IJEM
International Journal of Economics and Management
Journal homepage: http://www.ijem.upm.edu.my

Anti Dumping Policy and Heterogeneity Responses on the Productivity of Domestic Import-Competing Firms: Evidence from Indonesia

DITANIKA KARISMA NUR TRISTITA[a*] AND MADDAREMMENG A. PANENNUNGI[a]

[a]*Faculty of Economics and Business, Universitas Indonesia, Indonesia.*

ABSTRACT

This research aims to estimate the effects of antidumping protection policy on the productivity of domestic import-competing firms using Indonesian antidumping cases data and manufacturing sector firms level data from 2003 to 2014. Difference-in -difference approach is used to figure out the productivity effects differences of antidumping policy implementation among sectors which already got protection and sectors that had applied protection but failed. The empirical evidence indicates that the average productivity growth of firms receiving protection increases significantly. When the protection was applied, the productivity of domestic import-competing firms increased 20.9% higher than the productivity of firms which never got any protection. Statistically, there is firm heterogeneity response among protected domestic import-competing firms, in which the low-initial productivity firms increased their productivity more than the high-initial productivity firms during the protection. However, empirical finding shows that the difference is relatively small.

JEL Classification: D24, F13
Keywords: Antidumping; firms' heterogeneity; Indonesia; productivity

Article history:
Received: 22 June 2018
Accepted: 18 November 2018

[*] Corresponding author: Email: ditanika.knt@gmail.com

INTRODUCTION

The openness of international trade has been an interest among researchers; one of the issues focuses on the impacts on productivity. The effects of trade policy (tariff reduction and/or tariff protection) on productivity have been extensively discussed in the literature[1]. Recently, researches on this issue have considered firms' heterogeneity concept. This concept emphasizes that the effects of trade policy will be responded differently among firms based on their initial productivity (Lileeva and Trefler, 2010). The firms with low initial productivity will have higher expected-productivity gain rather than those with high initial productivity, when the market size increases. Higher expected-productivity gain makes the low initial productivity firms have higher incentive to invest in productivity; while the high initial productivity firms do the opposite. The concept of firms' heterogeneity is important to be considered because it indicates that the benefit of trade policy among firms is different.

Although tariffs on industrial goods show a downward trend over time, their decreasing has been in accordance with the use of trade protection instruments. Specifically, antidumping protection policy has been intensively used in the last decade (Konings and Vandenbussche, 2008). According to Antidumping Agreement (1994), antidumping policy is the enforcement of tariffs on goods which is proven to be dumping goods, i.e. sold goods are cheaper in export destinations rather than in their home country. The increasing of antidumping protection makes this policy become an issue that has been widely reported in various studies, specifically related to its impacts on import volume (Alhayat, 2014; Brenton, 2001; Ganguli, 2008; Konings, Vandenbussche, and Springael, 2001; Prusa, 1997; Tjahjasari, 2015), on market power/industrial markup (B. Blonigen, Liebman, and Wilson, 2007; Konings and Vandenbussche, 2005; Nieberding, 1999; Rovegno, 2013), and also on productivity (Chandra and Long, 2013; Konings and Vandenbussche, 2008; Pierce, 2011). Among these studies, the empirical study that focused on the impacts of antidumping protection to domestic import-competing firms' productivity is very limited.

In particular, only few empirical studies analyzed the impacts of antidumping protection to domestic import-competing firms. Konings and Vandenbussche (2008) and Pierce (2011) taking developed countries in their case studies. However, the results are contradictive. The differences of quantity units of productivity become the main issue in those studies. Konings and Vandenbussche (2008) stated that antidumping protection raised the revenue productivity of the protected sectors in EU. Meanwhile, using US case study, Pierce (2011) showed biased relationship between antidumping protection policy and revenue productivity. In US cases, revenue productivity increased due to the higher prices and margin, not because of the inceases in physical productivity. Furthermore, antidumping duties lead the low-productivity firms to continue their production rather than to stop. It decelerates the reallocation of resources.

So far, limited to our knowledge, studies on the impacts of antidumping policy on productivity in developing countries have never been reported. Takii (2014) proposed some principal differences between developed and developing countries which could affect the differences of empirical study result regarding trade policy impact. The differences are partly due to the fact that most of the world's leading technologies are under multinational firms based in some developed countries. In developing countries, the research and development (R&D) activities are limited; so one channel to access advanced technology is by importing material inputs. Therefore, it can be concluded that there are behavioral differences between developed and developing firms. In the case of antidumping policy, when protection is applied, the imports will decline and the price of goods (output) will increase; then domestic firms are able to produce more output. To produce more output, the production process requires more imported raw materials input which quality is better. Therefore, the impact of trade policy on firms' productivity is predicted to be greater when it is applied in developing countries than being applied in developed countries. The study of Takii (2014) is seen from the impact of input tariff on productivity in developing countries. However, it could help us to explain the difference result between our study and previous study in developed countries.

In Indonesia, studies of antidumping protection mostly evaluated its impacts on import volume (Alhayat, 2014; Tjahjasari, 2015). A study of trade policy (tariff reduction) and productivity of manufacturing industry was done by Amiti and Konings (2007) by looking at the impacts of changes in the rate of input and output tariffs

[1] Most of these empirical evidences proved that tariff reduction increases productivity (Amiti & Konings, 2007; Fernandes, 2007; Pavcnik, 2002; Schor, 2004; Topalova & Khandelwal, 2011), while other findings showed that tariff protection increases domestic import-competing firms' productivity (Konings & Vandenbussche, 2008; Pierce, 2011; Chandra & Long, 2013).

on firms' productivity. Input tariff reduction raises the firms' productivity through learning process and quality effect, while output tariff reduction can increases firms' productivity by generate tighter import competition. The study showed that the input tariff reduction significantly increased firms' productivity more than the output tariff reduction. The study also evaluated the heterogeneity responses of firms by interacting the input tariff and the firms' status of importing raw materials. It proved that the input tariff reduction firms importing their raw materials increased more than the firms that did not import their raw materials. Although the study of Amiti and Konings (2007) had confirmed the positive corelation between tariff reduction (especially input tariff) and firms' productivity, the study only focused on overall industrial productivities; it did not explain the impacts to several domestic import-competing firms. In addition, the study had analyzed the impact of output tariff reduction to firms' productivity in Indonesia as developing country, however, the concept between output tariff reduction tariff protection policy, i.e antidumping policy, is slightly different.

