Non-Tariff Measures on Imported Intermediate Input: Empirical Evidence from Indonesian Manufacturing Sector

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ABSTRACT

The non-tariff measures (NTMs) increased all over the world, including Indonesia, as tariff decreased. The imposition of the NTMs on imported intermediate input in the Indonesian manufacturing sector became a concern since the proportion of imported intermediate input is still high. This study explores how an increase in NTMs imposed on imported intermediate input affects both labor productivity and profitability within the Indonesian manufacturing sector in 2010-2015. Thus, firm-level data of the NTMs on intermediate input were constructed. The estimated results provided evidence that increasing NTMs on imported intermediate input decreased both labor productivity and profit, suggesting policy improvements on NTMs imposed on imported intermediate input to reduce trade cost.

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Keywords: Firm-level data; imported intermediate input; Indonesia; non-tariff measures; productivity

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INTRODUCTION

The non-tariff measures (NTMs) significantly increased as tariff decreased in Indonesia. In 1989, MFN (Most Favoured Nations) tariff was 32.72%[1] , which fell dramatically and reached 7.23% in 2015. On the other hand, the imposition of NTMs is more intensive on the imported product in Indonesia. In 2015, 767 NTMs were affecting 75.3% of products traded. This number considerably increased as it was only 20 NTMs in 1998. (UNCTAD, 2015). The increasing number of NTMs has occurred all over the world since the global financial crisis in 2008, as more and more countries use NTMs as protection tools to provide domestic jobs. (Cadot et al., 2015).

NTMs are policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade of goods, changing quantity traded, and prices (UNCTAD, 2013). NTMs can have a price raising effect by creating an additional cost the so-called compliance cost or by restricting quantity supplied in the domestic market. In the form of product standards, NTMs can create some variable costs (such as laboratory sourcing costs) and fixed costs (such as upgrading costs of equipment/machinery and production processes to obtain certificates) (Verhoogen, 2008; Bustos, 2011). Meanwhile, in the form of non-automatic licensing, quota, government procurement, and local content, NTMs have the potential to increase the price by reducing imported quantity and competition (Fugazza, 2013; Baldwin, 1991 and Deardorff and Stern, 1997). The present paper attempts to measure the impact of NTMs on imported intermediate input on both the productivity and profitability of Indonesian manufacturing firms.

This study is motivated by two strands of research. The first strand is the literature focusing on the impacts of NTMs on trade flows (Otsuki et al., 2001; Wilson et al., 2004; Anders and Caswell, 2007; Gebrehiwet et al., 2007; Disdier et al., 2008; Kee et al., 2009; Xiong and Beghin, 2014). The impact of NTMs on productivity can vary as a result of firm heterogeneity. Fontagne et al. (2015) concluded that the imposition of NTMs in the export destination country harms both the extensive and intensive margins of firms in France. However, Chen et al. (2008), Henson et al. (2011), and Otsuki (2011) found a positive effect of NTMs on exports from developing countries, especially exports from large firms. Most of the literature in firm data level analysis focuses on the impact of NTMs imposed by export destination countries. However, the effect of NTMs imposed by importing countries has not been thoroughly examined.

The second strand is the analysis of the impacts of trade liberalization on firm productivity. There is strong evidence that firm productivity increased through trade liberalization on final and intermediate goods. The effect of trade liberalization on final goods was examined earlier (Pavenik, 2002; Trefler, 2004; Tybout et al., 1991; Levinsohn, 1993; Head and Ries, 1999). Meanwhile, the linkage between productivity and liberalization on intermediate goods has been discussed afterward. Evidence shows that liberalization in input intermediate reduces production costs, and improves input quality and efficiency (Halpern et al., 2015; Bøler et al., 2015). Tariff liberalization on input intermediate significantly increased productivity compared to tariff liberalization on final goods. (Amiti and Konings, 2007; Topalova and Khandelwal, 2011 and Luong, 2011). Thus, an empirical analysis of the relationship between NTMs on input intermediate and productivity is necessary for a better understanding of the effects of trade liberalization on input intermediate.

