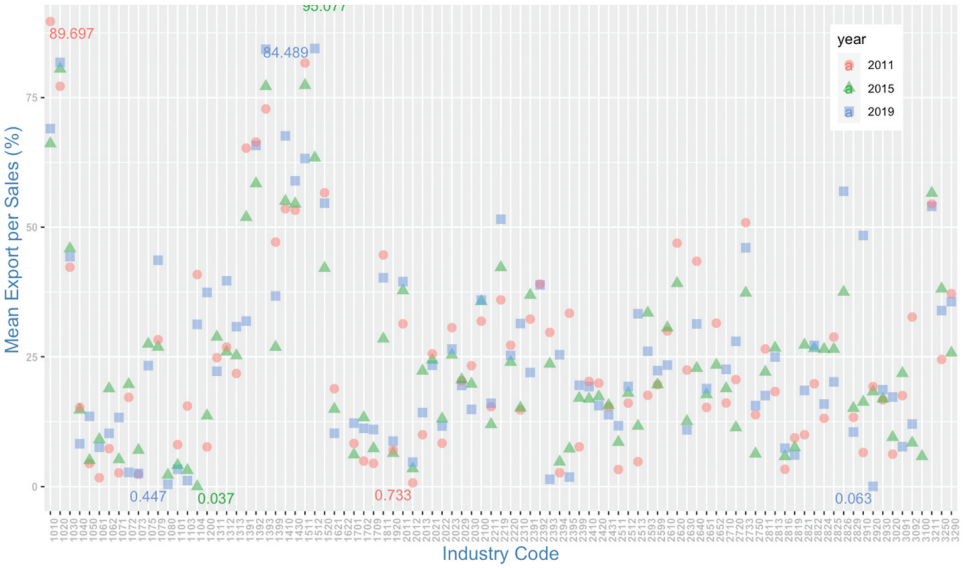

Figure 1. Fraction of exporting firms (FEFs) that export in each 4-digit industry in years 2011, 2015, and 2019.

Table 2. Top-10 industries with the highest fraction of exporting firms (FEFs).

Year	Industry Name	Industry Code	Percent of Firms	Fraction of exporting firms (%)
2011	Manufacture of clay building materials	2392	0.08	100
2015	Manufacture of watches and clocks	2652	0.05	100
2015	Manufacture of luggage, handbags and the like, saddlery and harness	1512	0.07	85.71
2015	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	2811	0.34	84.38
2011	Manufacture of other nonmetallic mineral products n.e.c.	2399	0.098	83.33
2011	Manufacture of wiring devices	2733	0.08	80
2011	Manufacture of medical and dental instruments and supplies	3250	0.25	80
2015	Manufacture of other nonmetallic mineral products n.e.c.	2399	0.05	80
2011	Manufacture of other pumps, compressors, taps and valves	2813	0.87	79.25
2011	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	2811	0.31	78.95

Source: Author's calculation.

2 and 3 allows the study to measure the range of variation in the FEFs and compare them over time. For 2011 and 2015, the FEFs range from 0% to 100% and from 2.94% to 100%, respectively. In contrast, the FEFs varied from 0 to 66.67% in 2019. The FEFs declined in 2015, compared to 2011, but in 2019, they decreased sharply. The reason will be discussed later in this section.

The FEFs vary from industry to industry, and exporting is more prevalent and intense in labor-intensive industries, such as the manufacture of textiles and food, compared with more capital-intensive ones, such as the iron and steel industries, as illustrated in Table 4.

Table 3. Bottom-10 industries with the lowest fraction of exporting firms (FEFs).

Year	Industry Name	Industry Code	Percent of Firms	Fraction of exporting firms (%)
2011	Manufacture of prepared animal feeds	1080	0.246	0
2019	Manufacture of furniture	3100	0.056	0
2019	Manufacture of computers and peripheral equipment	2620	0.089	0
2015	Manufacture of soft drinks; production of mineral waters and other bottled waters	1104	0.367	2.94
2019	Manufacture of cement, lime, and plaster	2394	0.915	4.88
2019	Manufacture of prepared animal feeds	1080	0.402	5.56
2011	Manufacture of soft drinks; production of mineral waters and other bottled waters	1104	0.263	6.25
2019	Manufacture of articles of concrete, cement, and plaster	2395	0.346	6.45
2019	Manufacture of motorcycles	3091	0.167	6.67
2015	Manufacture of prepared animal feeds	1080	0.411	7.89

Source: Author's calculation.

Table 4. Industry variation of mean export per sales and fraction of exporting firms.

Year	Factor Intensity	Industry Name	Industry Code	Percent of Firms	Fraction of exporting firms (%)	Mean export per sales (%)
2011	Labor intensive	Processing and preserving of meat	1010	0.15	33.33	89.7
2015		Processing and preserving of meat	1010	0.20	38.89	66.13
2019		Processing and preserving of meat	1010	0.20	55.56	69.03
2011		Manufacture of made-up textile articles, except apparel	1392	0.13	37.50	66.44
2015		Manufacture of made-up textile articles, except apparel	1392	0.12	54.54	58.41
2019		Manufacture of made-up textile articles, except apparel	1392	0.13	25.00	65.79
2011	Capital intensive	Manufacture of basic iron and steel	2410	7.02	28.81	20.23
2015		Manufacture of basic iron and steel	2410	6.4	24.83	16.87
2019		Manufacture of basic iron and steel	2410	6.28	16.73	19.26

Source: Author's calculation.