Referring to the empirical specification of Konings and Vandenbussche (2008), this study aims to estimate the effects of antidumping protection policy on the domestic import-competing firms' productivity by using difference-in-difference approach. This approach is known to evaluate differential productivity effects of antidumping protection among sectors which got protection and sectors that applied the protection but failed. The firms' heterogeneity is considered using the distance variable that represents the firms' initial productivity related to the frontier firms. This study analyzed the impacts of antidumping protection using antidumping cases and firm level data of manufacturing sector in a developing country, Indonesia; which is different from the previous studies using developed countries as the samples. Furthermore, it also analyzed the impacts of antidumping protection from the perspectives of domestic import-competing firms by considering firms' heterogeneity concept**.** There are at least two important points arising from these empirical findings. First, the average productivity of firms receiving protection improved significantly. Second, there is firms' heterogeneity among protected domestic import-competing firms. The low initial productivity firms gain more productivity than high initial productivity firms during the protection. However, empirical finding shows that this difference is relatively small. These findings are quite different with the finding of Konings and Vandenbussche (2008) which showed that the difference between them was quite large.

The rest of the paper proceeds as follows: section 2, discuss the conceptual used as basic framework in empirical analysis; section 3, explain data and research methodology applied in this study; section 4, discuss the result of the estimation procedures, and section 5, explain the conclusion and implication; and discuss future works.

Trade Policy in Indonesia

Most common used of trading protection instruments for unfair trade is antidumping policy. In Indonesia, the main institution that is responsible to protect domestic industry and domestic market from the unfair trade action conducted by other countries is the Indonesia Anti-dumping Committee (KADI). KADI was established based on the Government Regulation No. 34 of 1996. In line with the assignment conducted by KADI, they are also obliged to disseminate and ratify the rules and regulations from World Trade Organization (WTO) (KADI, 2015).

ANALYTICAL FRAMEWORK

The linkage between tariff and productivity policies can be explained by some theoretical models. The literature debate on this issue has been evolved to the more complex concept, which is firms' heterogeneity. The concept of firm heterogeneity emphasizes that the impacts of trade liberalization will be responded differently among firms. The conceptual framework in this study refers to a model developed by Lileeva and Trefler (2010) which considered firms' heterogeneity concept. In this model, the company aims to maximize profit through the decision to export and/or invest. The function of maximization profit as an export decision is shown by the following equation:

$$\pi_0(E) = \varphi_0[A + E_\tau^{-\sigma} A^*] - EF^E \ldots\ldots\ldots\ldots \text{(1), for E= 0,1}$$

From equation (1), a firm decides to export or not if output (φ_0) exceeds the Melitz cutoff of $\frac{(F^E)}{\tau^{-\sigma}A^*}$. Assuming for fixed cost of investment, the firm can increase productivity from φ_0 to φ_1. Thus, the firm's maximal profit when investing in productivity is:

$$\pi_1(E) = \varphi_1[A + E_\tau^{-\sigma}A^*] - EF^E - F^I \quad \ldots\ldots\ldots\ldots (2)$$

Basically, the problem faced by the firms is when they are indifferent in deciding whether to: exporting and investing, and neither exporting nor investing. The firms' decision can be seen from the differences of the profit gained. From equation 1 and 2, the difference of the profit is:

$$\pi_1(1) - \pi_0(0) = [\varphi_0\tau^{-\sigma}A^* - F^E] + [(\varphi_1 - \varphi_0)A - F^I] + [(\varphi_1 - \varphi_0)\tau^{-\sigma}A^*] \ldots (3)$$

The first and second components show an increase in profit when the firm decides to export without investing and investing without exporting. While the third component shows an increase in profit when the firm decides to export and investing (market size effect). The firm's optimal decision is illustrated in Figure 5, where initial productivity (φ_0) is plotted with productivity gained from investment ($\varphi_1 - \varphi_0$) and it is described as follows: when the productivity is low, the firm will not invest. The firm will export if and only if initial productivity is above Melitz threshold (vertical line); when the firm has already exported, the firm will decide to invest if and only if the productivity gained is above the horizontal line; and when the first and second components of equation (3) are negative, the firm will not export without investing, and will not invest without exporting. In this area, because exporting and investing are complementary, the firm's decision to exporting and investing yields the same profit.

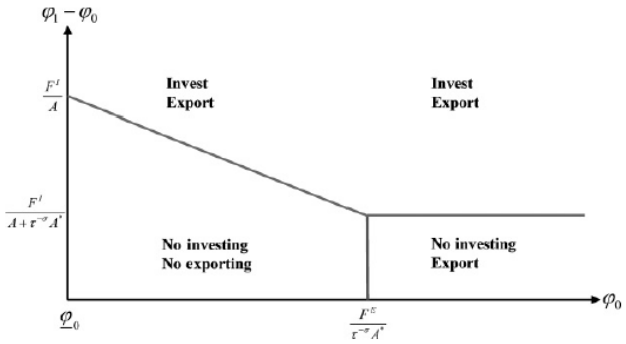

Figure 1 The optimal choices of Exporting and Investing (Lileeva and Tefler, 2010)

