Arndt-Corden Department of Economics
Crawford School of Public Policy
ANU College of Asia and the Pacific

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Krisna Gupta

Arndt-Corden Department of Economics

Crawford Scholl of Public Policy

Australian National University

krisna.gupta@anu.edu.au

September 2021

Working Papers in Trade and Development

No. 2021/21

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Abstract

Indonesian government has been working hard in engaging with the world market as average tariff keeps on decreasing. However, it seems to rely on Non-Tariff Measures (NTM) rather than tariffs to protect its industries. This paper inspects whether these measures hurt firms by limiting their access to better quality and cheaper foreign inputs. This paper builds on Amiti and Konings (2007) to inspect the impact of trade policy shocks to firm's Total Factor Productivity (TFP). The results suggest unintended consequences of protectionism: tariff and NTMs hurt firms' TFP and labour absorption significantly. The impact is less severe for bigger firms, confirming heterogeneous effect of trade policy. As the country is looking to boost foreign investment, the paper makes a strong case for reducing protection to keep mark-up in domestic manufacturing high as an incentive.

Keywords: Total factor productivity, Tariff, Non-tariff Measures, manufacturing, trade liberalization

JEL Codes: O14, O53, F14, F15

Forthcoming in *The Bulletin of Indonesian Economic Studies*

THE HETEROGENOUS IMPACT OF TARIFF AND NTM ON TOTAL FACTOR PRODUCTIVITY OF INDONESIAN FIRMS

Krisna Gupta

INTRODUCTION

Since the Asian Financial Crisis (AFC), Indonesian manufacturing sector can't seem to be the driver of Indonesian economic growth anymore (Aswicahyono, Hill, & Narjoko, 2010; Resosudarmo & Abdurohman, 2018). The latest development plan, Making Indonesia 4.0, looks for an import substitution strategy and Foreign Direct Investment (FDI) to boost manufacturing-led growth with a strong emphasize in using advanced technology.

In pursuing manufacturing-centred strategy, industrial policy matters even more because it is not only potentially distorting export, but also imported inputs such as energy, steel, and horticulture products. Moreover, it is argued that imported inputs can be a channel for technology upgrading (Castellani & Fassio, 2019). This fact is very important for a plan that relies on advancing technology in the short run.

Unfortunately, protectionism is on the rise (Rodrik, 2020). While the role of tariff is getting smaller in reducing trade, the role of Non-Tariff Measures (NTMs) starts to gain importance. WTO and many Preferential Trade Agreements (PTAs) discussed about reducing tariff, without explicitly regulate NTM. This makes NTM a compelling tool for countries wishing to regulate trade policies.

Indonesia seems to follow this trend (Patunru, 2018; Patunru & Rahardja, 2015). While overall tariff went down overtime, the new emergence of various types of NTMs are rising. Figure 1 shows the increase of Indonesia's NTM as the tariff reduces. Indonesia joined a handful of PTAs, the most important of which are with ASEAN, Japan and China, which have helped Indonesia to integrate more with the world (Pangestu, Rahardja, & Ing, 2015). However, NTM seems to play larger role to Indonesia's trade story, especially nearing the end of the commodity boom around 2012.

Unlike tariff, NTM has the potential to enhance trade (Disdier, Fontagné, & Cadot, 2015). Moreover, industrial policies start to regain the attention of many economists as one of the important ways to grow low-to-medium income economies (Rodrik, 2007). With Indonesian government trying to get back to pre-1998 level of growth, studying NTM's impact on the firms is important. The fact that Indonesian government is willing to distort market to do so makes this case extra compelling.

While the studies of the impact of NTMs are largely focuses on trade flows and development, the studies of NTM's impact on firm's performance and decision making remains scarce. According to Munadi (2016), 50% of Indonesia's total NTM was Technical Barrier to Trade (TBT), and 30% of total NTM were enforced by The Ministry of Industry. This fact may suggest that these barriers were enacted as industrial policies.

UNCTAD's new database (UNCTAD, 2017) allows more researchers to pursue more rigorous studies on NTM. Most of NTMs studies are focusing on estimating the cost of trade with Ad-Valorem Equivalent (AVE) of tariff, and its impact on trade flows. Studying NTM proposes technical challenges which are not present on tariff studies. The room to improve AVE estimation is still promising for future research.

This study builds from Amiti and Konings (2007) by constructing a Total Factor Productivity (TFP) variable to be used as the dependent variable to catch the direct effect of tariffs and NTMs to firm's productivity. This method avoids endogenous variable complications introduced by using export as a proxy to measure firm performance. TFP is calculated by using a method first introduced by Levinsohn and Petrin (2003), while tariffs data used in this paper is collected by web-scrapping Indonesian Ministry of Finance documents instead of relying on secondary data such as WITS.

I complement the literature by strengthening the evidence that access to imported inputs is essential for improving firm performance. Higher number of NTMs introduced to Indonesian economy also associated with lower TFP, albeit less important compared to tariff. Heterogenous effect is also found in this study. That is, firms with higher number of labours impacted less negatively compared to their smaller peers.

Indeed, at least in the span of this paper's observation, it is important for the government to be careful in introducing more NTMs, especially if the goal is to strengthen manufacturing. Global Value Chain (GVC) has been very important in reducing poverty and helping a country grows. Protectionism may have unintended consequences.

Next section discusses literatures covering the importance of imported inputs to firm performance as well as on TFP estimations. I show method used in this paper in the methodology section, and then discuss data used after. I then discuss the result, and lastly conclude.

LITERATURE REVIEW

Indonesian government often relies on trade policy, especially limiting import, to protect its infant industries (Patunru & Rahardja, 2015). In fact, many governments do have incentive to use trade barriers and NTM in particular to do this (Deardorff, 1987). Unfortunately, literatures on trade and industry suggest the other direction (Costinot & Rodríguez-Clare, 2014). Access to cheaper or higher quality intermediate inputs from overseas brings a general benefit to firms in a country (Amiti & Konings, 2007; Bas & Strauss-Kahn, 2014; Castellani & Fassio, 2019; Ing, Yu, & Zhang, 2019; Olper, Curzi, & Raimondi, 2017; Pierola, Fernandes, & Farole, 2018).

Many of these studies use some measures of export as a proxy for firm's performance. For example, Pierola et al. (2018) uses export value as their dependent variable to show correlation between higher import with higher export in Peru. Bas and Strauss-Kahn (2014) shows that controlling for Total Factor Productivity (TFP), an increase of 10% of input varieties leads to a 10.5% higher market scope for exporters in the European Union (EU). Castellani and Fassio (2019) show that in Sweden, being a first-time importer is an important driver for a firm to have its first export. The more varies the import goods are, the more varies the exported goods. Fugazza, Olarreaga, and Ugarte (2017) show that the impact of NTMs in Latin America varies depending on their size, that is, bigger firm gains while smaller firms were forced to exit the export market.

Using export as a proxy for firm performance have its own challenge. One notable problem is a possible reverse causality problem, even when controlling for productivity (Bas & Strauss-Kahn, 2014; Pierola et al., 2018). One way to go around that is to instrument import with tariff (Bas & Strauss-Kahn, 2014). However, this can still be problematic if tariff is also not exogenous, especially in a country which actively targets current account deficit. This approach also not suitable in NTM setting, as it can be trade promoting in some cases (An & Maskus, 2009; Cadot, Asprilla, Gourdon, Knebel, & Peters, 2015; Cadot, Ferrantino, Gourdon, & Reyes, 2018).

One way to deal with this problem is to directly estimate the impact of NTM to TFP. While NTM can have a reverse causality with trade balance, it is unlikely that the introduction of NTM targets TFP. Directly relating trade policy to firm productivity is also proposed in many study that use Computable General Equilibrium (CGE) method (Walmsley & Strutt, 2019), which make the result of this estimation more compelling for parameterisation.

A seminal paper investigates the relationship between trade policy and TFP directly was conducted by Amiti and Konings (2007). Specifically, they see the impact of import tariff reduction in inputs of Indonesian firms to their productivity. They estimate the TFP using a modified algorithm first proposed by Olley and Pakes (1996). Their result suggests that import tariff reduction significantly increases productivity of Indonesian firm. In particular, a reduction of 10 percentage points of import tariff leads to a 12 percent increase to firm's productivity.

Olley and Pakes (1996) are among the first who dealt with the problem associated with unobserved productivity shock. That is, investment (and inputs) made by firm is endogenous to a productivity shock observed only by the manager. They estimate a productivity shock that follows a first order Markov process which determine investment decision. Amiti and Konings (2007) improve the method by adding export and import decision as a variable that determine firm's decision to invest. Assuming that trade policy is exogenous, firms use it to construct a production plan for the next period and then decide whether to invest, just like the unobserved productivity shock.

Levinsohn and Petrin (2003) extend the method by incorporating intermediate input. They argue that investment can be hard to adjust, limiting its capacity to absorb the unobserved productivity shock. Additionally, investment proxy will not work if many firms report zero investment. The method proposed by Levinsohn and Petrin (2003) has been tested to Indonesian manufacturing dataset by at least two papers with little comment on the problem (Pane & Patunru, 2019; Vial, 2006).

In the study of NTM, gravity estimation with binary independent variable to capture the impact of NTMs seems to be the standard approach (Cadot et al., 2015; Disdier et al., 2015; Kee, Nicita, & Olarreaga, 2009). There are two main approaches to control for the impact of NTM to trade (Deardorff & Stern, 1997). The first one is to use trade quantity, which is the approach of a highly cited paper by Kee et al. (2009). The second one is to use price-based AVE (Cadot et al., 2015; Marks, 2018). Quantity based method has a more straightforward data but suffer from the lack of information on the impact of different prices and more subtle interpretation. Price based captures easier to interpret impact of NTM to the cost of trade but have problem particularly in differentiating price difference as the cost of trade or better-quality product.

Both measures also have its own criticism (Deardorff & Stern, 1997). Impact of NTMs is harder to generalize partly because some of NTMs promote trade (An & Maskus, 2009; Cadot et al., 2015). Moreover, a generalize count database of NTMs are, while broad, lack depth. It is one thing to know what NTM affect a certain good, it is another to know how restrictive those NTMs are across time and countries (Cadot et al., 2015).