Table 5. Average fraction of exporting firms (AFEFs) and average mean export per sales (AMES) in the Indian manufacturing sector.

Year	Percentage of Firms	Average mean export per sales (%)	Average fraction of exporting firms (%)
1	2	3	4
2011	99.54	25.34	47.45
2015	99.64	24.93	44.77
2019	99.54	26.32	30.25

Source: Author's calculation.

Jointly, Columns 3 and 4 of Table 5 show that the decline in India's trade-to-GDP ratio reduced the extensive trade margin (i.e., the percentage of exporting firms in each industry). In contrast, the falling trade-to-GDP ratio has a negligible impact on the intensive trade margins (i.e., the average of industry-level mean export per total sales).

A glance at India's exports, imports, and GDP during the study period shows that all three variables are rising, but the GDP growth rate is greater

than the trade growth rate. Trade can increase faster than GDP growth when a country's economy becomes more open to trade (Abboushi 2010). Conversely, if a country follows protectionist policies, GDP can grow faster than trade because protectionism can lead to higher domestic prices (Krugman, Obstfeld, and Melitz 2022, 237–239) and encourages firms to sell in the domestic market instead of exporting; as a result, the number of exporting firms will decrease.

India's trade-to-GDP ratio dropped from 56% in 2011 to 40% in 2019[2] due to internal factors such as increased protectionism, demonetization, an economic slowdown, and policy changes (Bown 2023; Shukla 2021), along with external factors such as the U.S.-China trade war and declining global trade. In addition, trade protectionism policies implemented recently in India (Shukla 2021), such as tariff hikes on imports, restrictions on foreign direct investment (FDI), the Merchandise Exports from India Scheme (MEIS), the Make in India campaign, and the trade diversion effects of free trade agreements between India and other countries (Shiino 2021), reduced India's trade-to-GDP ratio. A recent study by Chatterjee and Subramanian (2023) found that since 2014, around 3,200 tariff hikes at the HS 6-digit level led to a rise in average tariffs from 13% to nearly 18%. The most significant increases occurred in 2018, with about 2,500 tariff hikes, adding nearly 4%. They calculated that tariff hikes impacted import categories worth about USD 300 billion, or approximately 70% of all imports. They also estimated sector-wise tariff hikes; in 2018, agricultural tariffs increased from 35% to 38.3%, and tariffs on low-skill manufacturing products increased from 10% to nearly 25%. During 2014 to 2020, tariffs on cell phones and electronic products increased by 20% and 3.6%, respectively. Between 2004 and 2014, India signed 11 preferential/free trade agreements, but none were signed afterward, and the country chose not to join the Regional Comprehensive Economic Partnership. In March 2020, the Indian government announced the Production Linked Incentive (PLI) initiative, which aims to boost the country's manufacturing of electronics, pharmaceuticals, clothing, and automotives (Chatterjee and Subramanian 2023). The inward-looking approach in India, particularly after 2014, caused a decrease in the FEFs from 47.45% in 2011 to 30.25% in 2019, as shown in Table 5, Column 4. On the other hand, we can hardly tell that the average MES in 2011 differs from that in 2015 and 2019, as presented in Table 5, Column 3. NCTs and NTTs have been unable to explain these changes in extensive and intensive trade margins as they use country rather than firm-level data. The article's finding is similar to a study conducted by Mayer and Ottaviano (2008), which shows that aggregate trade and FDI flows respond to nations' fundamentals through extensive margins to a considerable extent.

[2]See https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=IN.

Mean export per sale

In this section, the study empirically shows that the MES are positive in all 4-digit industries, even though not all firms are exporters in each industry, to contribute to the critiques of NCTs. Figure 2 provides the scatter plots of the MES in all 4-digit industries included in the study over three years, namely, 2011, 2015, and 2019. Although not all firms within an industry are exporters, the MES in all industries are positive and vary by industry. Labor-intensive industries like textiles and food have a higher MES than capital-intensive ones like iron and steel. For instance, as seen in Table 4, in 2019, the MES in the manufacture of made-up textile articles, except apparel, is 65.79%, and in the processing and preserving of meat, it is 69.03%. Basic iron and steel manufacturing exports 19.26% of its output. Data from 2015 and 2019 reflect the same facts.

The article extracted Tables 6 and 7 from Figure 2 to provide the top 10 and bottom 10 4-digit industries with the highest and lowest MES. Overall, the MES for industries ranged from 1.71% to 89.70% in 2011, and from 0.54% and 1.84% to 95.08% and 91.61% in 2015 and 2019, respectively. These empirical pieces of evidence show that NCTs are partially valid.

