ERIA Discussion Paper Series

Import Penetration, Export Orientation, and Plant Size in Indonesian Manufacturing

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July 2014

Abstract: *This paper empirically examines differential impacts of globalisation on plant size among plants with different characteristics, including initial plant size, import and export status, and ownership. After accounting for other characteristics, results of this analysis suggest that both import penetration and export orientation do not have differential impacts on the size of larger and smaller plants. This is contrary to fears that only relatively large plants can benefit from globalisation while smaller plants would lose their market shares. The results also suggest that negative impact of import penetration on plant size is greater for importers and that the increase in export orientation positively impacts the size of exporting plants.*

Keywords: Globalisation, Plant size, Indonesia
JEL Classification: F14, F61

1. Introduction

The trade theory emphasising firm heterogeneity suggests that globalisation generates both winners and losers among firms within an industry, and it is heterogeneity that magnifies these effects (Melitz and Trefler, 2012). Better-performing firms can grow because of market expansion while some worse performing firms are forced to exit from markets due to increased competition. Thus, firm heterogeneity is why responses to globalisation differ among firms even within narrowly defined industries.

Policymakers are always attentive to the impact of trade liberalisation on inequality because it may be the basis of the government's support for the country's engagement in more globalised economic activities. One of the fears is that only relatively large firms can benefit from globalisation while smaller firms would lose market shares. This view is consistent with the prediction of firm heterogeneity theory (e.g., Melitz, 2003; Helpman, *et al.*, 2004). While theoretical analyses on the impact of globalisation have mostly focused on the welfare effects of trade liberalisation, only a few works have intensively examined the effects of liberalisation on firms of different sizes. This paper, thus, empirically examines globalisation's differential impacts on various firm characteristics, including initial (relative) plant size, import and export status, and ownership.

Likewise, only a few empirical studies had analysed the impact of trade liberalisation on the size of manufacturing plants (Head and Ries, 1999; Gu, *et al.*, 2003; and Baldwin and Gu, 2009). Unlike earlier research works, which focused on the Canadian manufacturing industry, this study focuses now on the manufacturing industry in Indonesia, which is a developing economy.

There are obvious differences between developing economies and developed economies in some important respects of this study. Such differences partly stem from the fact that most of the world's advanced technology is controlled by multinational corporations based in a few advanced countries (Blomström and Kokko, 1997). In developing economies where research and development (R&D) activities are limited, importing intermediate inputs in production is a significant channel of access to sophisticated global technology. Therefore, it is likely that those

firms based in developing economies and engaged in the importation of intermediate inputs can grow in size faster than non-importers could. However, this paper finds that the size advantage enjoyed by firms that import inputs diminishes when imported output penetrates the local markets.

Meanwhile, results of empirical studies on the productivity advantage of firms importing intermediate inputs are mixed. For example, Amiti and Konings (2007) find that the reduction in intermediate inputs' tariffs has a positive impact on Indonesian firms' productivity, while Vogel and Wagner (2010) cannot find clear evidence of any productivity gain among importers in German manufacturing. The finding in this paper indicates that the advantages of importing intermediate inputs depend on the extent of import penetration of the output.[1]

Market structures may also differ between developed and developing economies. In a developing economy, some strategic industries have been protected under the import-substitution industrialisation policy. These industries tend to be dominated by a relatively small number of large (government-owned) firms. Thus, one of the reasons developing countries have promoted trade liberalisation in the last decades is the belief that the pro-competitive effects of trade can improve efficiency in the less competitive industries that these few large firms dominate.

The Indonesian government's policies had also shifted from import substitution to an export-oriented one since the mid-1980s. Using plant-level micro-data on the Indonesian manufacturing, this paper examines the impact of trade liberalisation on plant size taking into account the industry characteristics, including concentration and the extent of dominance by large plants.

The decline in trade cost due to tariff reduction can affect the size of plants via at least two channels. One is via increased factor market competition (Melitz, 2003). Another is via increased product market competition (Melitz and Ottaviano, 2008). The paper focuses more on the latter channel. Also, while existing studies focused on the impact of trade reduction, this paper delves on the impact of import competition on the size of plants. This study considers tariff reduction as part of trade cost among others, including transportation costs. Furthermore, trade cost, along with factors such as change in exchange rates and demand in domestic and foreign markets, is a determinant of the degree of import competition. These indicate that the degree of

import competition changes even if tariff rates do not change, causing omitted variable biases in the regression analysis.

The rest of the paper is organized as follows: The next section reviews theoretical and empirical studies related to trade liberalisation impact on firm/plant size. Section 3 introduces the dataset examined in this paper and explains this study's empirical methodology. Section 4 presents results of the econometric estimation and Section 5 provides some concluding remarks.