In Indonesian context, one of the earliest studies related to NTM is conducted by Marks (2018). He compares prices in Indonesia and Singapore for 140 tradable goods which are controlled by NTMs, in which he finds in general Indonesian goods to be more expensive. He uses survey data in which some of them are confidential. All taxes, tariffs and subsidies are accounted for. Econometrics estimation is not exploited in this study. However, this paper generally shows that NTM leads to higher prices.

METHODOLOGY

This paper builds from Amiti and Konings (2007) and Pane and Patunru (2019). Both studies describe their need to control for possible endogeneity of material inputs, therefore using a semi-parametric approach first proposed by Olley and Pakes (1996). The estimation is conducted in 2 stages, where the first is to estimate TFP, and then use the TFP as a dependent variable for, among others, the change in trade policy, namely tariff and NTM.

Following Amiti and Konings (2007), I assume a firm to have a Cobb-Douglass production function:

$$Y_{it} = A_{it}(\tau) L_{it}^{\beta_l} K_{it}^{\beta_k} M_{it}^{\beta_m} N_{it}^{\beta_n} \qquad (1)$$

Where the output Y of a firm i in time t is a function of a productivity A_{it}, its labour input L_{it}, its capital K_{it}, material input M_{it}, and energy consumption N_{it}. In this setting, productivity is a function of a trade policy τ, that is, a change in trade policy is translated to be a productivity shock for firms. This change in trade policy is assumed to be exogenous.

To estimate equation (1), a simple way is to take logs:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_n n_{it} + \epsilon_{it} \qquad (2)$$

where lower case letters represent the log form of its uppercase counterparts. Firms' revenue is used for y_{it}, deflated using wholesale price index sourced from BPS. L_{it} is the number of labours employed by the firm, K_{it} is fixed capital, and M_{it} is material input deflated by input price index for manufacturing, also sourced from BPS.

Estimating equation (2) provides with an estimated coefficient for each variable, which allows for constructing a predicted revenue for firms. TFP is then calculated by subtracting the predicted revenue from the observed revenue:

$$tfp_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_m m_{it} - \hat{\beta}_n n_{it} \qquad (3)$$

where tfp_{it} is the firm i's TFP in time t. With this estimation, the variable tfp would contain all the information in the residual, such as firm's characteristics, and any unobserved impact of trade policy to productivity shock (τ).

The estimated TFP is then used in the second stage to look for associated change of trade policy, namely tariff and NTM.

$$tfp_{it} = \gamma_0 + \gamma_{tarff} tariff_{it} + \alpha_i + \eta_{it} \qquad (4)$$

where tar means tariff with fixed effect included.

Essentially, two main deviations from Amiti and Konings (2007) emerged. Firstly, instead of using their modification of Olley and Pakes (1996), I am using the latest method of estimating TFP proposed by Levinsohn and Petrin (2003). As discussed in the literature review, Olley and Pakes (1996) was concerned that there is an information about unobserved productivity shock in the error term from equation (2). They absorb the information using investment as a proxy. Levinsohn and Petrin (2003) suggest that using intermediate input is better especially in the existence of zero investment. This is the case for Indonesian dataset (Vial, 2006).

The problem with estimation from equation (2) is that the error term may contain a productivity shock observed only by the firm's manager. Observing a shock, a firm may adjust their level of input and investment, causing correlation between factors and the error term. The first notable work to address this is Olley and Pakes (1996). They separate the error term ϵ_{it} to two separate residuals:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_n n_{it} + \omega_{it} + \mu_{it} \qquad (5)$$

where ω_{it} is a shock observed only by the firm i's manager while μ_{it} represents an independent error term.

They use investment as a proxy to observe ω_{it} and re-write (4):

$$y_{it} = \beta_l l_{it} + \phi_{it}(i_{it}, k_{it}) + \beta_m m_{it} + \beta_n n_{it} + \mu_{it} \qquad (6)$$

where

$\phi_{it}(i_{it}, k_{it}) = \beta_0 + \beta_k k_t + \omega_{it}(i_{it}, k_{it})$

To avoid bias from k_t entering the term ϕ_{it} twice, they added an extra assumption that ω_{it} follows a first-order Markov process (i.e., $E[\omega_{it}|\omega_{it-1}]$) to make sure that β_k is unbiased and consistent.

Levinsohn and Petrin (2003) argues that using investment as a proxy can have a problem. Firms which finish an investment and report zero investment on the next period may be wrongly observed as experiencing a negative productivity shock. Investment is costly to make and may not flexibly capture a productivity shock. They suggest using intermediate input instead, as intermediate input is easier to adjust and naturally never zero as long as a firm produces.

Using Levinsohn and Petrin (2003), the first stage estimation used in this paper becomes:

$$\phi_{it}(m_{it}, k_{it}) = \beta_0 + \beta_k\, k_{it} + \beta_m\, m_{it} + \omega_{\text{it}}(k_{it}, m_{it}) \tag{7}$$

while the second stage becomes:

$$y_{it}^{*} = \beta_0 + \beta_k k_{it} + \beta_m\, m_{it} + E[\omega_{it}|\omega_{it-1}] + \mu_{\text{it}}^{*} \tag{8}$$

where $y_{it}^{*} = y_t - \beta_l l_{it} - \beta_n n_{it}$ and $\mu_{\text{it}}^{*} = \omega_{it} - E[\omega_{it}|\omega_{it-1}] + \mu_{it}$. This way, β_k and β_m are less biased because the error term is independent from k_{it} and m_{it}.

The second deviation is in modelling the tariff (and NTM, essentially). Since I have the information of which good is imported from which country, I need to map these larger dimensions to each firm in each given time. To map these variables into each firm in each year, I use coverage ratio calculation (UNCTAD, 2017). This calculation can be applied for both tariff and NTMs.

The tariff coverage ratio of firm i at time t, T_i, is defined as:

$$T_{it} = \frac{\sum tariff_{scit} V_{scit}}{\sum V_{scit}} * 100 \tag{9}$$

where $tariff_{sct}$ is a tariff imposed on good s from country c at time t, while V_{sct} is the imported value of good s sourced from country c at time t.

Coverage ratio for NTMs is defined as:

$$C_{\theta it} = \frac{\sum NTM_{\theta scit} V_{scit}}{\sum V_{scit}} * 100 \qquad (10)$$

for each type of NTM θ in the UNCTAD database that is imposed by Indonesia at time t. This formula allows for different coverage ratio for different type of NTM. One-digit NTM is used in this paper, but it is easy to extend the type of NTM that is used for other contexts.

Having considered the two deviations, the final second stage regression is

$$tfp_{it} = \gamma_0 + \gamma_T log(1 + T_{it}) + \sum_{\theta} \gamma_\theta \log(1 + C_{\theta it}) + FO_{it} + \alpha_i + ISIC_i + \eta_{it} \qquad (11)$$

where T_{it} represents the tariff coverage ratio, $C_{\theta it}$ represents coverage ratio for each type of 1-digit NTM faced by firm i in time t. Firm fixed effect and dummy ISIC is included in the equation, as well as percentage of foreign ownership (FO).

There is little doubt that tariff under this setting would behave differently compared to Amiti and Konings (2007). That is, more tariffs should reduce TFP as they lose access to foreign goods that are either cheap, or necessary to produce. As shown in previous literature, foreign ownership usually is associated with better productivity, so positive relationship between FO_{it} and tfp_{it} should be expected. Finally, ISIC is important to control since exposure with GVC is different between sectors.

DATA

The main dataset is a combination of two different datasets, namely Indonesian manufacturing survey, *Survei Industri* (SI), and Indonesian customs data, both provided by Indonesian Bureau of Statistics (BPS). SI provides firms' characteristics such as factors, output, value added, and foreign ownership, among other things. Customs data, meanwhile, contain information of firms' imports by source countries and 8-digit HS Code. The two datasets are connected using a same firm id. The main data is mainly constrained by the customs data which is only available from 2008-2012.

Customs data

The customs data in Indonesia is not widely available, and it is only published for 2008-2012 observations. It connects export and import data of firms with the firm survey data. This type of data is valuable for researchers wanting to investigate the relationship of international trade and firms' performance.

Table 1 shows the most traded goods by Indonesian firms in current million USD from 2008-2012. Indonesian firms import many goods necessary for production such as machineries, plastics, cotton and iron and steel. This is in-line with Indonesia's import in general, as Indonesia import mostly manufacturing inputs and capital goods. Similarly, Indonesia also exports a lot of machineries, suggesting a degree of Global Value Chain (GVC) integration among Indonesian firms. Vehicles and textile products to be among the most exported goods by Indonesian firms is not unexpected. Additionally, Indonesian firms also supply to the world many important inputs such as rubber and fats.

Table 1. Most imported and exported goods by 2-digit HS Code, in current million USD

IMPORT HS2012

HS-2	Description	2008	2009	2010	2011	2012
72	Iron and Steel	2,060	1,070	1,810	2,280	2,660
84	Mechanical Machinery	2,030	1,520	2,580	3,360	4,130
85	Electrical Machinery	1,610	1,580	2,300	2,880	2,540
29	Organic Chemicals	1,180	925	1,250	1,560	1,850
39	Plastics and articles	875	753	1,110	1,560	1,680
23	Food Waste	642	616	597	1,080	1,270
52	Cotton	571	465	710	1,090	854

EXPORT HS2012

HS-2	Description	2008	2009	2010	2011	2012
85	Electrical Machinery	2,070	2,990	4,340	4,890	4,750
40	Rubber and Articles	1,760	1,590	3,680	5,770	4,130
15	Animal or Vegetable Fats	1,330	1,700	2,730	4,270	4,540
87	Non-railway Vehicles	1,150	1,370	2,060	2,290	3,500
84	Mechanical Machinery	986	993	1,440	1,790	1,660
61	Knitted apparels	636	989	1,040	1,370	1,320
62	Non-knitted apparels	643	1,150	1,360	1,560	1,290

Source: Calculated by author from BPS customs data.

Survei Industri (SI)

The original SI, extracted only for 2008-2012 to match the customs data, is an unbalanced panel dataset with 117,589 observations in total. Naturally, the merged dataset is a subset of SI. Table 2 displays summary statistics of firms' characteristics of the combined dataset. The first column is only for firms do not exist in the customs data, while the second column is the dataset used in this paper. The third column contains the original SI.