Building upon those two strands of the literature, this research attempts to estimate the effect of NTMs on imported intermediate in terms of productivity and profitability in the Indonesian manufacturing sector in 2010 and 2015. The present paper provides two significant contributions. *First,* this paper is the first study that examines the impact of NTMs on imported intermediate input to productivity and profitability to the best of our knowledge. The recent contribution provided by Navaretti et al. (2018) examined the impact of TBT in the EU on average productivity and the number of domestic firms at the industry level. Beghin et al. (2015) assessed the impact of public and private quality standards in food markets, international trade, and global supply chains in many works of literature. Cadot and Gourdon (2016) estimated the impact of deep integration in regional trade agreements on the price rising effect of NTMs. The closest literature to the present study is research by Baghdadi et al. (2016), who examined the impact of NTMs on imported goods in Tunisia. However, that study did not accurately estimate the effect of NTMs on imported intermediate input. The effect of NTMs on input could be different between imported capital and intermediate input. In Indonesia, the studies on NTMs mostly focused on NTMs and final goods. Tristita and Panennungi (2018) estimated the impact of anti-dumping

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[1] MFN rates are the highest (most restrictive) that WTO members charge one another. MFN tariff is obtained from simple mean for all products.

measures imposed in final goods on firm productivity. Marks (2017) measured the impact of NTMs on consumer goods on nominal and effective rates of protection.

Second, this study uses a different methodology in data construction, particularly in quantifying NTMs of imported intermediate input at the firm level. It used intensity index (coverage ratio and frequency index) on imported intermediate input as a quantification method. The intensity index is commonly used in NTMs analysis. The difference in the intensity index in this study is that the index is calculated from imported intermediate input at the firm level. Data of imported intermediate input at a firm-level were constructed to calculate this index. In this study, imported intermediate inputs with the highest proportions cost were selected as the imported input for each firm.[2] Other quantification methods such as Ad-Valorem Equivalents (AVEs) of NTMs (Kee et al., 2009; Cadot and Gourdon, 2016, Cadot et al., 2015) and the price gap or price comparison (Andriamananjara, 2004; Marks, 2017) could not be used in this study. AVEs are the most appropriate method to analyze the price effect of NTMs at the commodity level (HS code). Meanwhile, price gaps or price comparisons were used to measure the price gap between imported and domestic goods without differentiating whether or not the product is the final or intermediate goods.

The manufacturing sector becomes the focus of this study since it gives the most significant contribution to GDP in Indonesia. However, the contribution and growth of this sector have continued to decline in the last decades. The Indonesian manufacturing sector still depends on imported intermediate input. More than 75% of Indonesia's imports are industrial intermediate inputs (BPS, 2017).

By using the Indonesian manufacturing data (IBS) between 2010 and 2015, this study examines the effect of NTMs of imported intermediate input on firm performance, in particular for medium and large firms. The result of this study provides evidence that increasing NTMs on imported intermediate input is correlated with the decreasing of average labor productivity and profitability of the importing firms. These findings support the hypothesis in Melitz (2003) and Demidova and Rodriguez-Clare (2011) models. The result is different from Baghdadi et al. (2016), who found that NTMs increased labor productivity and profitability of small and medium firms.

The rest of this study is organized as follows: Section 2 provides an analytical framework; section 3 explains variable construction, data, and empirical strategy; section 4 discusses the result of the estimation, and chapter 5 presents the conclusion and implication while discussing future works.

ANALYTICAL FRAMEWORK

The relationship between NTMs imposed on imported intermediate input and firm productivity and profitability was explored using Melitz (2003) as a basic model. The latter model was modified by Demidova and Rodriguez-Clare, then henceforth called DRC (2011). As the basic model, Melitz (2003) explained the existence of heterogeneous firm's responses to trade liberalization. Melitz's Framework explains the impact of trade liberalization, depending on the firm initial productivity (z). Liberalization provides gain and loss to some firms. In the equilibrium of a closed economy, there is a productivity cut-off (z_{11}^*) as a cut-off point for any firm deciding to stay or exit the market. This productivity cut-off is derived from zero profit condition in free entry market setting $(\pi(z_{11}^*) = 0)$. A firm with productivity (z) above the productivity cut-off (z_{11}^*) will continue to operate whereas firm with productivity below (z_{11}^*) losing profit and exiting the market. International trade creates productivity cut-off for exporter (z_{12}^*) which is higher than productivity cut-off in the close economy or productivity cut-off of a domestic firm (z_{11}^*).

The trade liberalization in the form of a reduction in variable cost or iceberg trade cost (τ) increases productivity cut-off of the domestic firm $(z_{11}^{*\prime} > z_{11}^*)$ and decreases productivity cut-off of exporters $(z_{12}^{*\prime} < z_{12}^*)$[3]. A decline in productivity cut-off of exporter increases the number of the firm entering the export market. Meanwhile, an increase in productivity cut-off of domestic firms reduces the portion of domestic sales of all firms. Therefore, an increase in profit occurs only in the firm that could cover the loss of domestic sales with export sales, which are also the most productive ones. The exit of the least productive firms and increased market share of the most productive firms both contribute to the increase in average productivity.

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[2] The average share cost of imported intermediate input in this study is 80%.
[3] As in Melitz (2003) productivity cut-offs for domestic production and for exporting move in the opposite directions.

