Trade Liberalization and Productivity ff Manufacturing Industry in Indonesia: The Role of Intermediate Input Import Intensity

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Abstract

This study aims to analyze the role of intermediate input import intensity in the mechanism of how trade liberalization affect plant productivity. The estimation strategy used in this paper is Olley Pakes Methodology which accommodate the control for simultaneity problem and selection bias. The international trade policy used in this paper is Most Favored Nation (MFN) Import Tariff constructed by using 10 digit HS code World Bank Data matched with Manufacturing Industry Intermediate Input Structure from Statistics Indonesia with total of 144,856 observations in 2010 – 2015. The import tariff is separated to output tariff and input tariff then interacted with intermediate input import intensity in 5 digit code disaggregation for each company. As robustness check, every result in this research is compared with Ordinary Least Square (OLS) to ensure that the simultaneity problem and selection bias is solved during the process. The results confirm the mechanism explained by literatures that there is reduction of competition effect raised by liberalization in output market based on the company's import intensity. This study also found that there was a decline in the productivity of manufacturing industry during the trade policy paradigm towards protectionism. By modifying United Nation Industrial Development Organization (UNIDO) categorization of Medium High & High Technology Industries combined with Medium Technology Industries, Low Technology Industries, and Resource-based Industries, the result shows that the most effective trade liberalization policy in Indonesia is in Low Technology Industries.

Keywords: productivity, trade liberalization, olley pakes, import intensity, tariff

Background

Research on the impact of the trade liberalization reflected through the reduction of import tariff on output and input on productivity conducted by Amiti & Konings (2007) has been widely accepted and confirmed by various studies (Nataraj, 2011; Sulistiantoro & Hastiadi, 2019; Maulina & Damayanti, 2019; Verico & Pangestu, 2020; Verico, 2021) but the mechanism explaining how productivity increase due to trade liberalization is still a long discussion and produces mixed conclusions both theoretically and empirically (Luong, 2011).

The diverse explanation happens due to the difference perspective of the research. Some research support the trade liberalization while some others believe that there is still protection needed in the era of high liberalization.

Although it has succeeded as the first study to address the gap regarding input tariff and its effect on productivity, Amiti & Konings (2007) also presents a discussion that there is a channel can not be explained on how productivity effects occur when output tariffs or input tariff changes. In terms of output tariff reduction, many studies have found that productivity increases occur due to import competition (Pavcnik, 2002; Amiti & Konings 2007; Hastiadi & Sulistiantoro, 2019). However, Amiti & Konings (2007) recognize that in reality, firms in import competition may prefer to import their input or intermediate input rather than compete with import goods by using intermediate input available in the domestic market. This cause the possibility of an offset between the competition effect and the effect occurred when firms import their intermediate input. Therefore, further explanation is needed on the transmission that occur between change in output tariff and change in productivity.

The possibility of offsetting the competition effect especially for Indonesia is interpreted from a different perspective by Kis-katos & Sparrow (2015). Although the study was not conducted specifically for the manufacturing productivity, but Kis-katos & Sparrow (2015) contributed to the literature by providing additional important intuituition on how the effect of trade liberalization through output tariffs and input tariffs takes place through labor market mechanism so it creates an effect on poverty in Indonesia.

Kis-katos & Sparrow (2015) said that in the short run, trade liberalization will increase competition in regional output markets through output tariffs. This transmision has a tendency to increase poverty especially in the short run analysis but in the other side has poverty reducing effect in the long run. On the other hand, the decrease in the price of imported intermediate input goods from the decrease in input tariff shows a large magnitude effect or at least large enough to neutralize the increase in poverty with the increase in competition from the decrease in output tariff. That is how the offset to the competition effect occurs according to Kis-katos & Sparrow (2015).

The discussion is still open from the side of input tariff reduction. Intuitively, firms that import raw materials can get direct benefits with the technology contained in the imported input goods. However, when Amiti & Konings conducted their research in 2007, it was not possible to explain the exact channel that caused the increase in firm productivity as a result of input tariff reduction.

Luong (2011) tries to answer this question and says that all these possibility can occur depending on which market is liberalized, whether the input goods market or the output goods market. The variable of interest used in Luong (2011) to achieve this goal is the import intensity of intermediate inputs by firms and interacts it with both output tariffs and input tariffs. Luong (2011) argue that the import intensity will provide an explanation of how the effect of outout tariff and input tariff on productivity occurs, Luong (2011) fulfill the gap that is still left in the area of trade liberalization and productivity.