For further analysis, it is assumed that in this area, firms must choose between: exporting and investing, or neither exporting nor investing. Firms with high initial productivity have been successful in international market, so their indifferent behavior is due to the low expectation of productivity gained from investing. While firms with low initial productivity are not yet successful in international market so their indifferent behavior is caused by the high expectations of productivity gained from investing. The indifferent firm behavior between these 2 (two) options is if $\pi_1(1) = \pi_0(0)$, or from equation (4) when:

$$\varphi_1 - \varphi_0 = -\varphi_0 \frac{\tau^{-\sigma}A^*}{A+\tau^{-\sigma}A^*} + \frac{F^I+F^E}{A+\tau^{-\sigma}A^*} \quad \ldots\ldots\ldots (4)$$

Equation 4 is depicted as a downward-sloping line in Figure 1. Above the line is the firm chose for exporting and investing but below that line, the firm did not choose both. Next, assuming that there is an increase in access to the international market with a tariff reduction of τ. There are 3 (three) changes depicted by figure 2. First, downward sloping in equation 4 will rotate clockwise around its fixed vertical intercept. That is, some firms that previously did not do exporting or investing then decided to do both. Second, Melitz cutoff (vertical line) will shift to the left where some firms that were not exporting or investing are now starting to do exporting without investing. For this group, increased market access has no causal effect on productivity. Third, the horizontal line will shift down. That is, firms that have been exporting now begin to invest.

The conceptual frameworks developed by Lileeva and Trefler (2010) can be transformed into the context of an antidumping policy as tariff protection policy. When tariff reductions increase the size of a country's market

on the international market and decline the size of the home country, antidumping policy decreases the size of the foreign company's market in a country and increases the size of domestic firm's market. Assuming that imported dumped goods are also exported by domestic firms, the lower-productivity domestic firms are able to start and/or continue their exports and engage in productivity-improving investment. With these decisions, domestic firms are able to achieve their economic scale, increase their output which leads to increased productivity. Higher-productivity domestic firms operating at competitive cost levels are less likely to gain from the market size increase; and have fewer incentives to increase productivity. Thus, it can be concluded that the heterogeneity response of each firm's productivity depends on its initial productivity.

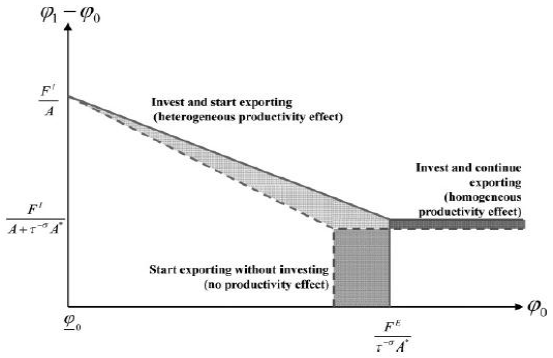

Figure 2 Switching Behaviour of Firms
Source: Lileeva and Tefler (2010)

Based on the conceptual framework developed by Lileeva and Trefler (2010), this study tries to prove that there is a heterogeneity response of firms' productivity as a response of antidumping protection implementation.

RESEARCH METHODOLOGY AND DATA

Estimation of Total Factor Productivity

Estimation of productivity in this study was conducted by calculating the value of total factor productivity (TFP). TFP is known as the residual of the production function. The production function in this study uses the Cobb-Douglas production function, where in a linear form, the Cobb-Douglas production function can be written as follows:

$$y_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 k_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots (5)$$

where y_{it} is log real value added of firm i year t, l_{it} and k_{it} are the log of a number of workers and log of real fixed capital which is proxied to real electricity consumption of firm i in year t, respectively. Studies using total factor productivity estimation had some empirical problems, i.e. *simultaneity bias* and *selection bias* (Van Beveren, 2010). These problems caused the estimation using Ordinary Least Square (OLS) was not being considered because the parameter estimation would be biased and furthermore, the value of TFP would also be biased (Blundell and Bond, 2000; Levinsohn and Petrin, 2003; Van Beveren, 2010; Van Biesebroeck, 2007). Following Van Beveren (2010), assuming that firms' productivity is plant-specific, but time-invariant, the estimation of production function in equation (5) applied fixed effect method. The value of TFP was calculated as the residual which is known only by the firms (β_0) and unobserved residual (ε_{it}). After having the coefficient value of each variable of the production function, the natural logarithm of TFP ($lnTFP$) of each firm i at year t was calculated using this equation:

$$tfp_{it} = y_{it} - \widehat{\beta_1} l_{it} - \widehat{\beta_2} k_{it} \quad \ldots\ldots\ldots\ldots (6)$$

Estimation of Antidumping Impact to Domestic Import-Competing Firms

The main empirical specification of this study refers to by Konings and Vandenbussche (2008). Hence, unlike the previous study, the main empirical specification to estimate the impacts of antidumping protection to domestic import-competing firms in this study was held by direct control from firms' heterogeneity using distance variable. Distance variable for each firm is defined as the ratio of TFP of firm-i towards TFP of the frontier firm, or the firm having higher TFP in the beginning of observation at the same sectors. Referring to Konings and Vandenbussche (2008), the use of distance variable is assessed to capture the initial productivity of firms relative to the most productive firms in the same sector with values ranging from 0 to 1. This variable is aimed to capture the gaps or differences between low initial productivity firms and high initial productivity firms. Mathematically, a distance variable is written as follows:

$$Distance_{i,j,2003} = \frac{TFP_{i,2003}}{Max_j TFP_{j,2003}} \ldots\ldots\ldots\ldots (7)$$

where $TFPi$ is the exponential TFP of each firm and $t = 2003$ is the initial period of the observation. When $the\ distance$ is equal to one, the efficiency of the firm is the same as the frontier firm, whereas when the distance $(dist)$ is equal to zero, the company has the lowest efficiency level. The greater the distance value, the more efficient the firm on the initial conditions. As a comparison, this study also uses initial TFP $(TFPin)$ of each firms to capture the heterogeneity.