The DRC model modified the Melitz model (2003) by introducing the set up for a small economy where price, number of firms, and productivity cut-off of trading partners are exogeneous. The DRC model assumes that there are 2 countries, home country=1 and foreign country=2. By using comparative statics and simple figure, the DRC explained in details how trade barriers on imported intermediate input imposed by the home country affect the equilibrium of productivity cut-off of exporter (z_{12}^*) and domestic wage (w_1).

The equilibrium of the DRC model is determined by two conditions, namely competitiveness (cc) and trade balance (tb), as shown in the upper quadrant of figures 1 and 2. The cc curve is an upward sloping curve while the tb curve is downward sloping curve[4]. According to cc, a higher wage reduces a country's competitiveness, leading to an increase in the productivity cut-off for exporting. According to tb, an increase in the productivity cut-off for exporting leads to a decline in export and a trade deficit. The deficit must be counteracted by a decrease in the wage, increasing exports, and decreasing imports.

The imposition of NTMs on imported intermediate input creates additional iceberg trade cost (τ) to firms and changes the equilibrium. The DRC explains that the mechanism of equilibrium changes differ between large and small economies. In the large economy, as shown in figure 1, the increase in variable cost of imported product (τ_{21}) as the result of NTMs imposed by the home country shifts up both the cc and tb curves.[5] As in the cc, the increase in trade barriers in the home country will discourage additional foreign entry and reduce competition on the foreign market. Hence, the wage at home must increase to keep firms with given productivity indifferent to selling on foreign markets. Meanwhile, the increase in trade barriers in home countries decrease imports in tb. Thus, the wage at home must increase to restore trade balance for a given exporting productivity cut-off at home.

In a small economy, as shown in figure 2, the increase in iceberg trade cost (τ_{21}) does not affect the cc curve. It only affects the tb. The tb increases and generates new equilibrium with higher productivity cut-off for exporter (z_{12}^*) and domestic wage (w_1). In the small economy, the increase in productivity cut-off for exporters (z_{12}^*) is unambiguous. As in Melitz, the increase in productivity cut-off of exporter $(z_{12}^{*\prime} > z_{12}^*)$ pushes out firms with productivity between $z_{12}^{*\prime}$ dan z_{12}^*. It then reduces average productivity and increases domestic wage. As in Melitz (2003), the profit change $(\Delta\pi(z))$ is an increasing function of the firm's productivity level (z), so that the average profit will also decrease. In this study, the hypothesis of the relationship between NTMs, productivity, profitability explained in those theoretical models were tested using an empirical model.
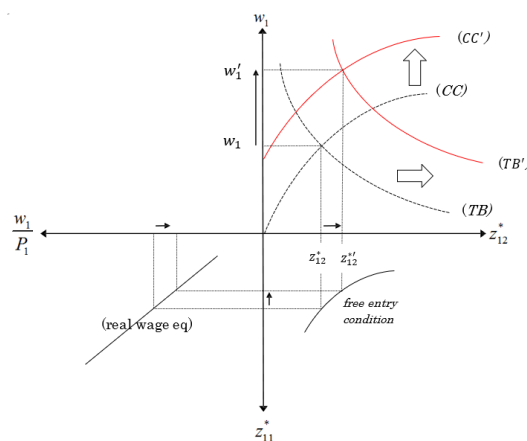

Figure 1 Comparative Statics of the trade-restriction rise in Large Economy (in Augier et al., 2014)

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[4] See mathematical proof in DRC'S appendix

[5] As in appendix: cc equations : $z_{12}^* = h_{12}(\tau_{12}, w_1)\varsigma_{11}\left[h_{21}(\frac{\tau_{21}}{\tau_{11}}, w_1)\varsigma_{11}(z_{12}^*)\right]$

Tb equations : $J_1(z_{12}^*) + 1 - G_1(z_{12}^*) = \frac{M_2}{M_1}\frac{f_{21}}{f_{12}} w_1^{-1}\left\{J_2\left[h_{21}\left(\frac{\tau_{21}}{\tau_{11}}, w_1\right)\varsigma_{11}(z_{12}^*)\right] + 1 - G_2\left[h_{21}\left(\frac{\tau_{21}}{\tau_{11}}, w_1\right)\varsigma_{11}(z_{12}^*)\right]\right\}$
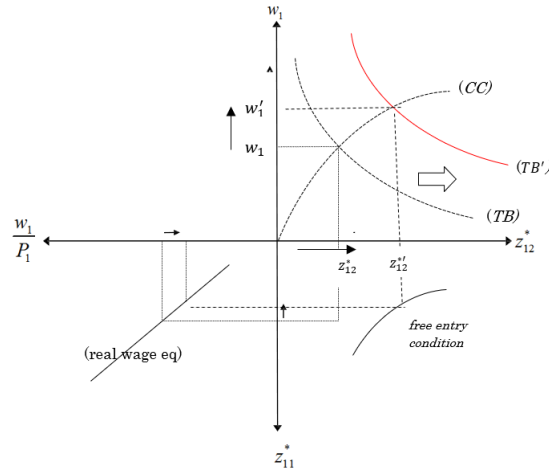
Figure 2 Comparative Statics of the trade-restriction rise in the small economy (in Augier et al., 2014)