The relevance of conducting an analysis of the effect of trade liberalization on manufacturing productivity in this study is still quite high even though this study was conducted at a time when tariff levels were already very low compared to two decades ago when Amiti & Konings (2007) conducted their research. Pangestu et al., (2015) examined international trade policy in Indonesia over a period of 50 years from 1965 – 2015. The research explained that trade policy has historically been influenced by many factors including the level of development of a country, the conflict between protection and openness, as well as expernalities suc as commodity boom, increase competition, and the development of international commitments such as bilateral, regional, and multilateral agreements. The policy is rolling and has the possibilities of repeating itself.

The repetition of policy pattern mentioned in Pangestu et al., (2015) can bee seen at the period of 1965 – 1971 when import quota policy was widely used and then being changed in 1990 – 2000 when Indonesia joined WTO mempership; so the economic openness increased rapidly and import tariffs were cut massively. However, the direction of this policy is indicated that there is a slow lead to protection after the global financial crisis in 2008.

This study confirm Nehru (2013) and Kis-katos & Sparrow (2015) regarding the possibility of a change in the direction of Indonesia's trade policy and protectionism. Most Favored Nations (MFN) tariff data for Indonesia shows that the trend of increasing import tariffs has slowly increased especially since 2014. MFD ad valorem tariff data for all economic sectors show an increase (Figure 1). In terms of percentage level, the tariff applied in 2018 is the highest tariff level for twelve years since 2006. This trend confirms the explanation of Pangestu et al., (2015). In addition, the slope of the tariff is steeper for averall sector (Figure 1 and Figure 2).

This study aims to answer the question of how trade liberalization through output tariff and input tariff policies affect the productivity of manufacturing firms in Indonesia based on the level of import intensity of the firm's intermediate input. The result obtained in this study are presented based on the categorization of UNIDO (2016) and Bappenas & IDB (2020).

Theoretical Review

Basically, there is no such things as final tariff or output tariff and input tariff in trade policy. The government of a country makes a decision to impose import tairffs on imported goods based on the type of product or classification of goods. One of the classifications used internationally is known as HS code or Haminized System (HS) codes. The HS code is a harmonized system providing standardized numerical codes used as classifying products traded in international trade activities among countries in the world. By using this standardized classification or code, a product can be recognized more easily and quickly without having to explain using long words. In other words, the HS code is a universal language to give an exact name to a product in international trade (UNSD, 2021).

In complex economic activities, goods produced by a production activity as output or final goods can become raw materials or intermediate input for other production activities in other industries sectors. For example, fresh shrimp, which is the output of the fisheries subsector in the agricultural sector, can be an input for the packaged shrimp paste industry in the food industry sector. The output of this packaged shrimp paste can be an input for shrimp cracker industry in food and beverage sector. Thus, it can be seen that standardizes classification codes allow a product to be fast tracked as information on the stucture of intermediate input in a certain economic activities, in this case are activities in the manufacturing industry.

There are various source that can be used as information on the structure of intermediate inputs in the manufacturing industry, including the Input-Output table (I-O table) produced in a standardized rule by National Statistics Office (NSO) or Statistic Agency in any countries in the world. This table is compiled with international standars based on the System National Accounts (SNA). The I-O table has a symmetrical (square) dimension in the form of details (product x product) consist of three-digit level code information of the product-based of Indonesian Standard Commodity Classification (KBKI) in rows and three digit level information of the activity-based of Indonesian Standard Business Field Classification (KBLI) in columns.

However, I-O table are not compiled every year by the NSO of a country. For example in Indonesia, the latest I-O table is in 2010 and 2016. In other words, this table has limitation of being compiled at one specific point of time or year within a period. In addition, the level of aggregation of this table is quite high where the classification of products and activites is at three-digit level of the KBKI and KBLI classifications (Badan Pusat Statistik, 2021). The input structure of the manufacturing industry in the I-O table of Supply Use Table (SUT) which is

the forerunner of the I-O table is data source used in Kis-katos & Sparrow (2015) and Maulina & Damayanti (2019) to separate output tariffs and input tariffs.