Moreover, since the model in the conceptual framework requires the decision of choosing between exporting and investing in productivity, this study deals with the export status of firms. As assumed in the model, the closer distance value is related to the higher export capacity of firms, hence, it is also possible that firms with high productivity level are not exporting. This issue is controlled by using export status of each firms. That two potential issues are then being considered in the main empirical specification as follows:

$$tfp_{ijt} = \alpha_i + \alpha_1\, AD_{jt} + \alpha_2 AD * dist + \alpha_3 AD * \exp + \alpha_4\, d\_crisis_t + \alpha_5\, imp_{jt} + \alpha_6\, capint_{it} + \alpha_7\, lnwage_{it} + \alpha_8\, bbimp_{it} + \alpha_9 mshare + \varepsilon_{it} \ldots\ldots\ldots (8)$$

Where:

1. Total Factor Productivity (tfp): Dependent variable that represents the productivity growth in company i, sector j, and year t
2. Dummy antidumping policy (AD): AD = 1 (one) for the current year of protection and AD = 0 (zero) for the previous year, but only for a group in sector j that gets protection (treated group). As for other companies in the control group, the dummy is 0 (zero). These AD variables are the main variables in which the coefficients are used to capture differences in the impacts of antidumping policies on treated groups and control groups.
3. Distance $(dist)$ is the variable that captures *firms' heterogeneity.* It is calculated as the ratio of TFP of firm-i towards TFP of the frontier firm, or the firm which has the highest TFP in the beginning of observation at the same sector. As a comparison, this study also uses initial TFP $(TFPin)$ to capture the heterogeneity. Initial TFP is defined as the value of productivity of each firm in the beginning of observation or $t = 2003$.
4. Dummy export (exp) describes the export status of firms, where it is equal to 1 (one) if the firms export, 0 (zero) otherwise.
5. Dummy crisis (d_crisis): a dummy that is equal to 1 (one) for 2008 and 2009, and is worth 0 (zero) otherwise. Dummy crisis is used to control the global financial crisis that occurred in 2008 - 2009.
6. Import penetration (imp): variables used to capture import competition (Olper, Curzi, and Raimondi, 2016; Schor, 2004). Penetration of imports is obtained by dividing the value of imports by the value of production plus the value of imports, in sector j at year t (Schor, 2004).
7. Capital intensity $(capint)$: a variable that describes the size of the technology and knowledge attached to the machinery and production equipment in the industry. The higher the use of capital, the higher the productivity in the industry (Oh, Heshmati, and Loof, 2014). The capital intensity is obtained by dividing the expenditure for electricity consumption by the expenditure on wages (capital labor ratio).
8. Wage rate $(lnwage)$: the proxy variable of human capital since the wage rate can reflect the level of education of its workers. The higher wage rates are expected to increase industrial productivity (Oh et al., 2014).
9. The share of imported raw materials $(bbimp)$: variables that capture the proportion use of imported raw materials. The use of imported raw materials is assessed as access to more advanced technology so as to increase productivity (Amiti and Konings, 2007).

10. Market share ($mshare$): variable that controls the initial market size of each firms, which is defined as the proportion of firms' output towards sector's output.

Coefficient of interest in this specification is coefficient variable AD, the interaction coefficient of variable AD and $distance$, and the interaction coefficient of variable AD and $dummy\ export$. The coefficients of the interaction variables $AD * dist$ and $AD * exp$ are expected to be negative. The negative coefficient of variable $AD * dist$ means that the productivity of firms with lower initial productivity increases greater than firms with higher initial productivity. While the negative coefficient of $AD * exp$ reflects the difference of productivity effects between treated and control groups; which is exporting or not exporting. It is assumed in the conceptual framework that the firms already exporting are less affected by the policy because they have already enjoyed their positions in the international market.

In this study, the empirical specification is estimated using *Difference-on-difference (DiD)* where this approach is usually used to evaluate public policy (Abadie, 2005). DiD approach is usually implemented using the interaction between time and group where its coefficient shows the differences between those two groups: treated group and control group of firms. Treated group is a sector group affected by antidumping policy treatment. The treated group is determined based on the Indonesia antidumping case data from 2003 to 2014 (Global Antidumping Database), in which there were 13 (thirteen) sectors involved in submitting antidumping initiation and obtaining protection. In determining the control group, there are 2 (two) potential sources that caused the estimation results to be biased; those are self selection bias and government selection bias. Self selection bias arose because the types of sectors proposing antidumping initiatives were different with those that did not. This source of bias could be controlled by using the same sector group that proposed antidumping initiation, but was rejected by the Government. However, due to the limitations of existing data, the control group in this study was all sector groups who had proposed antidumping initiation but were rejected by the Government. This control group is called terminated control group. Based on Indonesia antidumping case data, there are 4 (four) sectors that included into the terminated control group.

The Government selection bias occurred when the variables used by the Government to assign for protection varied among sectors; and these variables were correlated with productivity. Government selection bias could be controlled by restricting control groups to sector groups who had never proposed antidumping initiation, but had the same protection probability as a sector that proposed antidumping initiation. The group was referred to as the matched control group, which was identified by matched sampling techniques. The matched control group included the sectors that never received AD protection; hence the sectors has high predicted probability of protection. The predicted probability of this sectors is at least equal or higher than 75% of the predicted probability of protection in the group of sectors that did receive AD protection[2]. The dependent variable contains 3 (three) possible outcomes i.e. 'no filing', 'filing and termination' and 'filing and protection'. The explanatory variables that were used to estimate the matched control group referred to the variables used in Konings and Vandenbussche (2008) and Pierce (2011), which are: lagged import penetration, lagged industry employment, lagged labor productivity, GDP growth, and number of previous antidumping cases[3].