The study also shows that in India, a small (large) number of exporting firms sell a large (small) portion of their production overseas. Table 8 reveals that in 2011, precisely 47.07% of manufacturing firms exported less than 10% of their products, and approximately 70% of firms exported less than 30% of their products. Interestingly, less than 5% of firms exported more than 90% of their products in 2011. The results for 2015 and 2019 almost replicate those of

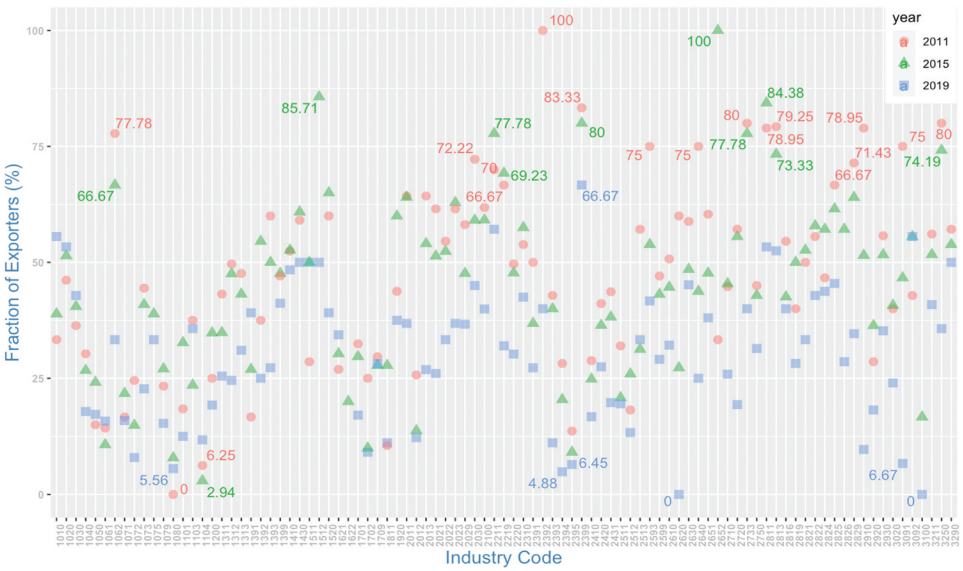

Figure 2. Mean export per sales (MES) in all 4-digit industries in years 2011, 2015, and 2019.

Table 6. Top 10 industries with the highest mean export per sales (MES).

Year	Industry Name	Industry Code	Percent of Firms	Mean export per sales
2015	Manufacture of builders' carpentry and joinery	1622	0.05	95.08
2019	Manufacture of builders' carpentry and joinery	1622	0.04	91.61
2011	Processing and preserving of meat	1010	0.15	89.70
2019	Manufacture of luggage, handbags and the like, saddlery and harness	1512	0.09	84.49
2019	Manufacture of carpets and rugs	1393	0.12	84.36
2019	Processing and preserving of fish, crustaceans and mollusks and products thereof	1020	0.50	81.79
2011	Tanning and dressing of leather; dressing and dyeing of fur	1511	0.12	81.68
2011	Manufacture of luggage, handbags and the like, saddlery and harness	1512	0.05	80.68
2015	Processing and preserving of fish, crustaceans, and mollusks and products thereof	1020	0.38	80.55
2015	Tanning and dressing of leather; dressing and dyeing of fur	1511	0.09	77.38

Source: Author's calculation.

Table 7. Bottom 10 industries with the lowest mean export per sales (MES).

Year	Industry Name	Industry Code	Percent of Firms	Mean export per sales
2015	Manufacture of soft drinks; production of mineral waters and other bottled waters	1104	0.37	0.04
2019	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	2920	0.12	0.06
2019	Manufacture of wooden containers	1623	0.03	0.38
2019	Manufacture of prepared animal feeds	1080	0.40	0.45
2015	Manufacture of wooden containers	1623	0.04	0.54
2011	Manufacture of fertilizers and nitrogen compounds	2012	0.58	0.73
2019	Manufacture of malt liquors and malt	1103	0.16	1.18
2019	Manufacture of other porcelain and ceramic products	2393	0.10	1.42
2011	Manufacture of grain mill products	1061	0.58	1.71
2019	Manufacture of articles of concrete, cement, and plaster	2395	0.35	1.84

Source: Author's calculation.

Table 8. Firm-level export per sales frequency distribution table.

Years	2011	2015	2019
Class limits	cf(%)	cf(%)	cf(%)
1[0,10)	47.07	44.76	43.46
2[10,20)	60.76	58.89	57.12
3[20,30)	69.51	67.10	65.96
4[30,40)	75.49	74.53	72.15
5[40,50)	80.75	79.06	77.77
6[50,60)	84.95	83.06	82.35
7[60,70)	88.26	87.25	86.12
8[70,80)	91.21	90.16	89.73
9[80,90)	95.20	94.55	94.69
10[90,100)	98.86	99.31	99.54

Source: Author's calculation.
Note: cf: Cumulative frequency.

2011. This result is similar to Bernard et al. (2018) and Bernard et al. (2003) with U.S. firm-level data, Mayer and Ottaviano (2008) with European firm-level data, and Eaton, Kortum, and Kramarz (2011) with the data of French manufacturing firms. In contrast, the findings are strikingly different from Lu's (2010) with Chinese manufacturing firm-level data. Labor-intensive Chinese exporting firms sell most of their output abroad as they are highly (less) competitive compared to their foreign (domestic) counterparts. Even though India is a labor-abundant country like China, the findings of this study do not support the theoretical framework and empirical findings of Lu (2010), as exporting firms are less competitive compared to their foreign counterparts.