RESEARCH METHODOLOGY

Variable Construction

The present study used NTMs on imported intermediate input as the primary explanatory variable. NTMs on imported intermediate input were quantified into two indicators, namely coverage ratio (CR) of NTMs and frequency index (FI) of NTMs. The imported input covered in this study was the imported raw material input. Imported capital was not included in this study.

Imported intermediate input data at HS level was constructed for each firm to examine the relationship of NTMs on imported intermediate input at the firm level. However, the data of imported intermediate input at firm level were not yet available at the HS code level. Therefore, the data were constructed using a survey of raw material as a part of the Indonesian Manufacturing Survey (IBS). There was a need to code the data from the survey at the HS-4 level following Indonesia's Harmonized System (HS) 2017.

Furthermore, a selection of imported intermediate input was conducted as one firm can import more than one product or raw material. In this selection, only the highest proportions of imported raw material were chosen. This method resulted in an average share cost representing 80% of the total imported cost. This proportion was sufficient in describing all imported input intermediate of each firm. After obtaining the imported intermediate data in HS code for each firm, the CR and FI of imported intermediate input of each firm were calculated.

Mathematically, the coverage ratio of NTMs on imported intermediate input is defined as the share of the imported intermediate product's value that is affected by at least 1 NTMs, formulated as follow:

$$CR = \left[\frac{\sum D_i V_i}{\sum V_i}\right] x\ 100 \tag{1}$$

where D_i is a dummy variable, 1 represents an imported intermediate input i subject to NTMs, 0 otherwise and V_i is the value of imports in imported intermediate input i, calculated at HS-4 level. Meanwhile, the frequency index of NTMs on imported intermediate input is defined as the percentage of the imported intermediate product affected by at least one NTM. It is computed as:

$$FI = \left[\frac{\sum D_i M_i}{\sum M_i}\right] x\ 100 \tag{2}$$

where D_i is a dummy variable reflecting the presence of one or more NTMs on imported intermediate products at HS 4 level. M_i is a dummy that indicates whether or not there are imports of intermediate product i. The value of CR and FI is between 0-100. The difference between CR and FI is the previous measure the importance of NTMs on overall import value. Meanwhile, the later only measures the presence of NTMs on tariff lines [6].

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[6] The difference between CR and FI can be illustrated as follows. Assume firm A imported raw material input HS code 1207 (Other oil seeds and oleaginous fruits). This HS code consist of 10 tariff lines of 6 digit HS. If 5 from 10 tariff lines are affected by minimum 1 NTMs,

The present study used NTMs data from the UNCTAD database published in TRAINS. These NTMs data were gathered from the country's official regulation. In this study, all NTMs imposed by the government of Indonesia on imported products (HS-6 level) from all countries were used. The number of NTMs in the affected product is the aggregation of bilateral, regional, or unilateral NTMs imposed by the government of Indonesia. Therefore, one product can be affected by more than 1 NTMs.

This study also included output tariff and input tariff as control variables. Output tariff from simple average MFN tariff imposed on the output of industry (ISIC-3 level) was constructed. To construct this tariff, MFN tariff data were converted from commodity code level (HS code) into 3-digit Indonesian ISIC code (KBLI) using the Indonesian Raw Commodity Classification (2010) published by Bureau of Statistics (BPS). Meanwhile, input tariff is a product-level tariff (HS-4) constructed from the simple average MFN tariff of the largest proportion of imported input intermediate[7]

Herfindahl Hirschman Index (HHI), as market concentration variable, is defined as the sum of squared market share in each three-digit sector (ISIC-3)[8]. The real effective exchange rate (REER) is the weighted average of Indonesia's currency concerning an index or basket of other major currencies. The weights are determined by comparing the relative trade balance of Indonesia's currency against each country within the index. Capital per labor was calculated from capital stock[9] divided by the total labor. The age of firms was considered as the age at which the company started its first year of operation. The dummy of large firms is included in this study. A large firm is defined as a firm employing more than 100 people (following the classification of Ministry of Industry, Government of Indonesia). The 2012 dummy was included to control export shocks in 2012, where 1 was for the year 2012, 0 if otherwise. In 2012, Indonesia's merchandise export reduced significantly as the impact of a global demand shock, particularly in China, the European Union, and Japan.