Data

Indonesian antidumping data case was obtained from Global Antidumping Databases. The data consist of the specification of protection product that were classified based on 10 digit Harmonized System (HS) 2012 code and converted into 5-digit KBLI[4] code of Badan Pusat Statistik (BPS). From 2003 to 2014 there were 27 (twenty-seven) cases of antidumping initiation in which 17 (seventeen) cases resulted in a protection and 10 (ten) cases were terminated. In contrast to the Konings and Vandenbussche (2008) study which used the antidumping initiation case only at 3 (three) time points in the middle of the observation period, this case study referred to Pierce (2011) using all cases of antidumping initiation during the observation period with differences in the year of initiation and enforcement of protection. From the data of the antidumping initiation cases, it was found overlapping data, i.e: first, in one sector group, there were two different protection decision results namely

[2] The definition of matched control group refers to Konings & Vandenbussche (2008).
[3] In this study, the lagged industry employment and lagged labor productivity variables were transformed in the form of natural logarithm following the Pierce study (2001), which was not done by Konings & Vandenbussche (2008)
[4] Klasifikasi Baku Lapangan Usaha Indonesia is a standard classification for economic activities published by Badan Pusat Statistik (BPS). It is refers to the International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4 published by the United Nations of Statistical Division (UNSD).

protection and termination. For example, the wheat flour sector was initially received protection in 2004, then the protective application was rejected in 2006. For overlapping case, the sector was grouped into a treated group. The second case of overlapping occurred when there were 2 (two) initiation cases in one sector group, such as Hot Rolled Coil initiation in 2006 and 2009 and Hot Rolled Plate initiation in 2008 and 2010. With the limitation of the data, these overlapping cases were still included in the observation.

In addition, this study also applied the data panel of Medium and Large Industrial Manufacturing Sector (IBS). The use of added value rather than gross output as a proxy of output has several considerations. First, by applying the added value, the use of deflator from the material input was no longer necessary, since it was difficult to do when the data did not describe what kind of material was used in the production process. Second, it could avoid the endogenous problem between material input and productivity shock. The use of electricity consumption (kwh) by the firms as a proxy for capital stock value also has several reasons, such as the unavailability of industrial capital stock data in Indonesia. In addition, the electricity consumption is considered to be the most appropriate variable that can describe the addition of the capital. However, in the actual conditions, an increase in electricity consumption does not merely indicate an increase in the amount of capital due to inefficiencies.

RESULT AND DISCUSSION

Treated Group and Control Group

Based on Indonesia antidumping case data, there were 13 (thirteen) sectors involved into treated group and 4 (four) sectors included into terminated control group. Meanwhile, to get a proper control group as counterfactual, the second control group or matched control group was proposed. After estimating the probability of protection for each outcome using multinomial logit regression[5], the predicted probability calculation of sector groups receiving protection was obtained; and the result shows that the 75th percentile of this group is 0.6783713[6]. The value was used as a threshold on the sector proposing for antidumping protection but not getting the protection by its predicted probability. The results show that in the group, there is no sector with predicted probability upper than 0.6783713. This means that in the case of Indonesia there is no government selection bias. Sectors predicting probability as protection have already protected, and vice versa. So the matched control group as an additional control group was not required. Furthermore, this study only used the terminated control group as a comparison group.

Total Factor Productivity (TFP) Estimation Analysis

The production function (equation 5) was estimated using a dataset of unbalanced panel data with 17 (seventeen) industrial sector groups from 2003 – 2014. Estimation result using fixed effect method[7] is shown in the table below:

Table 1 Estimation result of Production Function

Explanatory	Variable's Coefficient		
Electricity consumption (lnK_riil)	0.205	***	[0.008]
Number of workers (lnL_riil)	0.677	***	[0.027]
Constant	5.989	***	[0.143]
Number of observation	7494		
Overall R^2	0.5862		

Notes: * p<0.10, ** p<0.05, *** p<0.01, and standard errors in parentheses

[5] Multinomial logit estimation result is attached

[6] The threshold refers to Konings & Vandenbussche (2008); Pierce, 2011; Blonigen & Park (2004); Chandra & Long (2013).

[7] The selection of this method has been considering the result of panel data regression test with random effect and pooled least square method as a comparison. Despite having empirical problems related to TFP measurement, this study does not focus to address these issues.

The coefficient value in table 1 shows that the elasticity of labor is greater than the elasticity of capital which indicates that the addition of manpower - especially in the short term- will be more effective to increase the production output in certain industrial sectors rather than the addition of capital. After obtaining the coefficient value of the production function variables, the total factor productivity (TFP) value is calculated as a residual production function using equation 6[8].

Distance Variable as Proxy of Firms' Heterogeneity

In this study, the firm heterogeneity is proxied to the distance variable, which is described as the proportion of a firm's TFP to a TFP of the firm which has the highest TFP at the same sector on the beginning of the observation (frontier firm). This variable shows the initial productivity of the firm relative to the frontier firm, which is called as the productivity gap. When the distance is equal to 1, the firm is as productive as the frontier firm, but when the distance is equal to 0, the firm has the lowest productivity level. After calculating the distance of each firm, descriptive statistics of distance variables are shown below:

Table 2 Statistic Descriptive of *Distance*

Variable	No. of Obs	Mean	Std. Dev.	Min	Max
dist	5088	0.14	0.22	0.000016	1

The descriptive statistics above show that the mean and median values of the distance variables are 0.14 and 0.04 with a standard deviation of 22%. It is stated that the median firm's efficiency rate is only 14% or 1/7 of the most efficient level of in the industry, based on its initial productivity. When the variables are plotted, the distribution of productivity is skewed to the left with many inefficient firms and only some firms that are quite efficient. After checking the manufacturing data, it appears that less efficient firms have relatively fewer numbers of workers. Following Konings and Vandenbussche (2008), the distance variables are then weighted towards employment relatively.