As there are may types of classification in international trade activites, some informations are needed to bridge the various existing codes called correspondence (BPS, 2012). With this correspondence step, researchers in international trade consentration, especially those who use intermediate input structure with a high level of disagregation in discussing international trade liberalization, perform theoretical and empirical separation of tariffs in international trade liberalization research are known as output tariffs and input tariifs (Amiti & Konings, 2007; Amiti & Cameron, 2012; dan Sulistiantoro & Hastiadi, 2019).

In the development of research that uses input tariffs and output tariffs as main variable, Kis-katos & Sparrow (2015) combined the analysis tof the effect of trade liberalization on labor market as well as the regional analysis in terms of poverty rate at the district or city level and confirmed the estimation results of Amiti & Konings (2007). Amiti & Konings (2007) said that the effect of change in input tariffs has a greater sensitivity than output tariffs. The sensitivity of this effect is reflected in the magnitude of input tariffs which is larger than the magnitude of output tariffs.

Kis-katos & Sparrow (2015) presents evidence that the effect of input market liberalization is more direct than the effect of output market librealization. Output market liberalization the short run analysis has tendency to increase poverty, while in the long run analysis it has a tendency to decrease poverty. This presumably due to the costly adjustment to trade or the adjustment process to international trade that is known as costly process especially in the short run. In addition, the competition effect occuring through a decrease in output tarifss is highly dependent on the speed of labor market to make adjustments or in other words, in the scope of this study, the competition effect of output market liberalization is more direct. Kis-katos & Sparrow (2015) explain that the benefit of competition effect depends on the speed of adjustment of labor market.

Although Kis-katos & Sparrow (2015) did not specifically aim to see the effect of trade liberalization on productivity of manufacturing industry, the intuition built by Kis-katos & Sparrow (2015) regarding tranmission mechanism of how output tariffs and input tariffs effect other economic sector is an essential reference. The argumentation elaborated in Kis-katos & Sparrow (2015) about the possibility of an offset in the mechanism of the effect of output tarifss through competition effect by a decrease in input tariffs on poverty confirmed the statement of Amiti & Konings (2007) on page 1617 by refering to Corden (1971) in his book entitled The

Theory of Protection which said that a reduction in input tariffs can reduce the import competition effect raised by output tariff reduction.

The meaning of competition effect mentioned in Kis-katos & Sparrow (2015) is that when output market liberalization occurs, there are sectors that will disproportionately lose protection. Under these conditions, a reduction in input tariffs can reduce the cost of production, thus it will encourage firms to become more competitive in the market. The sensitivity of magnitude offect of this input tariff reduction will generally be greated to neutralize or to reduce the increase of poverty caused by output market liberalization.

Therefore, if the logical reasoning constructed by Kis-katos & Sparrow (2015) is brought to the scope of manufacturing industry, when there is a reduction in output tariffs will cause firms losing protection or the level of protection becomes lower. It means there is a higher competition in the market. Furthermore, there will be an exit process for companies that can not survive the existing competition. In this situatuon, a policy to reduce input tariffs is simultaneously applied, there will be a direct effect in the form of cost production decreasing as well as indirect effect such as learning effect. Thus, it will be able to reduce high competition effect occurred due to liberalization in output market.

The process of firms exits from the market during the competition effect shows that trade liberalization is not necessarily always beneficial for all parties (Amiti & Konings, 2007). Some empirical studies confirm this opinion by revealing that some firms will experience barriers to exit (Dani Rodrik (1988) in Amiti & Konings (2007)). If the exit process in the market is not controlled in a research, there will be selection bias in the analysis. Olley & Pakes (1996) was the first study to address the problem of selection bias in term of firm productivity.

Amiti & Konings (2007) then modify the estimation model of Olley & Pakes (1996) by using import decision variable and export decision that is assumed to be made by firms in period year-1 to control for potential simultaneity problems when firms make decisions related to the choice of input for production process in the following year. The firm's decision to import and export explained by Amiti & Konings (2007) considered as an endogenous factor that affects the productivity level. In this study, the intuition of Amiti & Konings (2007) is developed using main model of Luong (2011). The main variable in Luong (2011) is not import decision but the import intensity of intermediate inputs. Simultaneity problem in this study is controlled by using productivity in previous year as a proxy for nobserved productivity shock implemented in STATA packaged developed by Yasar et al., (2008). The hypotheses in this study are trade liberalization through output tariffs and input tariids has a negative effect on firm productivity and if the effect is in the same direction with its interaction with import intensity, then the firm

with higher level of import intensity will relatively experience higher productivity change. However, if the direction is opposite, the effect on productivity will be reduced depending on the level of import intensity of the firm.