Table 2. Summary Statistics of firms' characteristics in Indonesia from 2008-2012, mean and (standard deviation).

Firm's characteristics	*Not in customs data*	*Present in customs data*	*Original SI*
foreign ownership (%)	5.96	34.77	8.15
	(22.60)	(45.06)	(26.17)
fraction of output exported (%)	0.21	0.40	22.51
	(0.37)	(0.42)	(37.52)
fraction of input imported (%)	0.07	0.31	0.08
	(0.21)	(0.38)	(0.24)
no. of labour employed	162.75	535.44	191.07
	(602.46)	(1,457.65)	(711.73)
capital stock (Million IDR)	194	250	198.00
	(46,500)	(10,400)	(44,800.00)
total intermediate input (Million IDR)	41	170	50.80
	(515)	(1,330)	(617.00)
total output (Million IDR)	73.30	296	90.30
	(861)	(1,740)	(958.00)
total value added (Million IDR)	31.60	123	38.50
	(414)	(789)	(455.00)
value added per labour (IDR)	126,074	282,857	137,987.10
	(2,600,177)	(1,012,159)	(2,515,300.00)
No. of observation	108,662	8,915	117,598

Source: author's calculation from BPS

The notable point from table 2 is how different are firms presented in the customs data (column 2) with firms who are not presented (column 1) and firms in original SI (column 3). The firms in this study tend to be bigger, more productive, and have higher concentration of foreign ownership. Table 1 also suggests that importing firms also tend to have higher fraction of exported output.

Another point to note is about the fraction of imported input and the fraction of exported output. There are 54,253 missing observations of fraction of output exported, somewhat equally distributed between importing and non-importing firms. This would somewhat limit the suggestion that importing firms tend to export more. Moreover, there are 14,514 firms which report a non-zero imported input that are not presented in the customs data. It is possible that some firms that reporting a non-zero import supplied by a third party. These observations would add to the problem contained in SI as reported by previous users of SI (Amiti & Konings, 2007; Pane & Patunru, 2019; Vial, 2006).

TRAINS NTM database

The main data for NTM is TRAINS database. TRAINS is a collection of NTMs related to many different goods in HS-6 digit made available by UNCTAD (2017). TRAINS follow many regulations made by each country which are trade related, and then assign them manually to different HS code and NTM classification. The nature of their data collection allows for a neutrality, in that they do not classify it as trade-enabling or trade-restricting (UNCTAD, 2017).

NTM database consists of count variables which indicate the existence of official regulation different areas. These areas are classified according to Multi-Agency Support Team (MAST) group (UNCTAD, 2018, 2019). There are three broad classification, technical measures, non-technical measures, and export related measures. These three broad classifications are narrowed down to 16 chapters coded from A to P, but not all chapters are recorded to be exists in Indonesia.

There is a challenge in using the data in a time series manner. TRAINS database does not follow regulations, and only note an NTM in the time data is collected (UNCTAD, 2017). Indeed, there is no existing use of the database in a time-series manner yet. The dataset does have an information which shows the start-date of a given NTM as well as its end-date. In this paper, NTM is considered exists if an observation lies between the start-date and end-date of the NTM.

For ASEAN countries, UNCTAD worked together with ERIA in two different time point. The first NTM data collecting was conducted in 2015, and then the dataset is updated in 2018. Interestingly, there is inconsistencies from documents associated with the two datasets. In 2015, There exists as much as 199 trade-related regulations in Indonesia issued by 14 different government institutions (Munadi, 2016). However, in Munadi (2019), the number of identified trade-related regulations in 2015 dataset is said to be 169 instead of 199. The trade-related regulations in the 2018 dataset is 192, which is said to be increased from 169 (Munadi, 2019), but then this statistics is inconsistent with the previous publication.

Table 3 shows the summary statistics of the number of active trade-related regulations which are active in any given year from 2008 to 2012, for both 2015 version and 2018 one. It seems that for all type of NTMs, Indonesian government is indeed increasing the number of goods regulated by its NTMs for SPS and TBT. The same thing can't be said for other, more harmful intervention such as Pre-shipment inspection and quotas, as noted by Munadi (2019).

Both datasets have different number of observations and number of NTMs applied. Additionally, NTM in the 2018 dataset version is generally larger than the 2015. There is a possibility of duplication, but it is recommended by UNCTAD (2017) to keep the duplication since the duplication might come from different regulation affecting the same goods. Since this paper observe 2008-2012 data points, the two different datasets should not matter especially since the newer dataset kept codes from the older dataset (Munadi, 2019). Results from the two datasets are very similar in terms of direction and weight. While the use of dataset does not significantly change the regression result, this paper reports results using the 2015 dataset since it is closer to the time of observation.

Table 3. TRAINS NTM dataset on Indonesia, started before each year and ended after each year, for 2015 dataset and 2018 dataset, mean and (standard deviation)

2015 set	***2008***	***2009***	***2010***	***2011***	***2012***
Sanitary & Phytosanitary (SPS)	1.715	2.337	2.222	2.255	2.774
	(2.644)	(4.018)	(3.950)	(4.054)	(5.128)
Technical Barrier to Trade (TBT)	0.481	0.455	0.641	0.682	0.663
	(0.962)	(0.978)	(1.334)	(1.361)	(1.352)
Pre-shipment inspections and other formalities	0.562	0.466	0.443	0.462	0.776
	(1.202)	(1.081)	(1.059)	(1.046)	(1.075)
Non-automatic licensing, quotas, prohibitions and quantity-control measures	0.623	0.560	0.605	0.618	0.594
	(0.809)	(0.818)	(0.873)	(0.861)	(0.853)
Price-control measures, including additional taxes and charges	0.000	0.000	0.015	0.014	0.016
	(0.000)	(0.000)	(0.168)	(0.165)	(0.168)
Measures affecting competition	0.019	0.052	0.050	0.048	0.046
	(0.139)	(0.238)	(0.233)	(0.229)	(0.224)
Export-related measures	0.901	0.704	0.708	0.683	1.172
	(1.172)	(1.132)	(1.109)	(1.098)	(1.465)
observations	1,675	2,204	2,318	2,400	2,510
2018 set	***2008***	***2009***	***2010***	***2011***	***2012***
Sanitary & Phytosanitary (SPS)	1.690	2.529	2.453	2.432	3.204
	(2.577)	(4.704)	(4.652)	(4.638)	(5.852)
Technical Barrier to Trade (TBT)	0.489	0.445	0.621	0.656	0.637
	(0.984)	(0.989)	(1.387)	(1.438)	(1.424)
Pre-shipment inspections and other formalities	0.710	0.563	0.546	0.542	0.872
	(1.549)	(1.395)	(1.377)	(1.372)	(1.366)
Non-automatic licensing, quotas, prohibitions and quantity-control measures	0.599	0.526	0.588	0.583	0.558
	(0.740)	(0.759)	(0.828)	(0.827)	(0.817)
Price-control measures, including additional taxes and charges	0.000	0.000	0.015	0.015	0.014
	(0.000)	(0.000)	(0.171)	(0.170)	(0.166)
Measures affecting competition	0.018	0.053	0.051	0.051	0.048
	(0.139)	(0.239)	(0.236)	(0.235)	(0.229)
Export-related measures	1.060	0.836	0.811	0.804	1.511
	(1.430)	(1.363)	(1.350)	(1.346)	(1.803)
observations	1,682	2,182	2,250	2,269	2,383

Source: UNCTAD TRAINS database

The use of SPS and TBT are the most extensive in Indonesia. The increased trend is driven by the use of Indonesian National Standard (Standar Nasional Indonesia or SNI) and labelling requirement (Munadi, 2018). Pre-shipment inspection and the requirement to pass through a specific port is considered to be too tedious (Munadi, 2018), and alarmingly went up in 2012.

There is also non-automatic licensing in the form of Ministerial technical recommendation, and some additional taxes such as luxury and value added taxes. Measures affecting competition is mainly due to special privileges for State-Owned Enterprises (SOEs), and among export-related measures is an export tax.

Tariffs

With highly granular data made available by the customs data, it makes more sense to use detailed tariff data from 2008-2012. Since a database of that detail is not made freely available, I rely on Indonesian Ministry of Finance repository to find information of relevant regulations between the observation year. Indonesia is very active in updating its tariff line, having around 7 regulations each year. Updated tariff line in accordance with Preferential Trade Agreements (PTAs) are extracted from websites of each agreement.

Table 4 shows the difference between tariff collected by hands from seeing regulations with Tariff downloaded from World Integrated Trade Solutions (WITS) website. WITS database does not contain complete PTAs Indonesia and ASEAN are involved such as IJEPA (Indonesia with Japan) and AANZFTA (ASEAN with Australia and New Zealand). Most of the tariff reduction happened in 2009-2010 with ASEAN, China, India, Australia, and New Zealand in particular.

Chronologically, the author-collected tariff fits regulations better. There is a delay in the implementation of regulation regarding ATIGA implementation in 2010 and AKFTA in 2009 in the WITS dataset. Moreover, there is no information on IJEPA special tariff with Japan, also ANNZFTA with Australia and New Zealand in the WITS dataset.

Table 4. Tariff collected by author compared to WITS tariff database, simple average, standard deviation in bracket.

Author's database	*2008*	*2009*	*2010*	*2011*	*2012*
Most Favoured Nations	7.049	7.612	6.928	6.975	6.960
	(12.213)	(12.536)	(8.037)	(7.231)	(7.145)
ASEAN	2.478	2.490	0.150	0.150	0.150
	(11.094)	(11.206)	(4.559)	(4.559)	(4.559)
China	7.049	3.819	2.193	2.208	1.941
	(12.213)	(12.673)	(7.941)	(7.941)	(7.927)
South Korea	7.049	2.624	1.912	1.912	1.542
	(12.213)	(12.265)	(7.131)	(7.131)	(7.102)
India	7.049	7.612	6.394	5.874	5.341
	(12.213)	(12.536)	(7.809)	(7.517)	(7.322)
Japan	6.110	4.639	3.274	2.618	2.230
	(11.967)	(12.356)	(7.353)	(7.114)	(6.487)

Australia and New Zealand	7.049	6.446	2.948	2.278	1.545
	(12.213)	(11.922)	(6.765)	(6.318)	(6.065)
WITS Database	***2008***	***2009***	***2010***	***2011***	***2012***
Most Favoured Nations	7.762	7.595	7.564	7.051	7.053
	(12.631)	(12.456)	(12.412)	(7.015)	(7.016)
ASEAN	-	1.840	1.843	0.152	0.152
		(11.079)	(11.067)	(4.285)	(4.287)
China	-	3.665	2.743	1.850	1.579
		(12.342)	(12.392)	(6.853)	(6.823)
South Korea	-	2.564	2.560	1.698	1.326
		(12.087)	(12.084)	(6.395)	(6.349)
India	-	-	-	5.409	4.991
				(6.726)	(6.620)
Japan	-	-	-	-	-
Australia and New Zealand	-	-	-	-	-

Source: Ministry of Finance, ortax.org, WITS, and various source with PTA partners.