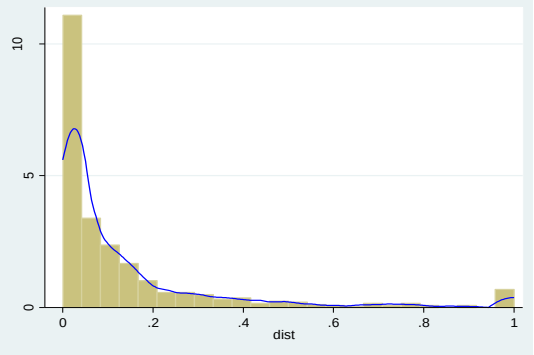

Figure 3 The distribution of *distance* variable

The Effects of Antidumping Protection on Heterogeneity Response of Firms' TFP Analysis

The impacts of antidumping policy (equation 8) were estimated using difference-in-difference (DiD) approach by comparing the total factor productivity (TFP) value of treated group against the control group. The estimation results are shown in table 3[9]. Column 1 using *distance* variable as proxy of firms' heterogeneity, while column 2 *initial TFP* variable as comparison. Coefficient of interest in all specifications are the interaction coefficient between *AD* and *distance* and/or *initialTFP* variables, also the interaction coefficient between *AD* and *export status*. Using *distance* variable as a proxy of firms' heterogeneity, the estimation result in column 1 shows positivity and significant variable *AD* coefficient of 0.209 and the variable coefficient of *AD_dist* is negative and significantly equal to – 0.000049. The similar result is obtained by using *initial TFP* variable as a proxy of firms' heterogeneity. Inserting the mean distance of the used data, the antidumping policy has a positive marginal effect of 0.208 or 20% to increase productivity (0.209 + (– 0.000049 * 0.14)). By looking at the results

[8] The result is attached.
[9] All specifications are estimated with fixed effect method based on Hausman Test results. The results indicate that Fixed Effect estimators are more efficient than Random Effect.

above the estimation, it can be concluded that the impact of antidumping policy on productivity is still positive and significant. Statistically, among protected sectors, there is a heterogeneity response of productivity as an impact of antidumping protection. Low initial productivity firms increased their productivity during the protection higher than high initial productivity firms. This result confirms the theory stating that higher-productivity domestic firms that are effective and efficient are less likely to gain from the market size increase and have fewer incentives to increase productivity (Lileeva and Trefler, 2010). These firms already succeeded in international markets, so that the implementation of antidumping protection affects less to these firms compare to the low-productivity domestic firms. However, the value of the interaction coefficient is too small to show the diversity of productivity response to antidumping protection.

The variable coefficient of AD_exp which is significant and equal to – 0.407 shows the differences between treated and control group of exporters and non-exporters firms when the antidumping protection is applied. The negative sign of the coefficient shows that the exporters firms experienced lower productivity gain from the protection. The marginal effect is equal to 0.198 (0.209 + (– 0.407 * 1)), which means that the exporter firms' productivity gain is 19.8% lower than the non-exporter firms when the protection is applied. The reason why the exporter firms' productivity gain is less than the non-exporters firm or even experienced the productivity losses by the antidumping policy was already explained by Konings and Vandenbussche (2008). The export firms may experience a decline in international markets when antidumping policies lead to counter-action by trading partners. Based on literature of learning-by exporting, the decline in international market access would decline learning gain from exporting and therefore decline the firms' productivity level.

Table 3 The effect of antidumping protection on heterogeneity response of firms' TFP

	lnTFP (1)		**lnTFP (2)**	
AD	0.209	***	0.217	***
	[-0.03]		[0.03]	
AD_dist	– 0.000049	***		
	[0.00]			
AD_TFPin			– 0.005	***
			[0.00]	
AD_dexp	– 0.407	***	–0.402	***
	[0.05]		[0.05]	
d_crisis	– 0.223	***	– 0.221	***
	[0.03]		[0.03]	
IMP	– 0.065		–0.065	
	[0.03]		[0.03]	
capint	0.006	***	0.005	***
	[0.00]		[0.00]	
ln_UPriil	0.159	***	0.161	***
	[0.00]		[0.00]	
bbimp	0.136	**	0.134	
	[0.07]		[0.06]	
mshare	10.421	***	10.384	***
	[0.05]		[0.05]	
_cons	4.188	***	4.171	***
	[0.19]		[0.18]	
N	4578		4571	

Notes: * p<0.10, ** p<0.05, *** p<0.01, and standard errors in parentheses

Combining these results, the impacts of trade protection could be different among firms. A firm which had already exported and already set in the competitive level likely gained fewer incentives to increase productivity. The estimation shows that this type of firms would gain productivity losses by antidumping protection implemetation (–19.8%). Comparing to the firms that had lower initial productivity and decided to start exporting, the marginal effect of the antidumping implementation shows positive impact on the productivity gain (20.9%). In this type of firms', the response of productivity are heterogen, depends on the initial productivity and the export status of each firms.

CONCLUSION

Using the antidumping case and firm level data of manufacturing sector in Indonesia, this study proves that the productivity of the average firms receiving protection improves significantly. It can be seen when the protection is applied, the productivity of domestic import-competing firms improves 20.9% higher than the productivity of firms which never got any protection. Furthermore, the result indicates that among protected domestic import-competing firms, low initial productivity firms gain more productivity than high initial productivity firms during the protection. However, empirical finding shows that this difference is relatively small. These results are quite different with recent studies held by Konings and Vandenbussche (2008) and Pierce (2011) using developed countries as their case studies. Konings and Vandenbussche (2008) confirmed that the domestic protected firms' productivity was around 2.6% – 6.7% higher than the productivity of unprotected firms; they also confirmed that the firms' responses were heterogen, as well as Pierce's findings (2011). Nevertheless, Pierce (2011) stated that the revenue productivity increases of the protected plants were biased because it was more likely induced by the increasing of prices and markups, whereas the physical productivity actually dropped. This finding fits the prediction that the impacts of antidumping policy on the protected domestic import-competing firms' productivity is greater when the policy is applied in developing countries rather than in developed countries.