Comparing the LP and TFP of exporters and non-exporters

To understand whether exporting firms are more productive compared to non-exporting firms, the study suggests two possible approaches: 1) to compare the distribution of LP and TFP of exporting and non-exporting firms in a given year; and 2) to test whether the exporters' median LP and TFP are greater than non-exporters.

The distribution of the LP (LPW_i and LPC_i) and TFP of exporters and non-exporters across 4-digit manufacturing firms for years 2011, 2015, and 2019 are compared in Figures 3 and 4, respectively. The study eliminated outliers to enhance the clarity and interpretability of the figures; hence, in 2011, 2015, and 2019, respectively, the figures include: 1) LPW_i of 93%, 89%, and 92% of firms, those reported the employee headcounts in the database, which are less than or equal to Rs 20 million; 2) TFP of 86%, 86%, and 88% of firms, those reported all factors of production required for TFP estimation, which are less than 25; 3) LPC_i of 76%, 73%, and 78% of firms, those reported their sales revenue and employee compensation, which are less than or equal to 36 rupees, 26 rupees, and 24 rupees in 2011, 2015, and 2019, respectively. The remaining highly productive firms are considered outliers and are not included in Figures 3 and 4. The area under the solid curves shows the frequency distribution of exporters' LP and TFP (Figures 3 and 4). In contrast, the area under the dashed graphs depicts the frequency distribution of non-exporters. The solid and dashed vertical lines represent the median LP and TFP of exporters and non-exporters, respectively.

The LP and TFP distributions of exporting and non-exporting firms are asymmetric and positively skewed, and the distributions show that exporters' LP and TFP are higher than those of non-exporters, at least in the left tails. The LP and TFP discrepancy between exporters and non-exporters were more pronounced in 2011 than in 2015 and 2019. The bottom left and right panels of Figure 3 compare the LP of exporting and non-exporting firms in 2019. Although the median LP of non-exporting firms in 2019 is greater than that of exporting firms, the number of firms still exists in the left tail of the graph,

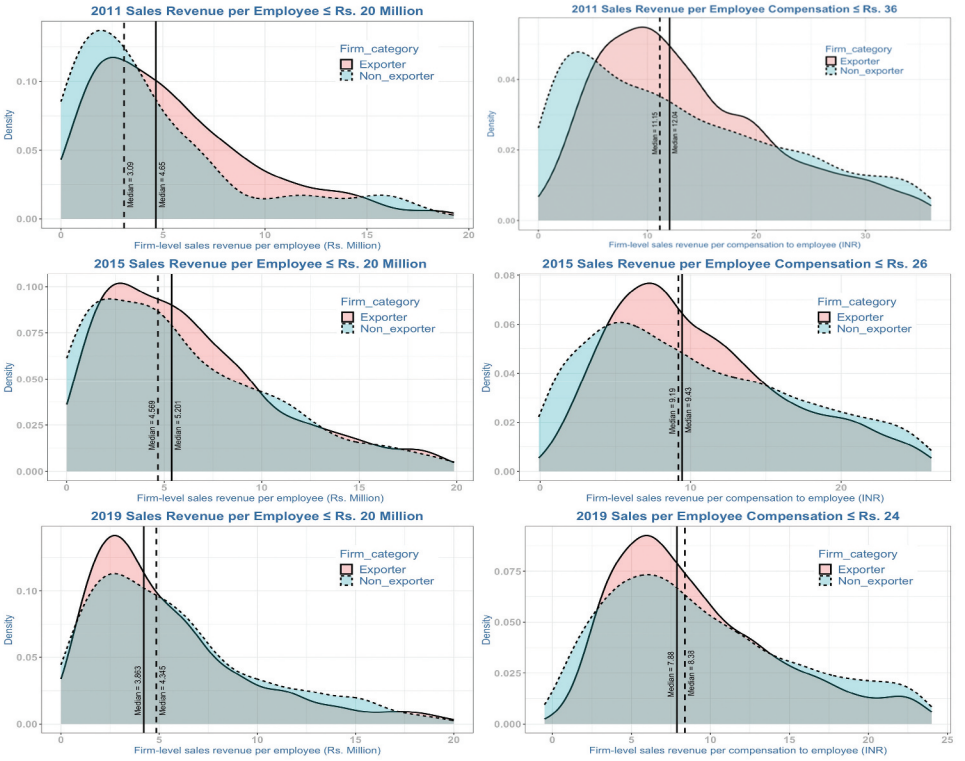

Figure 3. Distribution of labor productivity (LP) across all 4-digit Indian manufacturing firms in 2011, 2015, and 2019.

showing that exporting firms are more productive than non-exporting firms. Similarly, the bottom right panel of Figure 4 compares the TFP of exporting and non-exporting firms in 2019. Notably, the difference between the median LP and TFP of exporters and non-exporters was not statistically significant in 2019, as is seen in Table 10.

Analyzing Figures 3 and 4, during the period characterized by the decline in India's trade-to-GDP ratio from 56% in 2011 to 40% in 2019 due to external and internal factors, as discussed earlier, provides lessons on protection and firm-level productivity. The decline in India's trade-to-GDP ratio narrowed the differences between the median LP and TFP of exporting and non-exporting firms in 2015 and 2019 compared to 2011, and the reduction in exporters' median LP and TFP is observable during the study period. Consequently, the decline in firm heterogeneity in terms of LP and TFP reduces the between-firm reallocation effects of trade.