In general, the datasets confirm several observations made by literatures. Firstly, Indonesian tariff data was indeed decreasing, especially after the Global Financial Crisis (GFC) as many PTAs are made between ASEAN and its main trading partners. Secondly, Indonesia increasing its use of NTMs at roughly the same time. The increasing use of NTMs are sound in particular with SPS and TBT. This trend seems to continue until 2018, with *Standar Nasional Indonesia* (SNI), or Indonesian National Standard, as the driver (Munadi, 2019).

<u>*Coverage ratio*</u>

With the customs data, tariff, and TRAINS combined, tariff and NTMs that is faced by Indonesian firms can be calculated. Moreover, we can also calculate the coverage ratio faced by each firm. Table 5 shows descriptive statistics of tariff and NTMs that are relevant to Indonesian firms based on the customs dataset, as well as coverage ratio for tariff (T) and NTMs (C_θ where $\theta \in A, B, C, E, F, H, P$).

Table 5. Coverage ratio of tariff and NTMs compared to the original database.

Variable	***Observation***	***Mean***	***Std. Dev.***	***Min***	***Max***
					Tariff
Tariff	407,532	3.503	4.971	0	150
Tariff Coverage Ratio (T)	407,532	3.420	5.646	0	150
					NTMs
SPS (A)	407,532	0.108	0.718	0	29
TBT (B)	407,532	0.140	0.663	0	13

Pre-shipment inspection (C)	407,532	0.028	0.214	0	5
Licensing, quota, etc (E)	407,532	0.321	0.550	0	6
Price control etc (F)	407,532	0.000	0.008	0	2
Competition measures (H)	407,532	0.007	0.083	0	2
Export-related (P)	407,532	0.063	0.376	0	7
Coverage ratio A	407,532	0.246	0.931	0	19
Coverage ratio B	407,532	0.202	0.478	0	9
Coverage ratio C	407,532	0.059	0.237	0	4
Coverage ratio E	407,532	0.337	0.468	0	6
Coverage ratio F	407,532	0.000	0.001	0	0
Coverage ratio H	407,532	0.014	0.083	0	1
Coverage ratio P	407,532	0.110	0.353	0	7

Source: Author's calculation based on the Indonesian Customs data and TRAINS

Tariff faced by these firms lies between the MFN tariff and FTA tariffs from table 4. This is to be expected, especially since Indonesian firms import many from European Union (EU) and United States (US), the two regions without any special FTA yet. Tariff coverage ratio (T) is not very different from the average tariff faced by these firms, which is expected.

The number of NTM faced by these firms in general seems to be low, suggesting that firms mostly less restrictive goods compared to general NTMs. Licensing and quota restriction, however, seems to be more important, since many of Indonesian quota restrictions target meat and horticulture products, an important input for firms in food industry. In general, the coverage ratio is higher compared to the average number of NTMs, which means many important goods that firms buy are restricted with NTMs.

With the data is completed, next section discusses the result of the regression. Firstly, TFP estimation is conducted. The result from the TFP estimation is then used to regress the impact of trade policies to firm's performance.

RESULT AND DISCUSSION

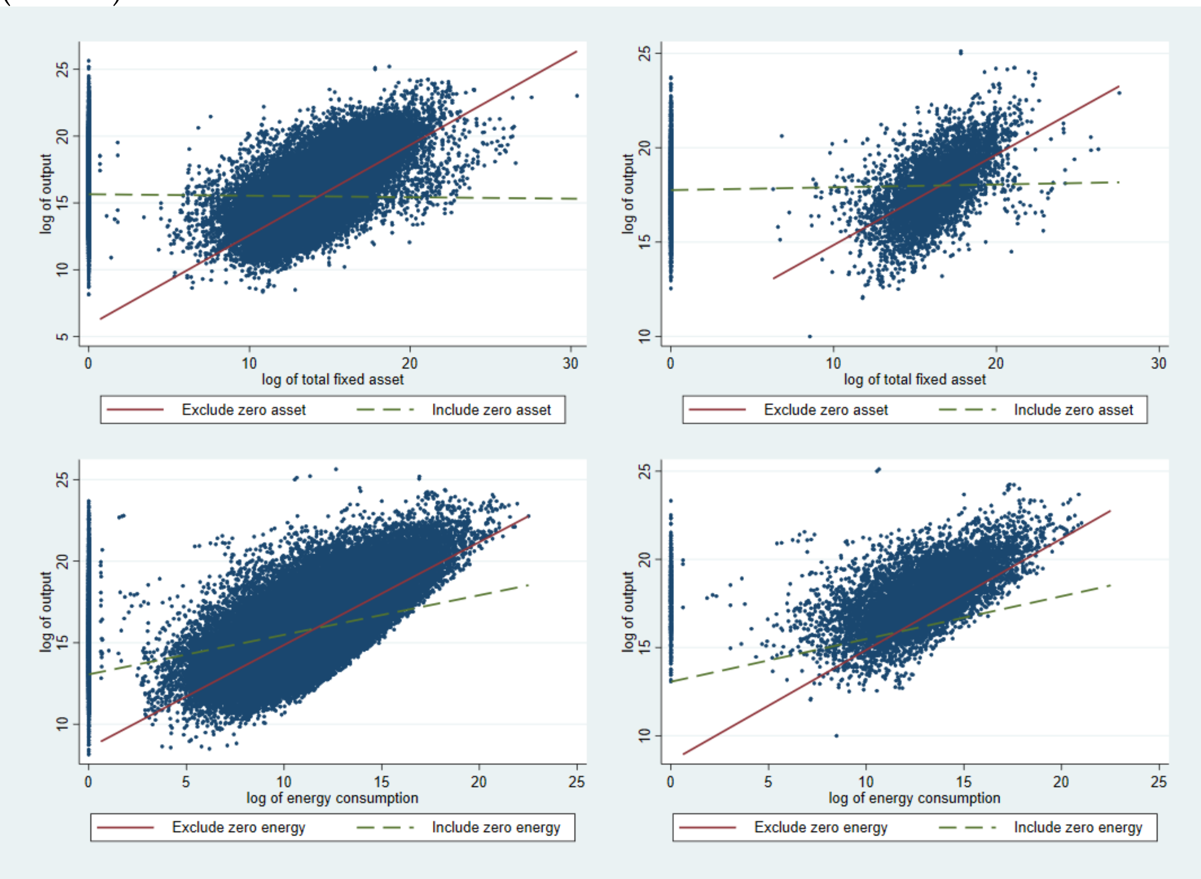
TFP estimation

The first part of the regression conducted in this paper is estimating TFP using Levinsohn and Petrin (2003) methodology[1]. As discussed in other papers (perhaps most comprehensively by Vial (2006)), Indonesian SI has issues with unbalanced panel data as well as unmatched accounting in its aggregated variables. Missing data on investment is not uncommon, and among those who do report, report zero investment. Levinsohn and Petrin (2003) methodology can deal with zero investment.

[1] There is a command to do this in Stata. See Petrin, Poi, and Levinsohn (2004)

However, SI data also filled with zero reported fixed capital. Many of the zero capital are accompanied by high output, which skew data to the left. Zero capital are reported on over 30% of the dataset, and this proportion is robust for firms both exist and do not exist in the customs data set. This problem also detected on the reported energy consumption, but not in intermediate inputs.

Figure 1. Capital, Energy - Output Scatterplot for total observation of SI (left) and for observations only on customs data (right), Capital-Output (top) and Energy-Output (bottom)



Source: Author's calculation based on the BPS

Figure 1 plots log of capital and energy consumption on the x-axis with log output on the y-axis. There are four panels on the figure 1. The top row shows capital on the x-axis while the bottom rows show energy consumption on the x-axis. The left column represents all observations of SI including while the right column only shows firms exist in the customs data. Striped lines show correlation for all observation, while solid lines censor all zeroes.

Figure 1 suggest that the zeroes are very important and could possibly bias the regression. The impact is even stronger in the case of capital, as it even leads to a negative correlation (i.e., downward sloping) for all observation (top left). For firms in the customs data, the effect is not as extreme but still not very different from zero. The zero impact is less clear on energy, but still important.

Table 6. TFP Regression Coefficient, for three different datasets for both all observation and censored observation.

	Original SI		Not in customs data		Present in customs data	
Variables	all obs	only k,n>0	all obs	only k,n>0	all obs	only k,n>0
	(1)	(2)	(3)	(4)	(5)	(6)
Labour (l)	0.354***	0.307***	0.355***	0.307***	0.268***	0.254***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.011)	(0.015)
Capital (k)	0.000	0.223***	0.000	0.219***	0.000	0.161***
	(0.000)	(0.014)	(0.000)	(0.015)	(0.002)	(0.038)
Energy (n)	0.035***	0.114***	0.037***	0.114***	0.019***	0.097***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.003)	(0.008)
Input (m)	0.234***	0.281***	0.251***	0.255***	0.344***	0.226***
	(0.013)	(0.024)	(0.017)	(0.024)	(0.056)	(0.075)
RTS	0.623	0.925	0.643	0.895	0.631	0.738
Observations	117,598	73,265	108,662	68,294	8,936	4,971

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 shows the coefficient from Levinsohn and Petrin (2003) regression on three different datasets for all observations (odd columns) and for observations with strictly positive log of capital and energy consumption (even columns). Column (1) and (2) are for all of SI, column (3) and (4) are for firms not in the customs data, and the last two columns are for firms presented in the customs data.