Hovewer, this study is not necessarily in contradiction to the recent studies held by Pavcnik (2002), Trefler (2004) or Amiti and Konings (2007), who found the positive impacts of trade liberalization (or tariff reduction) and the domestic firms' productivity in developing countries. While their studies were engaged with overall welfare effects of trade liberalization policy, this study is more likely to assess the effectiveness of antidumping policy implementation to the protected firms. In fact, the overall welfare effects of antidumping policy could be negative since antidumping policy could inhibit the reallocative efficiency process. The implementation of antidumping protection could be effective only in the shortrun, while in the longrun, antidumping policy leads the low-productivity firms to continue production rather than stopping production which decelerates the reallocation of resources (Pierce, 2011). At last, the empirical findings of this study confirm the conceptual framework developed by Lileeva and Trefler (2007) which stated that the impacts of trade policy (in this study is antidumping protection policy), could be different among firms and it depended on firms' initial productivity and moreover, firms' decision on investing and/or exporting. This firms' heterogeneity raises an idea that benefit gain from trade policy can be different among firms.

Following the empirical findings, there are some limitations in this study. The first one, this study allows the conversion of anti-dumping products from HS code to KBLI 5-digit code, therefore, the most specific analysis of this study is the sector level, even using the firms level data. In addition, the possibility that the firms are producing mixed products becomes the limitation not covered in this study. The second one, the limitations of the existing antidumping case data of Indonesia made this study not able to overcome the self-selection bias that might arise because the types of sectors proposing antidumping initiation were different with the sectors that did not. In this study, the control group used was all sector groups proposing antidumping initiation but were rejected by the Government; hereinafter is referred to as termination control group. The last one is the estimation method of total factor productivity which was developed to overcome the more complex problems in empirical, i.e semi-parametric approach. Due to some limitations in this study, the problems occured in estimating total factor productivity are not covered entirely.

REFERENCES

Abadie, A. (2005), "Semiparametric Difference-in-Differences Estimators", *Review of Economic Studies*, Vol. 72, pp. 1–19.

Alhayat, A. P. (2014), *Efektivitas Tindakan Anti Dumping Indonesia 1996-2010*, *Pusat Kebijakan Perdagangan Luar Negeri, BP2KP, Kementerian Perdagangan*.

Amiti, M. and Konings, J. (2007), "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia", *American Economic Association*, Vol. 97 No. 5, pp. 1611–1638.

Blonigen, B. A. and Park, J.-H. (2004), "Dynamic Pricing in the Presence of Antidumping Policy : Theory and Evidence", *American Economic Association*, Vol. 94 No. 1, pp. 134–154.

Blonigen, B., Liebman, B. and Wilson, W. (2007), *Trade Policy and Market Power: The Case of The US Steel Industry*, *NBER Working Paper*.

Blundell, R. and Bond, S. (2000), "GMM Estimation with persistent panel data : an application to production functions", *Econometric Reviews*, Vol. 19 No. 3, pp. 321–340.

Brenton, P. (2001), "Anti-dumping Policies in the EU and Trade Diversion", *European Journal of Political Economy*, Vol. 17 No. 3, pp. 593–607.

Chandra, P. and Long, C. (2013), "Anti-dumping Duties and Their Impact on Exporters: Firm level Evidence from China", *World Development*, Vol. 51, pp. 169–186.

Ganguli, B. (2008), "The Trade Effects of Indian Antidumping Actions", *Review of International Economics*, Vol. 16 No. 5, pp. 930–941.

Konings, J. and Vandenbussche, H. (2005), "Antidumping Protection and Markups of Domestic Firms", *Journal of International Economics*, Vol. 65 No. 1, pp. 151–165.

Konings, J. and Vandenbussche, H. (2008), "Heterogeneous Responses of Firms to Trade Protection", *Journal of International Economics*, Vol. 76 No. 2, pp. 371–383.

Konings, J., Vandenbussche, H. and Springael, L. (2001), *Import Diversion Under European Antidumping Policy*. *CEPR Discussion Paper Series*.

Levinsohn, J. and Petrin, A. (2003), "Estimating Production Inputs to Functions Using Control for Unobservables", *The Review of Economic Studies*, Vol. 70 No. 2, pp. 317–341.

Lileeva, A. and Trefler, D. (2010), "Improved Access to Foreign Markets Raises Plant-level Productivity For Some Plants", *The Quarterly Journal of Economics*, Vol. 125 No. 3, pp. 1051–1099.

Nieberding, J. F. (1999), "The Effect of U.S. Antidumping Law on Firms' Market Power: An Empirical Test", *Review of Industrial Organization*, Vol. 14, pp. 65–84.

Oh, D., Heshmati, A. and Loof, H. (2014), "Total Factor Productivity of Korean Manufacturing Industries : Comparison of Competing Models with Firm-Level Data", *Japan and World Economy*, Vol. 30 No. 30, pp. 25–36.

Olper, A., Curzi, D. and Raimondi, V. (2016), "Imported Intermediate Inputs and Firms' Productivity Growth : Evidence from the Food Industry", *Journal of Agricultural Economics*, Vol. 68 No. 1, pp. 280–300.

Pierce, J. R. (2011), "Plant-level Responses to Antidumping Duties: Evidence from U.S. Manufacturers", *Journal of International Economics*, Vol. 85 No. 2, pp. 222–233.

Prusa, T. J. (1997), The Trade Effects of U.S. Antidumping Actions. In R. C. Feenstra (Ed.), *The Effects of U.S. Trade Protection and Promotion Policies* (pp. 191–214), University of Chicago Press.

Rovegno, L. (2013), "Trade Protection and Market Power: Evidence from US Antidumping and Countervailing Duties", *Review of World Economics*, Vol. 149 No. 3, pp. 443–476.

Schor, A. (2004), "Heterogeneous Productivity Response to Tariff Reduction. Evidence from Brazilian Manufacturing Firms", *Journal of Development Economics*, Vol. 75, pp. 373–396.

Takii, S. (2014), Import Penetration, Export Orientation, and Plant Size in Indonesian Manufacturing, *ERIA Discussion Paper*.

Tjahjasari, A. (2015), *The Impact of Anti-Dumping Policy on Import Volume of Steel Product in Indonesia*, *Institute of Social Studies*.

Van Beveren, I. (2010), "Total Factor Productivity Estimation: A Practical Review", *Journal of Economic Surveys*, Vol. 26 No. 1, pp. 98–128.