Figures 3 and 4 demonstrate that exporters use inputs more efficiently than non-exporters, at least in the left tail of the distributions; therefore, exposure to trade boosts LP and TFP at the industry level. Previous studies have reported that opening the market has compositional impacts. First,

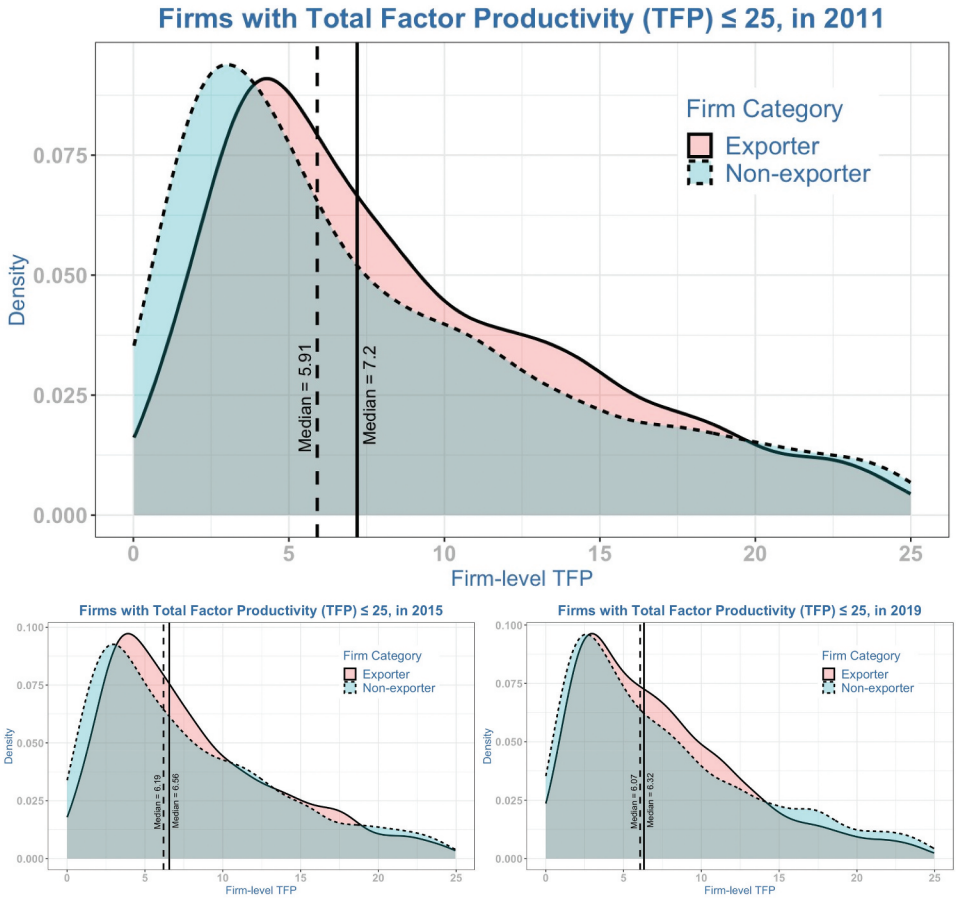

Figure 4. Distribution of total factor productivity (TFP) across all 4-digit Indian manufacturing firms in 2011, 2015, and 2019.

trade facilitations confront firms with more competition and a larger potential market; all else being equal, increased rivalry reduces markups and profits, but firms with lower marginal costs are better positioned to take advantage of a larger market. Second, each company attempts to increase its market share with trade, but not all firms are successful. Therefore, some non-exporting firms in the left tail of the distribution curve will leave the market, and the remaining firms will thereupon produce more. Trade facilitation in India can shift non-exporting firms' LP and TFP distribution to the right and reallocate resources from less productive non-exporting firms to more productive exporting and non-exporting firms. Consequently, LP and TFP at the industry level will increase, and industrial costs will fall. The result that the LP and TFP of exporting firms are higher than non-exporting firms, at least in the left tail of all the distributions, is consistent with previous studies that utilized firm-level data from developed economies (Bernard et al. 2003, 2018; Eaton,

Table 9. Test of normality.

			Shapiro-Wilk		Kolmogorov-Smirnov	
Year	Variables	Firm Category	Statistic (W)	p-value	Statistic (D)	p-value
2011	Sales revenue per employee compensation	Exporter	0.94751	0.0000	0.96314	0.0000
		Non-exporter	0.93392	0.0000	0.87478	0.0000
	Sales revenue per employee	Exporter	0.93227	0.0000	0.8162	0.0000
		Non-exporter	0.87491	0.0000	0.68767	0.0000
2015	Sales revenue per employee compensation	Exporter	0.95402	0.0000	0.95366	0.0000
		Non-exporter	0.95031	0.0000	0.88187	0.0000
	Sales revenue per employee	Exporter	0.9438	0.0000	0.82339	0.0000
		Non-exporter	0.93104	0.0000	0.75257	0.0000
2019	Sales revenue per employee compensation	Exporter	0.95036	0.0000	0.95827	0.0000
		Non-exporter	0.95875	0.0000	0.90499	0.0000
	Sales revenue per employee	Exporter	0.93399	0.0000	0.80654	0.0000
		Non-exporter	0.95407	0.0000	0.78749	0.0000
2011	Total factor productivity (TFP)	Exporter	0.91551	0.0000	0.90127	0.0000
		Non-exporter	0.89217	0.0000	0.81324	0.0000
2015	Total factor productivity (TFP)	Exporter	0.9199	0.0000	0.90306	0.0000
		Non-exporter	0.91385	0.0000	0.84375	0.0000
2019	Total factor productivity (TFP)	Exporter	0.9178	0.0000	0.87674	0.0000
		Non-exporter	0.90526	0.0000	0.82983	0.0000

Source: Author's calculation.