Data

This study used the unbalanced panel of Indonesian firms importing intermediate raw material in 2010-2015. Firm data were obtained from the Indonesian Manufacturing Survey (IBS) published by the Indonesian Bureau of Statistics (BPS). IBS covered medium and large firms and provided information on revenue, number of workers, capital spending, age, labor spending, the value of imported raw materials of medium and large firms. Imported raw material data at the firm level were obtained from surveys of raw materials (unpublished data) as part of IBS surveys. NTMs data were gathered from TRAINS, the UNCTAD database on Non-Tariff Measures[10]. The data on the import value of affected NTMs products were retrieved from UN COMTRADE. MFN tariff was obtained from the tariff dataset published by the WTO. The real effective exchange rate (REER) was extracted from the Bank of International Settlements (BIS) dataset.

Empirical Strategy

The empirical model in this study was defined as follows:

$$y_{i,t} = \alpha_0 + \beta_1 NTMs_{s,t} + \beta_2 tariff\_out_{k,t} + \beta_3 tariff\_in_{s,t} + \beta_4 age_{i,t} + \beta_5 HHI_{k,t} + + \beta_6 REER_t + \beta_7 \ln\left(\frac{cap}{labor}\right)_{it} + \beta_8 dummy\_large_{it} + \beta_9 dummy\_2012 + \varepsilon_{it} \tag{3}$$

where i, s, k, and t stand respectively for a firm, product (HS-4), sector (ISIC-3), and time. As dependent variables, $y_{i,t}$, (i) labor productivity (in logarithm) or value-added per labor was used and defined as the difference between real output and real intermediate inputs divided by total employment[11]. (ii) profitability (in

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the FI is 50. Coverage ratio is calculated from the share of import value of affected tariff lines. If import value of 5 tariff lines is 60 percent from total import value, then coverage ratio is 60.

One drawback of the coverage ratio, or any other weighed average, arises from the likely endogeneity of the weights, the fact that imports are dependent on NTMs. (Fugazza, 2013)

[7] In Amiti and Konings (2007) tariff input was constructed by using weighted average of tariff MFN. The weight is the proportion of imported input to total imported input. In this study, we use MFN tariff of the highest share cost among imported intermediate.

[8] HHI is compute as : $HHI = \sum_{i=1}^{n}(S_i)^2$ where S_i is the market of firm i, and there are n firms in industry.

[9] Capital stock is obtained by adding the value of building, machinery, vehicles which deflated by Wholesale Price Index (WPI) and the value of land deflate by PDB deflator

[10] Data available at https://trains.unctad.org/

[11] Value added per worker is defined as: ((total revenue divided by producer index) – (spending on intermediate input divided by Wholesale Price Index (WPI)) divided by total labor. Labor productivity was also proposed as a proxy for productivity in Trefler (2004), Schmitz (2005), Lileeva and Trefler (2010), Iacovone (2012), Fernandes and Paunov (2013), Chen and Steinwender (2017)

logarithm) is defined as the real operating profit obtained from the firm revenue deflated by the WPI sector (ISIC-3) minus total spending on material input and labor deflated by the WPI sector (ISIC-3) and inflation rate, respectively.

As the main control variable, indicators of NTMs ($NTMs_{s,t}$) were included as discussed in variable construction: (i) Coverage ratio of NTMs (ii) Frequency ratio of NTMs. As explained in the DRC model, the relationship between NTMs on imported intermediate input with labor productivity and profitability was expected to be negative.

As other control variables, output tariff ($tariff\_out_{k,t}$) and input tariff ($tariff\_in_{s,t}$) were also included. Both tariffs were expected to have a negative relationship with productivity. The increasing rate of output tariff reduced productivity through the decrease in international competition in the final goods market. Meanwhile, the increasing rate of input tariff reduced productivity through the decreasing access, quality, and variety of imported intermediate input. The age of firm as number of years in operation was included ($age_{i,t}$) to control firm characteristics. The relationship between age and productivity was expected to be positive. The relationship between age and profitability is also likely to be positive (Coad et al., 2013 and Baldwin et al., 2002). Variable capital per worker ($\frac{cap}{labor_{i,t}}$) was included to control whether or not capital deepening affects labor productivity. As in Amiti dan Konings (2007), the relationship between capital per labor and productivity is expected to be positive.