If the zeroes are included, capital's impact to output is not different than zero, which is not very realistic. While betas for energy consumption still show positive significance on the non-censored observation, dropping the zeroes changes its coefficient relatively importantly. The return-to-scale measurement for the censored observations are also more consistent with the literature. The regression from table 6 indeed provides a strong support to exclude firms which report zero capital and energy.

Table 7. Estimated TFP, for three different datasets for both all observation and censored observation.

Variables	Original SI		Not in customs data		Present in customs data	
	all obs	only k,n>0	all obs	only k,n>0	all obs	only k,n>0
	(1)	(2)	(3)	(4)	(5)	(6)
Estimated TFP	241,611.20	107,036.90	216,246.40	115,020.70	341,643.80	177,280.20
	(4,444,240)	(2,792,543)	(4,361,599)	(2,719,907)	(8,542,388)	(4,609,524)
Not in customs	221,284.30	98,534.27				
data	(4,542,027)	(2,826,922)				
present in customs	488,787.80	210,429.20				
data	(3,000,124)	(2,331,985)				
Value Added	137,987.1	111,455.8	126,073.5	100,510.9	282,856.5	261,822.6
Labour	(2,515,300)	(2,538,721)	(2,600,177)	(2,614,048)	(1,012,159)	(1,043,383)

Table 7 shows estimated TFPs from the regression. TFPs estimated on observations including zero capital and energy consumptions are more than double higher compared to TFPs from all censored datasets. This is expected as they underestimate the ability for capital and energy consumption to produce output.

TFP for firms present in customs data is higher on average compared to firms outside of the customs data, which is also expected. The difference of the TFP is much visible when it is estimated together, as shown on the column (1) and column (2) on the table 7. When they are estimated separately, TFP from firms outside the customs dataset (column (3) and (4)) is still lower than firms in the customs dataset (column (4) and (6)), albeit smaller.

To complement TFP calculation from Levinsohn and Petrin (2003), I also include a less-problematic estimation of TFP, namely value added per labour. This variable also allows me to keep all variable since the report for both value added, and labour does not suffer from capital and energy. The descriptive statistic of this variable is presented in the last row of table 7. Using this metric, it is still holding that firms included in the customs dataset are more productive. Lower average of value added per labour for the censored firms may suggest that there are more firms reporting high value added are also reporting zero capital and/or energy consumptions.

Impact of policies to TFP

Finally, only firms included in the customs data that is used in the second stage regression. There are three final variables that is used as independent variables. TFP1 is TFP of firms included in the customs data that is estimated together with other firms in the original SI dataset. TFP2 is TFP of firms that is included in the customs data, estimated within its own subset. Va/L is measured by value added per labour of firms included in customs data and reports strictly positive fixed capital and energy consumption[2].

Let $t = \log(1 + T_{it})$, $c_\theta = \log(1 + C_{\theta it})$, the three measures of TFP are then regressed using equation (7). The result is presented in table 8 in 6 columns. Column (1) to (3) are the four TFPs regressed using OLS, while (4) to (6) have ISIC-2-digit, year and firms fixed effects.

Table 8. Impact of tariff and NTM on TFP.

VARIABLES	TFP1	TFP2	Va/L	TFP1	TFP2	Va/L
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	-0.027	-0.025	-0.072***	-0.019	-0.013	0.002
	(0.020)	(0.019)	(0.023)	(0.022)	(0.021)	(0.028)
SPS	-0.094*	-0.079	-0.164**	-0.011	-0.025	-0.038
	(0.048)	(0.049)	(0.073)	(0.065)	(0.062)	(0.082)
TBT	0.289***	0.254***	0.379***	0.182**	0.142*	0.184*
	(0.092)	(0.078)	(0.099)	(0.078)	(0.074)	(0.098)
Pre-Shipment	0.082	0.067	0.295*	-0.063	-0.077	-0.057
	(0.109)	(0.109)	(0.161)	(0.114)	(0.107)	(0.143)
Licensing	-0.064	-0.036	-0.004	-0.093	-0.095	-0.116
	(0.059)	(0.058)	(0.087)	(0.076)	(0.072)	(0.096)
Price control	281.992***	585.429***	539.567***	138.837	374.367	116.246
	(87.628)	(111.394)	(134.382)	(1,557.471)	(1,469.290)	(1,957.694)
Competition	0.114	0.084	0.111	0.270	0.238	-0.048
	(0.320)	(0.315)	(0.348)	(0.351)	(0.332)	(0.442)
Export-related	0.009	0.035	0.057	0.073	0.094	0.040
	(0.081)	(0.081)	(0.140)	(0.105)	(0.100)	(0.133)
dummy FDI	0.171***	0.176***	0.153**	0.079	0.080	-0.030
	(0.059)	(0.054)	(0.074)	(0.066)	(0.062)	(0.083)
foreign	0.039***	0.040***	0.044***	0.021	0.020	0.026
ownership	(0.013)	(0.012)	(0.016)	(0.015)	(0.014)	(0.019)
Constant	6.357***	8.761***	11.256***	6.512***	8.930***	11.421***
	(0.040)	(0.040)	(0.052)	(0.178)	(0.168)	(0.224)
firm-fe	no	no	no	yes	yes	yes
year-fe	no	no	no	yes	yes	yes
ISIC-2-digit-fe	no	no	no	yes	yes	yes
Observations	4,971	4,971	4,971	4,971	4,971	4,971
R-squared				0.023	0.025	0.061
No. of firms	1,512	1,512	1,512	1,512	1,512	1,512

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

[2] Results using also firms which report zero capital and energy have somewhat lower coefficients albeit not significantly different.

Tariff coverage ratio is not shown to be significant for most of the TFP measures except for labour value added (Va/L). The significance of Va/L is also gone when fixed effects are introduced. SPS seems to have a negative impact to firm's TFP albeit weakly. These are also gone when controlled by fixed effects.

TBT has a strong positive correlation, which may suggest that the TBTs allow firms to have better quality inputs. However, the correlation is gone when fixed effects are introduced. Price control measures also have similar behaviour. Notably, the fact that there is so little number of price control measurement introduced by Indonesia leads to a relatively high coefficient.

Trade policies may affect firms differently compared to general population. As first argued by Melitz (2003), trade policies have heterogenous effects on firms. That is, it may hurt bigger firms less, or even benefit them. To capture this phenomenon, I adapt the approach of Fugazza et al. (2017) by introducing interaction between trade policy variables with firm size. I use the number of labours (LAB) as a proxy for size. Equation (7) is then modified to become:

$$tfp_{it} = \gamma_0 + \gamma_T \log(1 + T_{it}) + \gamma_{TL} \log(1 + T_{it}) * \log(LAB) + \sum_{\theta} \gamma_\theta \log(1 + C_{\theta it}) + \sum_{\theta} \gamma_{\theta L} \log(1 + C_{\theta it}) * \log(LAB) + FO_{it} + \alpha_i + ISIC_i + \eta_{it} \qquad (8)$$

Table 9 documents this result. Lower case represents log form. When size interaction is added, the average effect of tariff on firm's TFP becomes significantly negative. TFP2 shows an impact twice higher compared to TFP1, while labour value added failed to show response to the tariff change. When fixed effects are introduced, the impact of tariff to TFP is weaken for TFP1 and TFP2 albeit still significant. Interestingly, labour value added become positively significant. The results from TFP1 are comparable to Amiti and Konings (2007).

Table 9. Impact of tariff and NTM on TFP including size interaction.

VARIABLES	TFP1	TFP2	Va/L	TFP1	TFP2	Va/L
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	-0.357***	-0.630***	0.071	-0.205**	-0.371***	0.259**
	(0.067)	(0.065)	(0.090)	(0.083)	(0.077)	(0.104)
Tariff*lab	0.061***	0.112***	-0.026	0.036**	0.068***	-0.048**
	(0.012)	(0.011)	(0.017)	(0.015)	(0.014)	(0.019)
SPS	-0.250	-0.517**	-0.124	-0.260	-0.381	0.103
	(0.234)	(0.260)	(0.381)	(0.297)	(0.278)	(0.372)
SPS*lab	0.026	0.076*	-0.008	0.043	0.062	-0.029
	(0.042)	(0.046)	(0.067)	(0.051)	(0.048)	(0.064)
TBT	0.213	0.194	0.486	0.124	0.074	0.462
	(0.483)	(0.419)	(0.408)	(0.330)	(0.310)	(0.415)
TBT*lab	0.014	0.012	-0.019	0.011	0.013	-0.051
	(0.083)	(0.072)	(0.067)	(0.058)	(0.055)	(0.073)
Pre-inspection	0.418	0.749	-0.005	-0.115	0.160	-0.637
	(0.531)	(0.558)	(0.758)	(0.520)	(0.488)	(0.652)
Pre-inspection*lab	-0.058	-0.116	0.051	0.010	-0.043	0.100
	(0.094)	(0.098)	(0.134)	(0.093)	(0.087)	(0.117)
Licensing	-0.650**	-1.444***	0.640*	-0.451	-0.896***	1.477***
	(0.266)	(0.263)	(0.371)	(0.311)	(0.292)	(0.390)
Licensing*lab	0.107**	0.258***	-0.119*	0.065	0.147***	-0.295***
	(0.047)	(0.046)	(0.064)	(0.056)	(0.052)	(0.070)
Price control	-8,559***	-12,147***	-29,052***	-7,559	-10,221	-25,902
	(3,235)	(2,984)	(4,029)	(41,100)	(38,558)	(51,565)
Price control*lab	1,383***	1,985***	4,717.740***	1,214.495	1,665.753	4,154
	(514)	(474)	(640)	(6,533)	(6,129)	(8,197)
Competition	-1.155	-0.693	-2.269*	-2.027	-2.204*	-4.609***
	(1.152)	(1.095)	(1.194)	(1.277)	(1.198)	(1.602)
Competition*lab	0.228	0.129	0.434**	0.393*	0.413**	0.834***
	(0.216)	(0.210)	(0.213)	(0.220)	(0.206)	(0.276)
Export-related	-0.341	-0.475	0.343	-0.096	-0.291	0.480
	(0.357)	(0.385)	(0.679)	(0.476)	(0.446)	(0.597)
Export-related*lab	0.066	0.095	-0.049	0.036	0.075	-0.073
	(0.062)	(0.066)	(0.125)	(0.083)	(0.078)	(0.104)
dummy FDI	0.157***	0.152***	0.156**	0.066	0.061	-0.022
	(0.059)	(0.052)	(0.073)	(0.066)	(0.062)	(0.083)
foreign	0.039***	0.040***	0.045***	0.023	0.024*	0.025
ownership	(0.013)	(0.012)	(0.016)	(0.015)	(0.014)	(0.019)
Constant	6.354***	8.751***	11.259***	6.501***	8.904***	11.452***
	(0.040)	(0.040)	(0.052)	(0.178)	(0.167)	(0.224)
Fixed effects	no	no	no	no	yes	yes
Observations	4,971	4,971	8,936	4,971	4,971	4,971
R-squared				0.029	0.041	0.070
No. of firms	1,512	1,512	2,173	1,512	1,512	1,512

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results from table 9 confirms heterogenous effect of international trade to firms. Interaction between tariff and firm's size measured by the number of labours shows positive and significant results. This means that bigger firms impacted less compared to smaller firms, albeit still negative overall. Labour value added, however, shows a completely different sign, where bigger firms see smaller labour value added in the presence of higher tariffs.