Kortum, and Kramarz 2011; Mayer and Ottaviano 2008), yet they differ from Lu (2010). NCTs and NTTs can only partially explain these micro-data-driven facts.

The alternative technique for comparing the LP and TFP of exporting and non-exporting firms is to test the hypothesis. A parametric test proves useful, but it assumes that the data are normally distributed; therefore, when testing the difference in the median LP and TFP of exporting and non-exporting firms, it is vital to check the normality of the data before applying a parametric test, as the interpretation would be invalid if the normality assumption could not be satisfied.

This study uses Shapiro-Wilk and Kolmogorov-Smirnov statistical tests to examine the normality of LP and TFP for exporting and non-exporting Indian manufacturing firms. In both tests, the null hypothesis that the sample distribution is normal is contrasted against the alternative hypothesis that the sampling distribution is not normal.

Table 9 represents the normality test of data on TFP and LP measured in terms of sales revenue per employee compensation and sales revenue per employee. Since, in all cases, the p-values are less than 0.01, it can be concluded that both the Shapiro-Wilk test and Kolmogorov-Smirnov test revealed that LP and TFP are not normally distributed.

Due to the lack of normal distribution, the study uses the asymptotic Wilcoxon-Mann-Whitney test to examine whether exporters' median TFP and LP significantly differ from non-exporters.

H_{01}: The median LP of exporters is equal to that of non-exporters.

H_{a1}: The median LP of exporters is greater than that of non-exporters.

Table 10. Asymptotic Wilcoxon-Mann-Whitney test.

		Asymptotic Wilcoxon-Mann-Whitney test		
Year	Variables	Statistic (Z)	p-value	Difference-in median
2011	Sales revenue per employee compensation	4.7035	0.00000	1.287456
	Sales revenue per employee	4.2291	0.00000	1.310402
2015	Sales revenue per employee compensation	2.8693	0.002057	0.4588993
	Sales revenue per employee	1.9945	0.02305	0.4677663
2019	Sales revenue per employee compensation	−1.521	0.9359	−0.2092818
	Sales revenue per employee	−0.86322	0.194	−0.1461
2011	Total factor productivity (TFP)	6.9322	0.0000	0.994186
2015	Total factor productivity (TFP)	4.1919	0.0000	0.4933535
2019	Total factor productivity (TFP)	1.1645	0.1221	0.1427044

Source: Author's calculation.

H_{02}: The median TFP of exporters is equal to that of non-exporters.

H_{a2}: The median TFP of exporters is greater than that of non-exporters.

Table 10 shows the results of the asymptotic Wilcoxon-Mann-Whitney test. In 2011 and 2015, the p-values of the variables listed in Column 2 of Table 10 are less than 0.05, but in 2019, they are greater than 0.05. Hence, we can reject the null hypothesis that exporters' median LP and TFP are equal to non-exporters at a 5% significance level in 2011 and 2015. However, the study failed to reject the null hypothesis with reference to 2019. It can be concluded that the median LP and TFP of exporters were greater than that of non-exporters in 2011 and 2015. However, in 2019, the difference is not statistically significant. India's trade-to-GDP ratio dropped from 56% in 2011 to 40% in 2019[3] due to external and internal factors (discussed earlier), thereby reducing the differences in the median LP and TFP of both exporting and non-exporting firms in 2019 compared to 2011. Therefore, firm heterogeneity is reduced because of the reduction in the trade-to-GDP ratio. This is one of the main reasons that exporters' median LP and TFP are not statistically significant compared to non-exporters in 2019.

Figures 3 and 4 further illustrate that, on the right tails of all the distributions, there are still a few non-exporters, which are also equally productive. However, they self-select not to export due to various reasons. One primary reason could be a lack of knowledge or ability to engage in international trade. Since India has a large domestic market, highly productive non-exporters might be successful in the home market, but they may not have the networks, resources, or expertise needed to penetrate international markets. Moreover, some regulatory obstacles, including complex export processes or strict quality requirements, could make it more difficult for them to export. Furthermore, firms wishing to export may face serious obstacles due to the lack of funding, poor infrastructure, or insufficient logistics.

[3]See https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=IN.

Table 11. Asymptotic Wilcoxon-Mann-Whitney test for outlier data.