The increase in real efficiency causes the increase in productivity. Gains from real efficiency can be raised from mark-up. Herfindahl Index ($HHI_{k,t}$) as a measurement for market concentration was included to control mark-up. The hypothesis is the more concentrated sector (higher HHI), the higher mark-up, and the lower the productivity. Dummy of firm size ($dummy\_large_{it}$) was included as follows, 1 for a firm with more than 100 labors, and 0 otherwise. REER and dummy_2012 variables were included to control macroeconomic condition. The firm-fixed effect was used to control time-invariant omitted variables for unobserved heterogeneity in firm-level productivity and profit.

RESULT AND DISCUSSION

Descriptive Statistics

Figure 3 shows the distribution of imported input intermediate. The highest proportion of imported materials were chemicals products (21.10%), plastics and rubber (13.92%), textile products (12.37), and metals (12.94%). In 2010-2015, there were 7 types of NTMs imposed in Indonesia. The objective and description of those NTMs are shown in table 1.
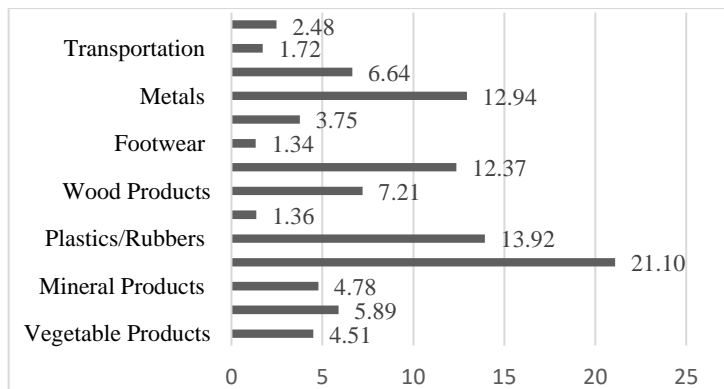

Figure 3 The Composition of Imported Intermediate Input by Products Group

Table 1 Types of NTMs imposed in Indonesia, 2010-2015

Type of NTMs	Description
Chapter A (SPS)	Sanitary and phytosanitary measures; these measures aim to protect health and prevent diseases in humans and animals. These NTMs include restrictions on ingredients and residues in food, labeling, certification, testing for SPS purposes, and quarantine.
Chapter B (TBT)	Technical Barriers to Trade, these measures aim to protect consumer's safety and environment sustainability. These NTMs includes product standard, quality requirement, certification, and testing for TBT purposes, transport and storage regulation, product identity requirement.
Chapter C (pre-shipment inspection)	Measures aim to ensure the quality, quantity, and price of goods before being imported into Indonesia. These NTMs include pre-shipment inspection and requirements to pass through specified ports of customs
Chapter E (Quantitative Restrictions)	Measures restricting the number of imports from a different or a specific supplier. These NTMs include non-automatic licensing that is not included in the SPS and TBs and quotas.
Chapter F (Fees)	Fees imposed on imported goods other than tariffs. These NTMs includes consumption taxes and excise taxes
Chapter H (Competition)	Measures granting exclusive rights for certain economic activities. These NTMs include giving an exclusive right to State-trading enterprises to import goods.
Chapter I (Local Content)	Measures deals with trade-related investment measures. These NTMs includes the local content requirement.

Source: UNCTAD (2013)

There were 62 NTMs repealed out of 767 NTMs throughout the study period. These NTMs were excluded on year repealed to ensure the validity of data. Table 2 summarizes the proportion of NTMs on imported intermediate input by type and affected products which were forcefully imposed until 2015.

The types of NTMs mostly imposed were TBT, SPS, and quantity restriction, with 55.73%, 22.89%, and 11.30%, respectively. In terms of the affected product, the most imposed NTMs were SPS (37.51%), TBT (24.62%), and quantity restriction (17.73%). Descriptive statistics of all variables in the present study are summarized in table 3. The average coverage ratio of NTMs on imported intermediate input was 48.68, while the average frequency index of NTMs on imported intermediate input was 40.57. There were 13,689 observations from a sample of 4,016 importing firms within six-years.

Table 2 The Proportion of NTMs by type and affected Products

NTMs type	% total NTMs	%total affected products
Chapter A (SPS)	22.89%	37.51%
Chapter B (TBT)	55.73%	24.62%
Chapter C (Pre-shipment Inspection)	7.98%	16.33%
Chapter E (quantity restriction)	11.30%	17.73%
Chapter F (fees)	1.20%	3.20%
Chapter H (competition)	0.75%	0.52%
Chapter I (local content)	0.15%	0.09%
Total	100%	100%

Source: Authors' calculations based on the UNCTAD database (2015)