Impact of NTMs to firm's measures see a more negative results of TFP compared to table 8, albeit remains weak. SPS still shown a relatively weak negative impact to TFP but only when measured by TFP2. Non-automatic licensing (C_e) shows a significant, negative results while also confirms heterogenous effect, that is, bigger sized firms fare relatively better compared to its smaller counterparts.

The impact of trade policies on employment

The results from labour value added is puzzling. One possible explanation is that firms decided to reduce the number of labours to cope up with loss of productivity. If the number of labours decreased higher than the decrease of total value added, firms will be shown to have a higher value added per labour.

To check for this phenomenon, I constructed a new dependent variable which measures the growth of labour:

$$\Delta lab_t = \log(LAB_t) - \log(LAB_{t-1})$$

and use it to replace TFP measurements in equation (8). The results of this regression are presented in table 10. Size interaction is presented in column (3) and (4) while even column receives fixed effect treatments. The consequence of this regression is losing year-2008 observations.

Table 10. Impact of tariff and NTM on firm's labour input growth.

VARIABLES	Δlab	Δlab	Δlab	Δlab
	(1)	(2)	(3)	(4)
tariff	-0.008	-0.028	-0.260***	-1.368***
	(0.009)	(0.021)	(0.047)	(0.063)
SPS	-0.028	-0.120*	-0.176	-1.650***
	(0.020)	(0.066)	(0.153)	(0.230)
TBT	0.034	-0.075	0.064	0.452*
	(0.038)	(0.075)	(0.236)	(0.257)
Pre-inspection	-0.041	0.121	0.066	1.997***
	(0.040)	(0.100)	(0.349)	(0.370)
Licensing	-0.015	-0.042	-0.818***	-4.455***
	(0.033)	(0.073)	(0.190)	(0.237)
Price control	135	1,543	14,832***	6,015
	-88	-1,185	(4,381)	-25,570
Competition	0.072	0.094	-0.999	-2.788***
	(0.289)	(0.387)	(1.563)	(1.006)
Export-related	-0.017	0.097	-0.246	-0.617*
	(0.028)	(0.091)	(0.203)	(0.333)
dummy FDI	0.031	0.147**	0.028	0.091*
	(0.030)	(0.065)	(0.031)	(0.053)
Foreign ownership	-0.008	-0.026*	-0.009	-0.007
	(0.007)	(0.014)	(0.007)	(0.011)
t*l			0.043***	0.251***
			(0.008)	(0.011)
SPS*lab			0.021	0.288***
			(0.027)	(0.041)
TBT*lab			-0.008	-0.095**
			(0.043)	(0.045)
Pre-inspection*lab			-0.008	-0.345***
			(0.061)	(0.066)
Licensing*lab			0.140***	0.809***
			(0.036)	(0.042)
Price control*lab			-2,312.256***	-802.297
			(695.302)	(4,064.466)
Competition*lab			0.207	0.360**
			(0.335)	(0.163)
Export-related*lab			0.042	0.132**
			(0.036)	(0.059)
Constant	0.033**	0.034	0.050***	-0.046
	(0.015)	(0.167)	(0.018)	(0.137)
firm,year,isic FE	no	yes	no	yes
Observations	3,726	3,726	3,726	3,726
R-squared		0.028		0.355
Number of psid	1,268	1,268	1,268	1,268

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

The result is similar to the impact of trade policies to TFP1 and TFP2. That is, higher tariffs are associated with lower growth of labour. With fixed effects are applied, a doubling tariff is responsible for a loss of job by 136.8%. The impact is smaller for bigger firms. The same is true for implementing SPS, non-automatic licensing, and some competition measures.

When imports are halted by tariffs and NTMs, firms have limited access to important inputs. Suppose that these inputs are not easily substitutable by domestic inputs or other factor of productions, firms will adjust by lowering their production. These findings complement the literature which already found extensive evidence of the importance of international trade, in particular imported inputs, to manufacturing development (World Bank, 2020).

I complement the literature on heterogenous effect of trade on firms, especially in Indonesian manufacturing. Bigger firms are able to better manage trade shocks and have less lay off. This is important to be noted by policy makers, especially since the latest Indonesian manufacturing development plan, Making Indonesia 4.0, puts a heavy reliance on attracting investment from big multi-national corporations (A.T. Kearney Incorporated, 2018). Policies for smaller firms are less clear.

The finding on employment is particularly interesting. It has been shown that lower import tariff has been shown to contribute to higher wage level and higher employment in industries with high intensity of imported inputs (Kis-Katos and Sparrow 2015, Amiti and Davis, 2012). This study confirms the finding by showing that the increase can be due to higher productivity gain on the firm level.

The heterogenous impact may add to debate on competition. With higher cost of importing inputs, smaller firms suffer more compared to bigger firms. The impact of higher trade barrier on intermediate input markets may push smaller firms out of the market to a degree. This may lead to bigger firms having a slight advantage in increasing their mark-up due to worsening competition, which could explain the result from value added per labour and decreased wage from previous studies (Kis-Katos and Sparrow 2015, Amiti and Davis, 2012). This study also adds to the debate on NTMs. NTMs can be seen as trade inducing and trade reducing. Treating NTM as neutral is certainly welcomed so that researchers can use it in different context. This study is among the first to use TRAINS dataset in a panel setting. The way the NTM is collected, that is, counting the number of regulations in different years (2015 and 2018) without following it is less than ideal. Even in the 2015 dataset, the lowers end-date of any NTM in Indonesia is 2016. It is possible this dataset is missing NTMs that are existed but ended during the observation used by this paper.

Measuring NTMs with count data is not ideal. TRAINS dataset lacks information on how restrictive the NTMs. For example, TRAINS dataset captures regulation concerning quota restriction on horticulture, but it does not show how much the quota changes overtime. It is still important to know if more goods have more regulation cover them. However, studying the impact of NTMs would require more depth (i.e., per sector or per goods studies) compared to studying tariff. These challenges to study NTM will not go anywhere and will be remained as one important focus area, especially in the return of inward oriented industrial policies (Rodrik, 2007).

It is important to acknowledge the role the policies on the intermediate input market. That is, whether the higher tariff and NTM leads to a stronger domestic growth for firms producing intermediate inputs. Unfortunately, SI does not contain information on the firm's input. Indeed, it is not clear that goods imported by firms as captured by the customs data are actually used for production. Moreover, as suggested on the previous chapter, the trade data reported by SI is not complete, and those which exist are not always match perfectly with the customs data.

This study reports another weakness of SI. As noted by SI user before, SI data is highly unbalanced, reported inconsistent and missing variables (e.g., investment, fixed capital, and energy consumption). In addition to this, this study found that even among completed data, there are many misleading zeroes. Unlike the missing data, these zeroes are extensive, accounted as many as 30% of the total dataset. Fortunately, these zeroes are found to be quite random and hopefully does not bias the result.

The fact that importer in this study consists only a very minor fraction of the whole sample of SI may limit the context of this study. It is shown already that this importer subset is already bigger than the rest of firms in the survey. Even among these big firms, size still matters considerably. Moreover, reported import in SI does not match one to one to the customs dataset. SI remains, arguably, the best dataset to study about manufacturing firms in Indonesia. Updating SI and its integration with the customs data would certainly better Indonesian manufacturing studies.

Tariff, NTM and trade

It is compelling to argue that more restrictive trade policies force firms to reduce their foreign input intakes which are essential to stay competitive. One way to check this is by regressing their actual import against trade policy indicators. I use Poisson-Pseudo Maximum Likelihood (PPML) first introduced by Silva and Tenreyro (2006). PPML is shown to be more consistent than log-log OLS in a presence of zero value data and heteroskedasticity, very common in trade data (Silva & Tenreyro, 2006).

Aside for trade policies, log of TFP is used as control. Gravity variables are used as well, such as log of GDP of Indonesia (gdp_o), log of GDP of source country s (gdp_s) and log distance between Indonesia and country s ($dist_s$). Also controlled are time difference (tdiff), contiguity (contig), donor relationship (Donor), and whether Indonesia and country s has a free trade agreement (fta_wto). I also add cost of doing business in Indonesia ($entry\_cost_o$) and its partner s ($entry\_cost_s$) as controls. These controls are sourced from CEPII.

Table 11 shows the result of the PPML regression on HS-8-digits import of firms. Three TFPs are used as controls on three different regressions, namely TFP1, TFP2 and Va/L. Column (4) to (5) has year and ISIC-2-digit fixed effects.