		Asymptotic Wilcoxon-Mann-Whitney Test		
Year	Variables	Statistic (Z)	p-value	Difference-in median
2011	Sales revenue per employee compensation	−2.5275	0.005745	−4.962644
	Sales revenue per employee	0.31497	0.6236	1.648909
2015	Sales revenue per employee compensation	−8.7162	0.0000	−8.953825
	Sales revenue per employee	−0.84618	0.8013	−1.468581
2019	Sales revenue per employee compensation	−3.0272	0.001234	−2.917167
	Sales revenue per employee	1.5548	0.94	6.569198
2011	Total factor productivity (TFP)	−1.0681	0.1427	−1.350447
2015	Total factor productivity (TFP)	−4.4123	0.0000	−4.101119
2019	Total factor productivity (TFP)	−1.7078	0.04383	−1.961212

Source: Author's calculation.

Thus, these firms might continue concentrating on the home market despite their high LP and TFP.

LP and TFP have right-skewed distributions; therefore, outliers are on the right tail of all the distributions where productivity is high. To show that there are few highly productive non-exporting firms and they self-select not to export, the study uses the asymptotic Wilcoxon-Mann-Whitney test on the outliers data to examine whether the null hypothesis of the median LP and TFP of exporters is equal to that of non-exporters against the alternative hypothesis of the median LP and TFP of exporters being less than that of non-exporters. Except for sales revenue per employee, all variables listed in Column 2 of Table 11 exhibit statistical significance at the 10% level, as their corresponding p-values are less than 0.1. It can be concluded that among outliers, there are some highly productive firms, but they self-select not to export.

Exporter premia and trading activities

Table 12 demonstrates exporters' premia in the Indian manufacturing sector across different years. We regressed the value added output (lnVA), total

Table 12. Exporter premia in Indian manufactures.

	Dependent variable:				
	lnVA (1)	lnTFP (2)	lnK (3)	lnL (4)	lnM (5)
2011	1.437***	0.081***	1.507***	1.499***	1.542***
Dummy (Exporters = 1)					
Std. Error	(0.052)	(0.030)	(0.052)	(0.045)	(0.066)
Observations	4451	4451	4451	4451	4451
2015	1.115***	−0.028	1.262***	1.274***	1.262***
Dummy (Exporters = 1)					
Std. Error	(0.042)	0.025	(0.043)	(0.037)	(0.052)
Observations	6908	6908	6908	6908	6908
2019	0.225***	0.009	0.192***	0.300***	0.293***
Dummy (Exporters = 1)					
Std. Error	(0.047)	(0.026)	(0.049)	(0.041)	(0.058)
Observations	6696	6696	6696	6696	6696

Notes: *p<0.1; **p<0.05; ***p<0.01; lnVA = Natural logarithm of value added; lnTFP = Natural logarithm of total factor productivity; lnK = Natural logarithm of net fixed assets; lnL = Natural logarithm of employee compensation; lnM = Natural logarithm of materials.

factor productivity (lnTFP), capital (lnK), employee compensation (lnL), and materials (lnM), all in natural logarithm form on a dummy variable that is *one* if the firm is an exporter and *zero* otherwise.

Ordinary least squares (OLS) regressions reveal that exporter premia are high when India's trading activities peak and diminish as trading activities decrease. In 2011, when trading activities were high, exporters exhibited substantial positive premia across all variables, with coefficients ranging from 0.081 to 1.542, all statistically significant at the 1% level. In 2015 and 2019, when there was a substantial decline in trading activities, the magnitudes of exporter premia significantly declined across different variables and years. For example, in 2011, exporters had $((e^{1.437} - 1) * 100)$ 320% more value-added, they were around 8.4% more productive by TFP, exporters were more capital intensive by approximately 351%, they paid 347% more employee compensation, and they used 367% more materials. Whereas, in 2015 and 2019, the differences were approximately 205%, −2.8%, 253%, 257%, 263% and 25%, 0.9%, 21%, 35%, 34%, respectively. Table 12 highlights that export premia decline as trading activities decline; hence, resources shift from exporters to non-exporters due to the decrease in firm heterogeneity resulting from protectionist policies followed in India.

V. Discussion

The study contributes to the critiques of NCTs and NTTs using firm-level data from the Indian manufacturing sector by raising six pertinent research questions. First, is the decrease in India's trade-to-GDP ratio attributed to a decline in the extensive or intensive trade margins? The study shows that the extensive trade margin declined over the period due to the decreased trade-to-GDP ratio, while the change in the intensive trade margin is negligible. As the country and industry are the units of analysis in NCTs and NTTs, these theories could not decompose the changes in trade into extensive and intensive margins. However, using firm-level data makes it feasible to distinguish between the two.

Second, does India export from one set of 4-digit industries to see NCTs hold? The descriptive analysis revealed that all 4-digit industries are exporting, which is contrary to NCTs, which believe countries will export from one set of industries and import from another. On the other hand, the fraction of firms that export varies from industry to industry, which can be explained through NCTs. In these theories, the variation in the FEFs from one industry to another depends on the industries' relative comparative advantage.

Third, do all firms within the same industry export in India? The results from the study indicate that all 4-digit industries with differentiated products export (intra-industry trade), but only a few firms within the same industries. NTTs describe how relatively similar countries trade, but these theories

assume that firms are homogeneous within an industry. Therefore, NTTs cannot explain why some firms solely produce for the domestic economy, even within narrowly defined industries, and only a fraction of firms can penetrate export markets. In sum, NCTs and NTTs assume that firms within an industry are identical, and because of this restrictive assumption, these theories cannot fully explain all the facts drawn from firm-level data. The study's findings are similar to a survey conducted by (Ding 2022) on the key components and findings of heterogeneous firms, trade policy literature that has been evolving since the early 2000s, which argues that there is substantial heterogeneity among firms within an industry.