Empirical Method

To determine the role of import intensity on the effect of trade liberalization on productivity of manufacturing industry in Indonesia 2010 – 2015, the data are taken from several sources with the description in Table 1. The estimation process is adopted from Amiti & Konings (2007) begins with the mathematical model equation as follows:

Production fuction:

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

In log natural form:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + e_{it} \quad (2)$$

e_{it} — η_{it} : *white noise*

e_{it} — ω_{it}: *unobservable productivity shock*

Amiti & Konings (2007) said that the firm's investment decision is determined by the level of productivity and capital accumulation in the previous year, then this argument can be expressed as $I_{it} = i_t(k_{it}, \omega_{it})$. With the modification made by Amiti & Konings (2007) then $I_{it} = i_t(k_{it}, \omega_{it})$ becomes $I_{it} = i_t(k_{it}, \omega_{it}, FM_{it}, FX_{it})$ with inverse form:

$$\omega_{it} = h_t(k_{it}, I_{it}, FM_{it}, FX_{it}) \quad (3)$$

Therefore from equation (2):

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + e_{it}$$
$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_0 + \beta_k k_{it} + \omega_{it} + \eta_{it}$$
$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_0 + \beta_k k_{it} + h_t(k_{it}, I_{it}, FM_{it}, FX_{it}) + \eta_{it}$$
$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \emptyset_{it}(k_{it}, I_{it}, FM_{it}, FX_{it}) + \eta_{it} \quad (4)$$

with $\emptyset_{it}(k_{it}, I_{it}, FM_{it}, FX_{it}) = \beta_0 + \beta_k k_{it} + h_t(k_{it}, I_{it}, FM_{it}, FX_{it})$ (5)

$\emptyset_{it}(.)$ is used to control unobserved productivity shock. In general, the measure of unobserved productivity shock is reflected through total factor productivity (TFP). The predicted parameter obtained from equation (4) is used to measured TFP in nonparametric procedure as follows:

$$tfp_{it}^{k} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} - \hat{\beta}_k k_{it} \quad (6)$$

$$tfp_{it}^{k} = \gamma_0 + \alpha_i + \alpha_{lt} + \gamma_1(output\ tariff)_t^k + \gamma_2(input\ tariff)_t^k + \gamma_3(input\ tariff)_t^k FM_{it} + \gamma_4 FM_{it} + \varepsilon_{it} \quad (7)$$

α_i : *firm fixed effect* (*individual unobserved time invariant heterogeneity*)

α_{lt} : *land time variant fixed effect* which is the interaction between year and year.

Island dummy is 1 id located in Java Island and 0 jika otherwise

$(output\ tariff)_t^k$: output tariff at 5 digit KBLI agregation level

$(input\ tariff)_t^k$: input tariff at 5 digit KBLI agregation level

FM_{it} : import decision of firm i in year t

To determine the roleof import intensity on the effect of trade liberalization on productivity, this study use model as follows:

$$tfp_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} - \emptyset_{it}(k_{it}, I_{it}, FM_{it}, FX_{it}) \quad (8)$$

This equation then adjusted to the TFP estimation technique conducted by Yasar et al., (2008). Form the TFP obtained in the first procedures, a panel data regression will be conducted using the specification by Luong (2011)

$$log\ (TFP_{it}) = \rho_0 + \rho_{islandyear} + \rho_1 otariff_{jt} + \rho_2 itariff_{jt} + \rho_i itariff_{jt} firminten_{it} + \rho_o otariff_{it} firminten_{it} + u_{jt} \quad (9)$$

$log\ (TFP_{it})$: *TFP* of firm i in year t

$otariff_{jt}$: *ad valorem* output tariff at 10-digit HS code corresponded to the 5-digit KBLI of firm i in year t

$itarif_{jt}$: weighted tariff (ad valorem) based on 5-digit KBLI input structure and then is merged with firm i in in 5-digit KBLI in year t

$firminten_{it}$: import intensity of firm i in year t to the total value of raw material

$\rho_{islandyear}$: island dummy variable interacted with year as control for productivity shock originating from island location

Indonesia is an archipelago country with large population and complex and diverse economic activities. Therefore, to avoid misinterpretation of the result, this study use industrial grouping based on the United Nations Industrial Development Organization (UNIDO) in 2016 which compiled The Industrial Statistics Guidelines that presents several industrial grouping, one of which is based on the technology intensity (UNIDO, 2016).