Table 11. Correlation between trade policies and import value

Import Value	z=1 (1)	z=2 (2)	z=3 (3)	z=1 (4)	z=2 (5)	z=3 (6)
tfp_z	0.125***	0.268***	0.319***	0.133***	0.277***	0.213***
	(0.013)	(0.016)	(0.023)	(0.016)	(0.018)	(0.024)
Tariff	-0.299***	-0.299***	-0.291***	-0.273***	-0.271***	-0.269***
	(0.045)	(0.045)	(0.045)	(0.044)	(0.044)	(0.044)
SPS	0.779***	0.811***	0.815***	0.703***	0.729***	0.724***
	(0.066)	(0.066)	(0.064)	(0.069)	(0.069)	(0.068)
TBT	0.030	0.025	0.061	0.130*	0.125*	0.136**
	(0.073)	(0.072)	(0.071)	(0.069)	(0.069)	(0.068)
Pre-inspection	0.818***	0.825***	0.708***	0.531***	0.536***	0.540***
	(0.093)	(0.095)	(0.100)	(0.104)	(0.106)	(0.106)
Licensing	0.061	0.048	-0.014	-0.108	-0.123	-0.114
	(0.100)	(0.101)	(0.102)	(0.092)	(0.093)	(0.092)
Price control	-4.874***	-4.859***	-4.791***	-4.356***	-4.356***	-4.462***
	(0.308)	(0.314)	(0.383)	(0.524)	(0.517)	(0.509)
Competition	1.074***	1.069***	0.955***	0.774***	0.777***	0.749***
	(0.237)	(0.238)	(0.230)	(0.229)	(0.230)	(0.228)
Export-related	-0.485***	-0.512***	-0.529***	-0.421***	-0.441***	-0.442***
	(0.119)	(0.120)	(0.121)	(0.125)	(0.126)	(0.124)
gdp_o	1.070***	1.013***	0.951***			
	(0.208)	(0.208)	(0.201)			
gdp_s	-0.228***	-0.227***	-0.242***	-0.247***	-0.247***	-0.248***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
$dist_s$	0.941***	0.984***	1.009***	1.079***	1.127***	1.063***
	(0.086)	(0.088)	(0.085)	(0.085)	(0.086)	(0.083)
fta_wto	0.155	0.165	0.077	0.039	0.051	0.020
	(0.155)	(0.155)	(0.156)	(0.160)	(0.159)	(0.158)
contig	0.428***	0.454***	0.276***	0.247**	0.246**	0.175*

	(0.107)	(0.107)	(0.103)	(0.104)	(0.105)	(0.104)
tdiff	-0.049*	-0.056**	-0.083***	-0.101***	-0.109***	-0.105***
	(0.029)	(0.029)	(0.028)	(0.029)	(0.029)	(0.029)
Donor	-0.254***	-0.289***	-0.394***	-0.449***	-0.483***	-0.483***
	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)
$entry\_cost_o$	-0.179***	-0.188***	-0.171***	-0.192***	-0.195***	-0.189***
	(0.037)	(0.037)	(0.036)	(0.035)	(0.035)	(0.035)
$entry\_cost_s$	0.492***	0.487***	0.486***	0.332***	0.326***	0.352***
	(0.117)	(0.116)	(0.114)	(0.106)	(0.105)	(0.106)
Constant	-20.298***	-20.768***	-19.987***	9.200***	7.177***	7.329***
	(5.991)	(5.987)	(5.792)	(0.742)	(0.754)	(0.754)
Year, ISIC-2 FE	no	no	no	yes	yes	yes
Observations	192,928	192,928	192,928	192,928	192,928	192,928
R-squared	0.008	0.009	0.010	0.012	0.012	0.013

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

TFPs are correlated positively with import on all the TFP measurements, corroborating the literatures that importing firms have higher productivity. Meanwhile, tariffs contribute to overall lower imports. That is, a doubling tariff rate is responsible for decrease of roughly over 26 percent of imports.

NTMs have mixed results. Increase numbers of SPS on imported goods is correlated positively with import. The same is true for competition measures and pre-inspections. On the other hand, price control measures are negatively correlated with import. TBT remains less important for firm's import.

The usual gravity variables are not deviating from the literature on trade. Free trade agreement is not significant, suggesting that Indonesia's FTAs are mostly drafted around tariff reduction, which is rather typical (Baier & Bergstrand, 2007). Indonesia imports more from countries that have small business starting costs, while increased cost of doing business in Indonesia, interestingly, related positively with firm's import. Indonesia also trades relatively less with countries that gives aid to it.

Table 12 adds interaction between trade policy variables with TFP measurement to controls for heterogenous effect. TFP's positive association with import value remains even when controlled with fixed effects. The general role of tariff is much stronger compared to table 11, showing more than double negative coefficients.

Table 12. Correlation between trade policies, TFP and import value

Import Value	z=1 (1)	z=2 (2)	z=3 (4)	z=1 (9)	z=2 (10)	z=3 (12)
tfp_z	0.113***	0.312***	0.331***	0.136***	0.342***	0.226***
	(0.013)	(0.017)	(0.032)	(0.017)	(0.021)	(0.033)
Tariff	-0.546***	-0.600***	-0.841***	-0.464***	-0.433***	-0.743***
	(0.100)	(0.144)	(0.247)	(0.121)	(0.163)	(0.248)
Tariff*tfp_z	0.035***	0.030**	0.045**	0.027*	0.016	0.038*
	(0.012)	(0.014)	(0.021)	(0.015)	(0.016)	(0.021)
SPS	1.076***	1.577***	2.026***	1.191***	1.632***	1.771***
	(0.277)	(0.280)	(0.324)	(0.299)	(0.309)	(0.331)
TBT	-1.090***	-1.106***	-1.903***	-1.100***	-1.071***	-1.698***
	(0.286)	(0.281)	(0.301)	(0.284)	(0.279)	(0.304)
Pre-inspection	-1.852***	-1.910***	-2.655***	-2.632***	-2.658***	-3.145***
	(0.581)	(0.588)	(0.751)	(0.649)	(0.658)	(0.768)
Licensing	1.211***	2.612***	2.065***	1.359***	2.650***	1.636***
	(0.419)	(0.436)	(0.520)	(0.457)	(0.470)	(0.521)
Price control	25.021***	22.841***	27.486***	33.873***	31.596***	32.040***
	(6.582)	(7.251)	(7.961)	(7.584)	(7.985)	(7.898)
Competition	3.581***	2.027*	4.164***	3.241***	1.892*	3.855***
	(1.159)	(1.140)	(1.264)	(1.080)	(1.080)	(1.163)
Export-related	0.509	0.926*	1.234*	0.815	1.300*	1.347*
	(0.525)	(0.540)	(0.668)	(0.649)	(0.676)	(0.722)
SPS*tfp_z	-0.044	-0.114***	-0.179***	-0.073	-0.135***	-0.155***
	(0.041)	(0.042)	(0.049)	(0.045)	(0.046)	(0.050)
TBT*tfp_z	0.157***	0.159***	0.273***	0.172***	0.167***	0.256***
	(0.038)	(0.037)	(0.040)	(0.038)	(0.036)	(0.041)
Pre-inspection*tfp_z	0.387***	0.395***	0.488***	0.458***	0.461***	0.535***
	(0.082)	(0.083)	(0.108)	(0.092)	(0.092)	(0.110)
Licensing*tfp_z	-0.172***	-0.372***	-0.306***	-0.217***	-0.402***	-0.258***
	(0.056)	(0.058)	(0.072)	(0.062)	(0.064)	(0.073)
Price control*tfp_z	-4.530***	-4.204***	-4.890***	-5.759***	-5.423***	-5.507***
	(0.995)	(1.096)	(1.201)	(1.138)	(1.199)	(1.184)
Competition*tfp_z	-0.372**	-0.161	-0.476***	-0.370**	-0.185	-0.464***
	(0.162)	(0.157)	(0.177)	(0.150)	(0.149)	(0.161)
Export-related*tfp_z	-0.139*	-0.197***	-0.247**	-0.173*	-0.241**	-0.253**
	(0.074)	(0.076)	(0.097)	(0.093)	(0.097)	(0.106)
gdp_o	-0.228***	-0.223***	-0.242***	-0.246***	-0.243***	-0.247***
	(0.028)	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)
gdp_s	1.058***	1.004***	0.946***			
	(0.207)	(0.207)	(0.200)			
$dist_s$	0.933***	0.964***	1.006***	1.074***	1.119***	1.060***
	(0.087)	(0.088)	(0.085)	(0.086)	(0.087)	(0.084)
fta_wto	0.150	0.154	0.030	0.024	0.034	-0.011
	(0.154)	(0.155)	(0.158)	(0.160)	(0.160)	(0.160)
contig	0.438***	0.460***	0.284***	0.258**	0.252**	0.188*
	(0.108)	(0.109)	(0.104)	(0.105)	(0.106)	(0.104)
Tdiff	-0.048*	-0.054*	-0.090***	-0.102***	-0.109***	-0.109***

	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)
donor	-0.243***	-0.286***	-0.401***	-0.442***	-0.487***	-0.483***
	(0.086)	(0.087)	(0.088)	(0.087)	(0.087)	(0.087)
$entry\_cost_o$	-0.178***	-0.186***	-0.172***	-0.189***	-0.191***	-0.187***
	(0.037)	(0.037)	(0.036)	(0.035)	(0.035)	(0.035)
$entry\_cost_s$	0.494***	0.493***	0.497***	0.337***	0.332***	0.363***
	(0.116)	(0.116)	(0.113)	(0.105)	(0.105)	(0.105)
Constant	-19.845***	-20.945***	-19.964***	9.211***	6.516***	7.070***
	(5.955)	(5.953)	(5.792)	(0.749)	(0.770)	(0.839)
Year, ISIC-2 FE	no	no	no	yes	yes	yes
Observations	192,928	192,928	192,928	192,928	192,928	192,928
R-squared	0.009	0.009	0.011	0.012	0.013	0.013

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

There is indeed an indication of heterogenous effect. That is, more productive firms tend to import more. The significance is weakened when ISIC-2-digit fixed effect is introduced[3]. It is possible that the significance is absorbed by industries more integrated with the Global Value Chain than others, which typically are more productive.

With heterogenous productivity being controlled, NTM effects to firm's import are much stronger. TBT shows a strong negative impact on import as well as pre-inspection. More productive firms impacted less negatively. However, other NTMs are associated with more imports, and affect less productive firms even more.

The result from NTMs is rather puzzling, especially since these NTMs affect TFP somewhat negatively. That is, just by having more import associated with these NTMs does not necessarily lead to higher productivity. It possible that these imports are inflated by increased price associated with the NTMs, which put pressure on firm's mark-up. Another possible argument is that some NTMs have reverse causality (Pierola et al., 2018), that is, as import increase, Indonesian government applies more NTM to lower Current Account Deficit (CAD).