Fourth, do all 4-digit industries show a positive MES or only some 4-digit categories, and does it vary by industry? The results revealed that the MES in all 4-digit industries was positive in 2011, 2015, and 2019, and NCTs can be critiqued to explain these facts because NCTs predict a positive MES for one set of industries (where the country has a comparative advantage). Moreover, the descriptive analysis of the study shows that the MES is greater in labor-intensive industries, such as the manufacture of textiles and food, than in more capital-intensive industries, such as the iron and steel industries. The primary reason is that India is a labor-abundant country, and the relative price of labor to capital is low, which is consistent with NCTs.

The findings also demonstrate that the MES varies from industry to industry, and most 4-digit industries export only a small portion of their products. The MES is low in most 4-digit industries because, in these industries, a small fraction of firms export (only more productive firms self-select into the export market), and exporting firms export a small share of their outputs (the iceberg trade cost and fixed cost of trade matter in exporting decisions). These two reasons make it clear that even within a narrowly defined industry (4-digit industries), firms are not identical, unlike NTTs, which assume firms are homogeneous in a given industry. According to NTTs, economies of scale and consumer preference for variety lead identical firms within an industry to specialize in distinct horizontal varieties, allowing relatively similar industries to trade. Meanwhile, NTTs can be critiqued to describe that most 4-digit industries only export a small portion of their products.

Fifth, does the LP and TFP of exporters equal that of non-exporters? The article suggests two possible explanations for answering this question. One possible explanation is to compare the distribution of LP and TFP of exporting and non-exporting firms in a given year. Our findings revealed that the distribution of the LP and TFP of exporting and non-exporting firms is positively skewed and asymmetric. In the distribution's left tail, where the LP and TFP are low, the number of non-exporting firms is more concentrated than exporting firms, which implies that exporters use inputs more efficiently than non-exporters. Another possibility is to test whether exporters' median LP and TFP are greater than non-exporters through a nonparametric

Wilcoxon-Mann-Whitney test. The results implied that exporters' median LP and TFP are greater than that of non-exporters at a 5% level. This study found that exporting and non-exporting firms' median LP and TFP decreased in 2019 due to a decline in India's trade-to-GDP ratio. The decrease in exporters' median LP is more significant than that of non-exporters. It is certain that firm heterogeneity also diminishes due to the decline in the trade-to-GDP ratio. This is the primary reason that the median LP and TFP of exporters in 2019 do not significantly differ from that of non-exporters.

Sixth, do exporter premia exist? The study shows that exporters' premia exist and decline with trading activities. Exporters have more value-added; they are more productive, more capital intensive, pay more employee compensation, and use more material inputs compared to non-exporters.

The policy implications of the study suggest that trade protectionism in India reduces the trade-to-GDP ratio; hence, it decreases the firm-level productivity of all Indian manufacturing firms and exporters' premia. As a result, the resources will not shift from less productive to more productive firms due to the decline in firm heterogeneity in terms of LP and TFP.

VI. Conclusion

This research used descriptive and inferential statistical analysis to determine whether NTTs and NCTs are consistent with micro-level data from Indian manufacturing firms to provide lessons on protection and trade theory. Our descriptive analysis revealed that all 4-digit industries export and exporting is more prevalent in India's labor-intensive industries; therefore, the FEFs and MES vary from industry to industry. Both NCTs and NTTs could explain only part of the micro-level data-driven facts. NCTs explain that industries with a comparative advantage export more than industries with a comparative disadvantage, but they fail to explain why all 4-digit industries export in India in 2011, 2015, and 2019. According to NTTs, all 4-digit industries export because of economies of scale and consumer preferences for variety. However, these theories cannot explain why, even within narrowly defined industries, most firms are not exporting, and exporting firms export only a small fraction of their total products. It can be concluded that neither NCTs nor NTTs can fully explain micro-level data-driven facts from the Indian manufacturing industry.

The asymptotic Wilcoxon-Mann-Whitney test revealed that the median LP and TFP of exporting firms were greater than that of non-exporting firms in 2011 and 2015, but in 2019, the difference was not statistically significant. The decline in India's trade-to-GDP in 2019, due to internal and external protectionist policies, is the primary reason why there is no significant difference in the median LP and TFP of exporters and non-exporters. Moreover, the findings indicated that non-exporting firms are more concentrated on the left tail

of the distribution compared to exporting firms, where LP and TFP are low. Hence, any movement from protectionism to free trade can increase LP and TFP through resource reallocation from less productive to more productive firms.

The trade policy implications of our investigation suggest that better trade facilitation and other forms of international integration increase LP, TFP, and the extensive trade margin. The productive capacity of firms and the flow of FDI, in turn, affect firms' decisions on employment and investment. These decisions have a more significant influence on household incomes, primarily through labor earnings. Higher household incomes allow them to invest more in education and health, which can increase LP even more. The cycle will be extended to attain inclusive economic growth in India. Do exporters charge lower prices than non-exporters? This is an essential question that needs to be addressed in future research.

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No potential conflict of interest was reported by the author(s).

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