Table 3 Descriptive Statistics

variable	mean	std.dev	max	min	observation
ln (labor_productivity)	9.01	1.06	10.07	0	13689
ln(profit)	8.49	1	9.50	0	13689
cov_ratio	48.68	46.11	100	0	13689
freq_index	40.57	45.84	100	0	13689
tariff_out	8.87	5.84	106.97	0.31	13689
tariff_in	6.48	6.02	150	0	13689
age	21.16	12.45	105	1	13689
reer	93.37	5.14	100	87.11	13689
hhi	1013.55	1178.05	10000	85.03	13689
ln(cap/labor)	4.79	4	9.01	0	13689
large	0.43	0.49	1	0	13689

Figure 4 shows that labor productivity and profit decreased in the sampling period. Labor productivity decreased by 0.68%, while profit declined by 5.35 % over the sampling period. Both labor productivity and profit reduced significantly in 2012 as the consequence of export shock. The decrease in economic growths in China, the EU, and Japan reduced the demand for Indonesia's export.
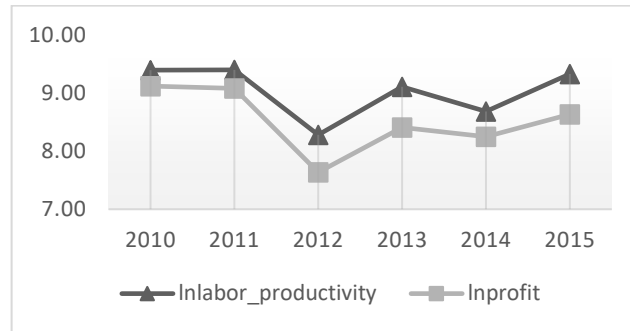
Figure 4. Average Labor Productivity and Profits (in logarithm)
Source: Authors' calculations from the Indonesian Manufacturing Survey (IBS).

ESTIMATION RESULTS AND DISCUSSION

In this study, the coefficient of interests is the coverage ratio and frequency ratio of NTMs. The fixed effect panel analysis was used to capture firm specific. The Hausman test suggested that the fixed effect panel is more appropriate. As shown in Table 4, the coverage ratio of NTMs (cov_ratio) has a significant negative correlation with both labor productivity and profit. This result indicates that the higher the share of imported intermediate input affected by NTMs, the lower the average labor productivity and profit. Table 5 shows a similar effect from the estimation with the frequency index of NTMs. The frequency index of NTMs (freq_index) has a significant negative correlation with both labor productivity and profit. It indicates that the higher proportion of tariff lines of imported intermediate input affected by NTMs, the lower average labor productivity and profit. The coefficient estimation of coverage ratio and frequency ratio was higher in the model without tariff (Table 4 and 5, column 1). However, the sign of coefficient did not change when tariffs were included.

Those results confirmed that the hypothesis on Melitz (2003) and DRC (2011) models were empirically proven. Increasing in iceberg trade cost as the result of NTMs on imported intermediate input, increased trade balance but kept the competitiveness curve unchanged. This change shifts equilibrium to the new equilibrium with higher exporter productivity cut-off. The higher the exporter productivity cut-off, the lower the average productivity. As in Melitz (2003), profit is an increasing function of productivity. Therefore, a decrease in average productivity also decreases the average profit.

Table 4 Regression Results Using Coverage Ratio of NTMs

Dependent variable:	Ln labor_productivity		Ln profit	
	[1]	[2]	[3]	[4]
cov_ratio	-0.0001**	-0.0001*	-0.0002***	-0.0002***
	(-2.14)	(-1.72)	(-3.89)	(-3.49)
tariff_out		-0.0001**		-0.0008**
		(-2.52)		(-2.13)
tariff_in		-0.0002**		-0.0002**
		(-2.13)		(-1.98)
age	0.0020***	0.0019***	0.0036***	0.0035***
	(2.96)	(2.88)	(5.67)	(5.61)
reer	0.0429***	0.0443***	-0.0138**	-0.0127**
	(6.61)	(6.81)	(-2.24)	(-2.05)
hhi	-0.0001	-0.0001	-0.0005***	-0.0004***
	(-0.76)	(-0.59)	(-3.08)	(-2.92)
ln(cap/labor)	0.0000*	0.0000*	0.0000***	0.0000***
	(1.91)	(1.89)	(3.41)	(3.40)
large	0.0201	0.0186	0.1010**	0.0997**
	(0.42)	(0.39)	(2.21)	(2.19)
dummy_2012	-0.8930***	-0.8910***	-0.9680***	-0.9670***
	(-32.27)	(-32.23)	(-36.86)	(-36.82)
Observations	13689	13689	13689	13689
R-Squared	0.1098	0.1108	0.1728	0.1736