With this result, it is hard to conclude that the channel in which NTMs reduces TFP is through lower import. Some NTMs are associated with higher imports while not associated with increased TFP at the same time. A more in-depth study aiming at specific industries may be able to capture this channel better.

But the main message from this study is clear. Lowering barriers to trade is very important to increase firm's TFP. With intermediate input consistently accounted for more than 70% of Indonesia's import, import substitution strategy may be compelling if the government wish to

[3] Year fixed effect alone did not change coefficients significantly.

limit CAD. Since limiting import is not very hard to do, it may be one of the strategies used to force firms invest in upstream industries.

However, erecting barrier to import these imported inputs will decrease Indonesia's competitiveness in short-to-medium run. While Indonesia has a huge market in its own right, not engaging in the world market will certainly limit Indonesia's growth potential. Without reliable access to foreign import, foreign investor will have a hard time integration its supply chain. Indonesian market alone may not be sufficient since most international firms are abusing GVC to stay competitive in the world market.

With less competitive products, Indonesia, in turn, would have to rely on domestic market to attract investment. With limited market, firms may need higher mark ups from Indonesian market, limiting import competition. This may lead, in turn, to erect even more import barrier for downstream market. We have seen more policies enforced for this purpose, such as Local Content Requirement (LCR) and SIM-card blocking for illegal smartphones which are not met LCR policy. Indeed, Ministry of Industry of Indonesia which tasked to do these policies have an increasing role in drafting NTM policies compared to other agencies (Munadi, 2019).

CONCLUSION

While Indonesia has been successful in reduction of tariff, NTMs are introduced extensively as a substitute. Infant industry argument has been used for some time by Indonesian government to justify these measures, but they may have unintended consequences. That is, disrupting trade means disrupting firm's GVC, which may lead to a less efficient manufacturing in the end.

I find strong evidence that tariff and NTMs lower Indonesia's TFP. I also complement the literature of heterogenous effect of globalisation among firms. That is, bigger firms have better ability to manage competitiveness loss from trade policy shock. Less access to imported input is found to be the main channel from the loss of competitiveness.

This finding suggests that import substitution strategy may be highly inefficient. Firms will have to deliver a less quality and more expensive goods. Moreover, losing access to important inputs may, in the end, limits Indonesian firm to compete in the export market and relies on the mark-up domestic market, which may further invoke import barrier on the output market.

Limitation in this study may limits how far the conclusion can be made. Firstly, count data is known to be a limitation in NTM studies, as it does not differentiate depth between counted policies. Secondly, observations that can be made is limited by the quality and amounts of data.

Data quality is certainly the main limitation in perfection Indonesia's manufacturing study, which desperately needed as the country aims to grow faster through manufacturing.

REFERENCES

A.T. Kearney Incorporated. (2018). Indonesia's 4th Industrial Revolution: Benchmarking Implementasi Industri 4.0. In. Jakarta.

Amiti, M., & Davis, D. R. (2012). Trade, Firms, and Wages: Theory and Evidence. The Review of Economic Studies, 79(1), 1-36. http://www.jstor.org.virtual.anu.edu.au/stable/41407043

Amiti, M., & Konings, J. (2007). Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia. *The American Economic Review, 97*(5), 1611-1638. doi:10.1257/000282807783219733

An, G., & Maskus, K. E. (2009). The Impacts of Alignment with Global Product Standards on Exports of Firms in Developing Countries. *World Economy, 32*(4), 552-574. doi:10.1111/j.1467-9701.2008.01150.x

Aswicahyono, H., Hill, H., & Narjoko, D. (2010). Industrialisation after a Deep Economic Crisis: Indonesia. *The Journal of Development Studies, 46*(6), 1084-1108. doi:10.1080/00220380903318087

Baier, S. L., & Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics, 71*(1), 72-95. doi:10.1016/j.jinteco.2006.02.005

Bas, M., & Strauss-Kahn, V. (2014). Does importing more inputs raise exports? Firm level evidence from France. *Review of World Economics, 150*(2), 35.

Cadot, O., Asprilla, A., Gourdon, J., Knebel, C., & Peters, R. (2015). *Deep Regional Integration and Non-Tariff Measures: A Methodology for Data Analysis*. Retrieved from New York and Geneva:

Cadot, O., Ferrantino, M. J., Gourdon, J., & Reyes, J.-D. (2018). *Reforming Non-Tariff Measures: From Evidence to Policy Advice*. Retrieved from Washington DC:

Castellani, D., & Fassio, C. (2019). From new imported inputs to new exported products. Firm-level evidence from Sweden. *Research Policy, 48*(1), 322-338. doi:10.1016/j.respol.2018.08.021

Costinot, A., & Rodríguez-Clare, A. (2014). Trade Theory with Numbers: Quantifying the Consequences of Globalization. In (pp. 197-261).

Deardorff, A. V. (1987). Why do governments prefer nontariff barriers? *Carnegie-Rochester Conference Series on Public Policy, 26*, 191-216. doi:https://doi.org/10.1016/0167-2231(87)90026-1

Deardorff, A. V., & Stern, R. M. (1997). Measurement of Non-Tariff Barriers. doi:doi:https://doi.org/10.1787/568705648470

Disdier, A.-C., Fontagné, L., & Cadot, O. (2015). North-South Standards Harmonization and International Trade. *The World Bank Economic Review, 29*(2), 327-352. doi:10.1093/wber/lht039

Fugazza, M., Olarreaga, M., & Ugarte, C. (2017). On the heterogeneous effects of non-tariff measures: Panel evidence from Peruvian firms. *UNCTAD Blue Series Papers, 77*. Retrieved from https://ideas.repec.org/p/unc/blupap/77.html

Ing, L. Y., Yu, M., & Zhang, R. (2019). the evoltion of export quality: China and Indonesia. In L. Y. Ing & M. Yu (Eds.), *World Trade Evolution: Growth, Productivity and Employment*. Abingdon
New York: Routledge.
Kee, H. L., Nicita, A., & Olarreaga, M. (2009). Estimating Trade Restrictiveness Indices. *The Economic Journal, 119*(534), 172-199. doi:10.1111/j.1468-0297.2008.02209.
Kis-Katos, K., & Sparrow, R. (2015). Poverty, labor markets and trade liberalization in Indonesia. Journal of Development Economics, 117, 94-106. https://doi.org/https://doi.org/10.1016/j.jdeveco.2015.07.005
Levinsohn, J., & Petrin, A. (2003). Estimating Production Functions Using Inputs to Control for Unobservables. *The Review of Economic Studies, 70*(2), 317-341. doi:10.1111/1467-937x.00246
Marks, S. V. (2018). Non-Tariff Trade Regulations in Indonesia: Nominal and Effective Rates of Protection. *Bulletin of Indonesian Economic Studies, 53*(3), 333-357. doi:10.1080/00074918.2017.1298721
Melitz, M. J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica, 71*(6), 1695-1725. doi:10.1111/1468-0262.00467
Munadi, E. (2016). *Indonesia's Non-tariff Measures: An Overview*: ERIA
UNCTAD.
Munadi, E. (2019). *Indonesian non-tariff measures: updates and insights*. Retrieved from Jakarta:
Olley, G. S., & Pakes, A. (1996). The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica, 64*(6), 1263-1297. doi:10.2307/2171831
Olper, A., Curzi, D., & Raimondi, V. (2017). Imported Intermediate Inputs and Firms' Productivity Growth: Evidence from the Food Industry. *Journal of Agricultural Economics, 68*(1), 280-300. doi:10.1111/1477-9552.12164
Pane, D., & Patunru, A. (2019). Does export performance improve firm performance? Evidence from Indonesia. *Working Papers in Trade and Development, 05*.
Pangestu, M., Rahardja, S., & Ing, L. Y. (2015). Fifty Years of Trade Policy in Indonesia: New World Trade, Old Treatments. *Bulletin of Indonesian Economic Studies, 51*(2), 239-261. doi:10.1080/00074918.2015.1061915
Patunru, A. (2018). Rising Economic Nationalism in Indonesia. *Journal of Southeast Asian Economies, 35*(3), 335-354. doi:10.1355/ae35-3b
Patunru, A., & Rahardja, S. (2015). *Trade Protectionism in Indonesia: Bad Times and Bad Policy*. Retrieved from https://www.lowyinstitute.org/publications/trade-protectionism-indonesia-bad-times-and-bad-policy
Petrin, A., Poi, B. P., & Levinsohn, J. (2004). Production Function Estimation in Stata using Inputs to Control for Unobservables. *The Stata journal, 4*(2), 113-123. doi:10.1177/1536867X0400400202
Pierola, M. D., Fernandes, A. M., & Farole, T. (2018). The role of imports for exporter performance in Peru. *The World Economy, 41*(2), 550-572. doi:10.1111/twec.12524

Resosudarmo, B. P., & Abdurohman. (2018). Is Being Stuck with a Five Percent Growth Rate a New Normal for Indonesia? *Bulletin of Indonesian Economic Studies, 54*(2), 141-164. doi:10.1080/00074918.2018.1521776

Rodrik, D. (2007). *One economics, many recipes: globalization, institutions, and economic growth*. Princeton: Princeton University Press.

Rodrik, D. (2020). why does globalization fuel populism. *NBER working papers*.

Silva, S., & Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics, 88*(4), 19.

UNCTAD. (2017). TRAINS NTMs: The Global Database on Non-Tariff Measures.

UNCTAD. (2018). *UNCTAD TRAINS: The Global Database on Non-Tariff Measures User Guide*. Retrieved from

UNCTAD. (2019). *International Classification of Non-Tariff Measures*. In UNCTAD (Ed.), (2019 ed.).

Vial, V. (2006). New estimates of total factor productivity growth in indonesian manufacturing. *Bulletin of Indonesian Economic Studies, 42*(3), 357-369. doi:10.1080/00074910601053227

Walmsley, T., & Strutt, A. (2019). *Improving the Modelling of Non-Tariff Measures in a CGE Framework*. Paper presented at the 22nd Annual Conference on Global Economic Analysis, Warsaw, Poland.

World Bank. (2020). *World Development Report 2020 : Trading for Development in the Age of Global Value Chains*: Washington, DC: World Bank.