Technological intensity for classifying industries by UNIDO is based on the Research and Development (R&D) expenditure that accompanies the production process of manufacturing companies in a country. Manufacturing indurtries with higher R&D expenditure intensity are classified as higher technology industries. R&D expenditure intensity in UNIDE classification is the ratio of R&D expenditure to output measure. Data on R&D expenditure intensity was released by the OECD in 2016 which also proposed a systematic classification for industry group with different relative R&D expenditure range. UNIDO created industry classification based on technology intensity named as follows: (a) Medium High and High Technology (MHT), (b) Medium Technology, and (c) Low Technology.

The systematic classification is slightly different from the classification made by OECD which consists of four categories by separating high and medium high technology UNIDO (2016). However, UNIDO (2016) explained that a classification with three categories is considered more appropriated especially for developing countries because high technology industries in developed countries such as industries for space research are rarely found in other countries.

The grouping done by UNIDO (2016) for ISIC revision 4 has been applied in the classification in Indonesia (KBLI) so that it can simplify the grouping as the numerical code used in the same as the KBLI in Indonesia. UNIDO (2016) initially consisted of three categories into two categories namely (1) combined MHT and Medium technology Industries and (2) Low Technology Industries. For the grouping Resource-based Industry used in this study based on Bappenas & ADB (2019). Please note that the exclussion within UNIDO are also excluded in this study so that the combined MHT, medium, and low technology groups will have smaller number of observations than when it is presented for the analysis for all sectors. The following groupings have been adjusted to the translation names in the Indonesian KBLI in two digit sectors. The data used in this study comes form various sources as mentioned in Table 1 of the appendix after bibliography.

Result and Discussion

Trade liberalization has grown rapidly over time. Pangestu et al.,(2015) explained that the paradigm of trade policy in the country will alternated and adjust to global economic condition. In one phase, trade policy can implement policies that lead to protection, at other times trade policy can implement policies that lead to liberalization. These implication are not always black and white It is often the combination of the two.

For example, before 1995 when Indonesia joinde the World Trade Organization (WTO), the policy was more directed towards protection policies both in terms of tariffs and nontariffs barriers (NTMs) in the form of import barries such as the application of import certificated and import quotas which are now increasingly abandoned. After 1995, following WTO membership, tariff reductions were sharply implemented. Several studies conducted during this period managed to capture the phenomenon of benefit and challenges especially for developing countries in facing the international trade in early stage.

The productivity of manufacturing industry is now strongly connected to international trade policies. Therefore, international trade policy needs to be studied in relation to its mechanism of influence of manucaturing productivity. A high-productivity manufacturing industries will be a solid backbone for national economy. Verico (2021) said that although the growth of the manufacturing industry in Indonesia is still below the service sector, its ability to absorb labor in formal sector is one of the reasons to maintain the focus of policy and research in productivity of manufacturing industry.

During the period of study, both output and input tariffs have been at very low levels. Input tariffs are close to zero percent with an average of only 1.902 percent. Output tariffs as general are above input triffs but also at a low average of 7.31 percent. The correlation between output tariffs and input tariffs in this study of 0.27 is much lower than in Amiti & Konings (2007) which has correlation of 0.66.

After estimating TFP with both Olley & Pakes (1996) and Ordinary Least Square (OLS) method, Table 2 shows that the estimation with OLS has an upward bias compared with Olley & Pakes (1996). This result confirms the study of Amiti & Konings (2007). In addition, estimation using OLS can experience endogeneity disturbance in the form of simultaneity problem and selection bias.

The estimation step to determine the effect of trade liberalization on productivity is then carried out as the rule for conducting robustness checks on the model, namely by using one variable of interest first on this case is the output tariffs. As in previous stueds, the inclusion of input tariff causes a decrease in the magnitude of output tariff variable. However, the parameter values of this variable can be said to be stable in all four steps with a stable standard errors as well. This is possible because in the previous stydt, the breakdown of correlation between output tariff and input tariff was quite high at 0.66 in Amiti & Konings (2007) while in this study is only around 0.27.