Van Biesebroeck, J. (2007), "Robustness of Productivity Estimates", *The Journal of Industrial Economics*, Vol. 55 No. 3, pp. 529–569.

APPENDICES

Appendix A Multinomial Logit Regression

Explanatory Variables	Probability of Protection		
Determinant of Termination Given Filling			
Ln(lagged employment)	0.679	**	[0.31]
Ln(lagged labor productivity)	0.932	**	[0.41]
Lagged import penetration	2.343		[1.71]
Previous AD filling (ADpet)	5.08	***	[1.67]
GDP growth	1.36	**	[0.63]
Determinant of Protection Given Filling			
Ln(lagged employment)	0.408	*	[0.25]
Ln(lagged labor productivity)	0.817	**	[0.37]
Lagged import penetration	2.116		[1.43]
Previous AD filling (ADpet)	5.298	***	[1.53]
GDP growth	1.461	***	[0.39]

Notes: * p<0.10, ** p<0.05, *** p<0.01, and standard errors in parentheses

Appendix B Log natural TFP for each sectors (2003 s.d. 2014)

Sector code	Industry	(ln_TFP) Mean	Std. Dev	Min	Max
10617	Wheat Flour Industry	6.26	1.08	3.48	8.65
17014	Special Paper Industry	5.11	1.02	0.22	7.55
17019	Other Paper Industry	5.40	1.30	2.52	9.46
20114	Other Inorganic Chemical Based Industry	5.81	1.28	3.10	11.59
20117	Organic Chemical Based Industry sourced from Petroleum, Natural Gas and Coal	7.16	1.50	3.81	10.85
20119	Other Organic Chemical Based Industry	6.42	1.30	1.91	10.88
20131	Plastic Material and Synthetic Resin Industry	6.17	1.57	1.90	13.03
20301	Artificial Fiber/Yarn/Strip Filament Industry	6.23	1.20	3.72	9.52
20302	Artificial Staple Fiber Industry	6.45	1.48	3.66	11.24
21011	Pharmaceutical Ingredients Industry	5.88	1.30	2.15	8.64
21012	Pharmaceutical Products Industry	6.09	1.35	1.32	14.84
22291	Plastic Sheet Industry	5.57	1.28	1.05	11.22
23931	Porcelain-Home Appliances Industry	5.21	0.94	1.81	8.85
24101	Iron and Steel Industry	6.37	1.23	3.36	9.44
24102	Steel Milling Industry	6.74	1.12	3.70	10.12
24103	Iron and Steel Pipe Industry	6.40	1.37	2.57	10.81
25940	Metal Buckets, Cans, Drums and Containers Industry	5.45	1.04	-3.51	9.06

Appendix C Indonesian Antidumping Case (source: Global AD databases)

Year	Products	No. of Product (HS)	Sector code (KBLI)	AD Dec.	Year of dec.	Year of end	Average Rate (%)	Defendant countries
2003	Uncoated Writing and Printing Paper	3	17019	P	2004	2009	53,4	Finlandia, Korea, India
2003	Coated Writing and Printing Paper	2	17014	T	2004	-	0,0	Finlandia, Korea
2003	Polyester Staple Fiber	1	20302	T	2004	-	0,0	Taiwan, Korea, Thailand
2003	Paracetamol	1	21011	P	2005	2010	18,4	RRT, AS
2004	Wheat Flour	1	10617	P	2005	2010	10,5	RRT, India
2004	Wheat Flour	1	10617	P	2006	2011	14,9	Uni Emirat Arab
2006	Hot Rolled Coil	9	24102	P	2008	2013	42,6	RRT, India, Rusia, Taiwan, Thailand
2006	Wheat Flour	1	10617	T	2007	-	0,0	Australia, Sri Lanka, Turki, Uni Eropa
2007	SodiumTripolyphospate (STTP)	1	20114	T	2008	-	0,0	RRT
2008	Bi-Axially Oriented Polypropylene Film	1	22291	P	2009	2012	10,0	Thailand
2008	Hot Rolled Plate	5	24102	T	2009	-	0,0	RRT, Taiwan, Malaysia
2008	Wheat Flour	1	10617	T	2009	-	0,0	Australia, Sri Lanka, Turki
2009	Alumunium Mealdish	1	25940	P	2010	2015	27,0	Malaysia
2009	Polyester Staple Fiber	1	20302	P	2010	2015	19,0	RRT, India, Taiwan
2009	I and H Section	2	24102	P	2010	2015	9,3	RRT
2009	Hot Rolled Coil	9	24102	P	2011	2016	26,1	Korea, Malaysia
2010	Hot Rolled Plate	2	24102	P	2012	2016	11,8	RRT, Singapura, Ukraina
2011	Tableware Ceramic	3	23931	P	2012	2017	87,0	RRT
2011	Cold Rolled Coil/Sheet	13	24102	P	2013	2016	31,7	RRT, Taiwan, Korea, Jepang, Vietnam
2012	Tin Plate	2	24102	P	2014	2019	6,6	Korea, RRT, Taiwan
2012	Polyethylene Terephthalate	3	20131	T	2014	-	0,0	RRT, Korea, Taiwan, Singapura
2013	Spin Draw Yarn	1	20301	P	2015	2020	7,5	Malaysia
2013	Partially Oeriented Yarn	1	20301	P	2015	2020	11,3	Malaysia, Thailand
2013	Draw Textured Yarn	1	20301	T	2014	-	0,0	RRT, Malaysia, Taiwan, India, Thailand
2014	Bi-Axially Oriented Polyethelene Terephtalate	1	22291	P	2015	2020	8,7	India, RRT, Thailand
2014	Cold-Rolled Stainless Steel	10	24102	T	2015	-	0,0	RRT, Korea, Malaysia, Singapura, Taiwan, Thailand
2014	Wheat Flour	1	10617	T	2015	-	0,0	India, Sri Lanka, Turki

Notes: AD Decision: P is Protection and T is Termination.