Notes: t statistics in parentheses * p<0.10. ** p<0.05. *** p<0.01

Table 5 Regression Results Using Frequency Index of NTMs

Dependent variable:	Ln labor_productivity		Ln profit	
	[1]	[2]	[3]	[4]
freq_ratio	-0.0034***	-0.0031***	-0.0030***	-0.0026***
	(-3.75)	(-3.35)	(-3.44)	(-3.05)
tariff_out		-0.0009**		-0.0008**
		(-2.41)		(-2.11)
tariff_in		-0.0002**		-0.0002**
		(-1.98)		(-2.09)
age	0.0020***	0.0019***	0.0036***	0.0036***
	(2.96)	(2.89)	(5.71)	(5.63)
reer	0.0419***	0.0432***	-0.0144**	-0.0132**
	(6.44)	(6.64)	(-2.34)	(-2.13)
hhi	-0.0001	-0.0001	-0.0005***	-0.0005***
	(-0.89)	(-0.71)	(-3.18)	(-3.02)
ln(cap/labor)	0.0000**	0.0000**	0.0000***	0.0000***
	(1.99)	(1.97)	(3.52)	(3.50)
large	0.0193	0.0180	0.1010**	0.0995**
	(0.40)	(0.38)	(2.21)	(2.18)
dummy_2012	-0.8900***	-0.8880***	-0.9660***	-0.9650***
	(-32.16)	(-32.13)	(-36.75)	(-36.72)
Observations	13689	13689	13689	13689
R-Squared	0.1106	0.1116	0.1725	0.1733

Notes: t statistics in parentheses * p<0.10. ** p<0.05. *** p<0.01

As shown in Tables 4 and 5, the estimation result of the coefficient of other explanatory variables using coverage ratio and frequency index was quite similar. Output tariff (tariff_out) and input tariff (tariff_in) had a significant negative correlation with average labor productivity and average profit. The decrease in the rate of output tariff, as a result of liberalization, increases productivity through the increase of international competition in the final goods market. Meanwhile, the decrease in the rate of input tariff increases productivity through the increased access, quality, and variety of imported intermediate inputs.

Age had a significant positive correlation with average labor productivity and profit, indicating that the longer the firm operates in the market, the higher both productivity and profit. According to Coad et al. (2013), older firms can convert sales growth into subsequent growth of profits and productivity. HHI as a market concentration variable has a significant negative correlation with average profit but does not have a significant relationship with labor productivity. The higher market concentration, the higher ability to mark-up price, leading to a decrease in average profit.

Capital per labor has a significant positive correlation between average labor productivity and profit. The higher the capital per labor, the higher productivity and profit, indicating capital deepening affecting labor productivity. Dummy large does not have a significant relationship with labor productivity but has a significant positive relationship with profit. Large firms can make more enormous profits.

REER had a significant positive correlation with labor productivity but had a significant negative correlation with profit. Increased in REER, imported input intermediate becomes cheaper, reducing import cost and productivity cut-off of the exporter and increasing average labor productivity. However, export became more expensive, reducing profit. Dummy 2012 had a significant negative correlation with labor productivity and profit, confirming that labor productivity and profit were significantly lower in 2012 compared to other years as a result of export shock.

CONCLUSION

These estimated results supported the theoretical prediction about the impact of NTMs on both productivity and profit, as in Melitz (2013) and DRC (2011). Using importing firm data on the manufacturing sector in 2010-2015, the present study provided evidence that the imposition of NTMs on imported intermediate input lower aggregated productivity and profit. The higher the coverage and frequency ratios of NTMs imposed on imported intermediate input, the lower averages productivity, and profit. This result suggests a policy to improve NTMs, particularly those imposed on imported intermediate input. Imported input has proven to have a positive effect on productivity (Halpern et al., 2015), therefore reducing trade cost arising from the NTMs imposition on imported input increase productivity. Not all NTMs can be removed since some NTMs protect the consumer (safety and health).

The results of this study differed to those of Baghdadi et al. (2016), which found a positive impact of NTMs on productivity and profit for small and medium enterprises in Tunisia. However, the results were similar to Navaretti et al. (2018), who found a negative impact of NTMs (TBT measure) on the average productivity of small firms in the European Union (EU).

There are some limitations to this empirical study. First, due to limited imported intermediate input data, the coverage and frequency ratios of NTMs were calculated at the HS-4 level. Analysis with a higher digit of HS (six digit or more) will provide better results. Second, this study focused on the impact of NTMs on imported intermediate input on domestic firms without considering NTMs harmonization. Further analysis is required to measure the impact of NTMs harmonization on productivity and profitability to provide more comprehensive results. Recent literature revealed that the effects of NTMs harmonization are similar to those of tariff liberalization. However, that analysis was not included in this research because of the limitation of information about products affected by NTMs harmonization in Indonesia.

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