The main model specification in this study for all sectors can be seen in Table 3 in column 1 where all parameters are statistically significant at 1 percent level except for the

interaction between output tariff and intermediate input import intensity (firminten). To be compared with the interpretation done by Amiti & Konings (2007) that a 10 percent reduction in input tariffs at that time was associated with a 12 percent increase in productivity where 3 percent came form the indirect effect (coefficient of the input tariff variable) and 9 percent came from the direct effect (cofficient of the interaction variable of input tariff with import decision dummy), then in this study the interpretation of the main model column 4 of table 3 is that every 10 percent reduction in output tariffs is associated with 1.7 percent increase in productivity, where the increase will be lower for firms with higher levels of import intensity. This can bee seen from the interaction coefficient between output tariff and import intensity (firminten). To be able to give meaning to this parameters of interaction variable. It can not be separated from the interpretation for input tariffs.

This research was conducted using unbalanced panel data with six years period 2010 – 2015. To facilitate description and interpretation of all categories, a summary of the main dmodel estimation results is precented in table 3. The merging of the MHT and Medium Technology Industries categories id done to keep the number of observations in each category not too lame so that the level of variation can be mantained. From the table, it can be seen that the from the total 26,242 companies in all sectors or the total number of observations form 2010 – 2015 which is 111,485 observation, 73 percent are in Low Technology Industries category. This dominance also illustrated the structure of Indonesia's manufacturing industry based on the intensity of its technology use. Contraductorily, it turns out that this dominating category of companies has the lowest average resilience among others. This can be seen from the average series size of 4.62 out of maximum series of 6 years study.

In term of statistical significance, please keep in mind that Indonesia is a small open economy. It can be seen that tariff reduction is most effective to increase productivity in Low Technology Industries category which dominated the structure of manufacturing industry in Indonesa. For the MHT and Medium Technology Categories, the policy of reducing input tariffs remains effective but the increase in productivity through output tariffs is not significant.

However, please note that even though the reduction of import tariffs is most effective in increasing productivity in low technology industries, the gain from trade liberalization is still higher than the increase in tariffs because the increase in tariffs imposed by small open economies will not able to change the world demand of world price. In addition, the large magnitude of the input tariff variables indicate that both importing firms and firms using domestic intermediate inputs can obtain high productivity gains through indirect effect or learning effect as how Amiti & Konings (2007) construct the intuition of this transmision.

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Appendix

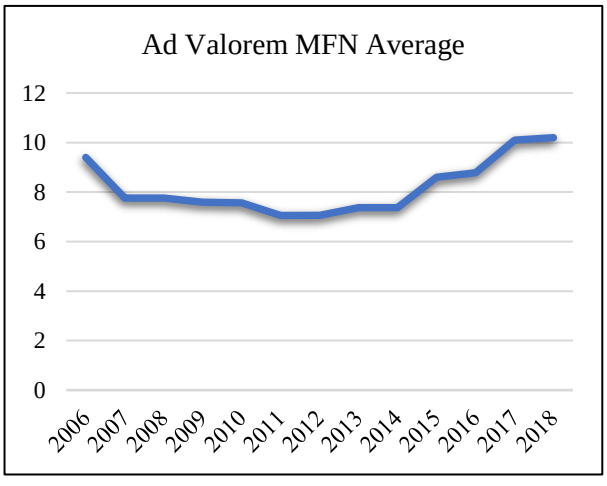

Figure 1. MFN *ad valorem*
Source: WITS (processed)

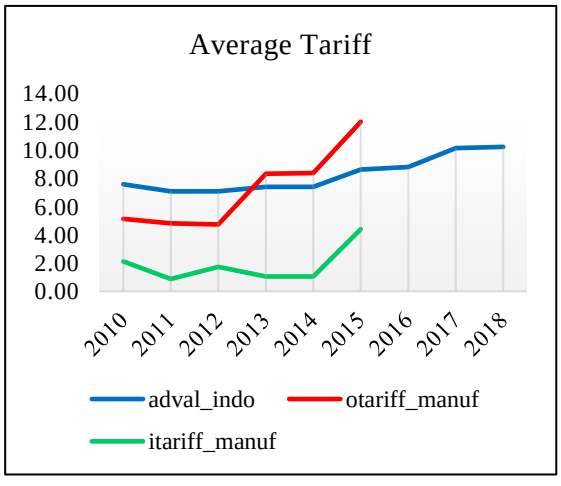

Figure 2. Average Manufacturing Industry Tariffs
SSource: WITS dan BPS (processed)

Table1. Data dan Data Source

No	Data	Data Source
1	Characteristics of manufacturing industry companies in Indonesia 2010 – 2015	Medium Large Industry Survet 2010 – 2015 from Statistics Indonesia or Badan Pusat Statsitik (BPS)
2	Manufacturing Industry Input Structure Table 2010 – 2015	Publication of Industrial Raw Materials Statistics 2010 – 2015 from Statistics Indonesia or Badan Pusat Statsitik (BPS)
3	Correspondence Table of KBKI with KBLI and HS code	Compilation from Statistics Indonesia or Badan Pusat Statsitik (BPS)
4	Import Tariffs on input and output goods *Most Favored Nation* (MFN)	Website of WITS (*World Integrated Trade Solution*) from World Trade Organization
5	*Producer Price Index* (PPI) or Indeks Harga Produsen (IHP) 2010 – 2015	Statistics Indonesia or Badan Pusat Statsitik (BPS)

Table 2. Coefficient Estimated of ln Total Factor Productivity

Dependent Variable: Ln output	***All Sectors***		***MHT & Medium Technology***		***Low Technology***		***Resouce-Based***	
	OLS	**Olley Pakes**	**OLS**	**Olley Pakes**	**OLS**	**Olley Pakes**	**OLS**	**Olley Pakes**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
lnelectq	0.0982	0.0637	0.0637	0.0641	0.1036	0.0612	0.0690	0.0492
lnlabor_all	0.3231	0.3220	0.3223	0.2986	0.3217	0.3317	0.3070	0.2936
lnrawt_def	0.6513	0.6415	0.6703	0.6484	0.6482	0.6452	0.6942	0.6792

Table 3. Estimation Results all Categories

Dependent Variables Ln TFP	***All sector***	***MHT & Med***	***Low***	***Resource-Based***
otariff	-0.00172***	-0.00052	-0.00192***	-0.00009
	[0.00020]	[0.00068]	[0.00021]	[0.00026]
itariff	-0.00592***	-0.00537*	-0.00626***	-0.00146
	[0.00093]	[0.00210]	[0.00109]	[0.00118]
it_firminten	-0.00006**	-0.00002	-0.00012**	-0.00001
	[0.00002]	[0.00003]	[0.00004]	[0.00003]
ot_firminten	0.00002	-0.000001	0.00003**	0.00001
	[0.00001]	[0.00002]	[0.00001]	[0.00001]
constant	4.290***	4.428***	4.163***	3.922***
	[0.00502]	[0.00976]	[0.00604]	[0.00566]
Obsertion	111,485	29,380	81,675	52,225
Companies in Total	26,242	7,127	19,680	12,725
Average series (year)	4.67	4.92	4.62	4.70
Max series (year)	1	1	1	1
Min series (year)	6	6	6	6

Standard errors in brackets

** p<0.05, ** p<0.01, *** p<0.001*

Tabel 4 Variables

No	Symbol	Meaning	Operational Variable
1	lny_def	ln Output (*value goods traded*)	Ln (value of output prodices, deflated by IHP 5 digit KBLI)
2	lnelecq	ln electricity (kWh)	Ln (kWh electricity PLN & non) as an approximation for capital utility
3	lnlabor_all	ln total labor	Ln (total labor)
4	lnrawt_def	ln revenue total inputs	Ln (value total intermediate input, deflated with IHP 5 digit KBLI)
5	otariff	Output tariffs	MFN ad valorem, correspondences between HS code and 5-digit KBLI
6	itariff	Input tariffs	Weighted average of each input with correspondence from KBKI / KKI & HS
7	firminten	Import intensity	Persentase rasio impor & total input pada level perusahaan
8	it_firminten	Interaction between it and firminten	Interaction of input tariffs and import intensity of firms
9	ot_firminten	Interaction between ot and firminten	Interaction of output tariffs and import intensity of firms
10	prprex	Export percentage	Percentage of the firm's exported output
11	dasing	persentage(*foreign share*)	Percentage of ownership by foreign company
12	prodwork	production workers	Percentage of paid production worker to total workforce
13	dumim	dummy import decision	dumim = 1 if in year t the company imports > 0
12	dumdasing	dummy *foreign share*	dumdasing = if in year t foreign share > 10% (10 percent based on Amiti & Konings (2007)
13	dummyex	dummy export decision	dummyex = 1 of om year t the firm's export > 0
14	islandyear	Interation island and year	islandyear = 1 if the firm is located in Java Island and 0 otherwise. Used to control productivity shocks occurred due to location and time.