2. Impacts of Trade Liberalisation on Plant Size

2.1. Trade Liberalisation and Plant Size

As noted earlier, trade theory with firm heterogeneity suggests that globalisation generates winners and losers within an industry: Better-performing firms can grow faster because of the market-expanding effect while some worse-performing firms are forced to exit from markets due to increased competition. Melitz (2003) develops a model that explains the mechanism. In the model, firms are heterogeneous in terms of marginal cost of production. Depending on certain determinants vis-à-vis their fixed cost of entry into markets, firms decide whether to exit, to produce for domestic markets or to serve foreign markets. The decision is made based on cutoff points of production (C^D) and export (C^X). Firms with marginal cost higher than C^D, indicating low productivity, decide not to produce. Firms with marginal cost between C^D and C^X decide to produce only for domestic markets, and firms with marginal cost lower than C^X serve foreign markets as well as domestic markets.

In the model, trade leads the most productive firms to expand thei production and serve foreign markets. On the other hand, the increased demand for labour by large, exporting firms causes higher real wages in labour markets and decreases in the cutoff C^D, forcing some least productive small firms to exit.

In its extension of Melitz and Ottaviano's study (2008), the potential pro-competitive effects induced by increased import competition is incorporated instead of the factor market competition. The increased competition in domestic product markets forces less productive small firms to lose their market share or to exit.

In these models, the consequences of trade liberalisation on firm size rely on the balance between reductions in import and export costs. In other words, the impact on firm performance depends critically upon the balance between domestic firms' access to foreign markets (market-expanding effects), and foreign firms' access to domestic markets (competition effects) (Tybout, 2009). Melitz and Ottaviano (2008) indicate that the gap in size between large and small firms widens in the case of symmetric bilateral trade liberalisation and, on the other hand, the gap narrows in the case of unilateral trade liberalisation. Related hypotheses were empirically examined by Baldwin and Gu (2009). They further extended the Baldwin and Gu model by allowing firms to produce multiple products.[2] In their theoretical model, firms respond to the increased competition by reducing the number of products and instead concentrating on their best-performing products. This leads to smaller firm sizes.

Using Canadian manufacturing data, Melitz and Ottaviano examined the impacts of bilateral trade liberalisation between Canada and United States on firm performances such as the number of products, product diversification, plant size, and product-run length. In the analysis, a symmetric bilateral trade liberalisation was assumed between the two developed countries. In contrast, in this present study on Indonesian manufacturing, the import competition and market-expanding effects are separately examined, thus assuming an asymmetric liberalisation.

2.2. Import and Export Status and Foreign Direct Investment

A related and important prediction from the theoretical models is the differential impact of trade liberalisation between exporting and non-exporting firms. Tariff reduction has a negative impact on the size of non-exporters via import competition while the impact on exporters depends on the balance of market-expanding and import-competition effects. Baldwin and Gu (2009) provide supporting empirical evidence on this hypothesis.

In the theoretical models, less productive firms are relatively small in size and less profitable so that they cannot cover the fixed costs to serve foreign markets. Therefore, it is predicted that trade liberalisation has more negative impacts on relatively small firms compared to large firms. In the real world, however, there are some large non-exporting firms as well as some small-sized exporters. Thus, which

one determines the extent of trade liberalisation's impact on firm size: initial firm size or export status? This question is asked in the empirical part of this paper.

It should be noted that the size of firms could be changed in two ways in a globalising world. First, turning into an exporter is thought to expand such firm's production. This advantage over non-exporters is called "size advantage of exporting" in this paper. Second, trade liberalisation can increase the size advantage because import competition has more of a negative impact on non-exporters. Therefore, examining the differential impacts on exporters and non-exporters is the same as examining the impact on the size advantage of exporting. This paper examines and compares the impact on the size advantages of exporting and initial firm size.

Importing can also be a key determinant of firm size. Importing intermediate inputs can enhance firm productivity because imports from advanced economies embody sophisticated technology. For example, results of Kasahara and Rodrigue's (2008) examination on the panel dataset from Chilean manufacturing suggest that being an importer of foreign intermediates can improve productivity. Results of Amiti and Konings' (2007) empirical analysis prove that the reduction in intermediate inputs tariff has a positive impact on Indonesian firms' productivity, indicating that there exists productivity gain from importing.[3] This improvement in productivity indicates a larger firm size. The difference in size between importing and non-importing firms is called "size advantage of importing" in this paper.

The size advantage of importing can also be affected by trade liberalisation. For example, automakers importing parts and components that embody leading technology from advanced economies can enjoy an advantage over non-importing automakers in a developing economy. However, once import tariff on automotives is reduced and import competition is increased, the advantage would diminish because imported cars also embody the leading technology.

In general, importation is known to be an important channel of international technology diffusion for developing economies. The increase in imports can help improve technologies not only in industries producing the products but also in upstream industries producing intermediate products. Here, the improvement of

technologies in the upstream industries leads to a decline in the size advantage of importing over non-importers.

Another firm characteristic examined in this paper is foreign ownership. Helpman, *et al.*, (2004), which extend the Melitz model by incorporating not only exporting but also foreign direct investment (FDI) as methods to serve foreign markets, predict that the responses to trade liberalisation differ between exporting firms and FDI firms. In the model, most productive firms invest abroad and can benefit more from trade liberalisation compared to the rest. In the Indonesian manufacturing sector, only a small number of local firms invest abroad while many foreign multinational enterprises (MNEs) abound. In fact, these foreign-owned plants account for a large portion of the output in some industries. For example, the share of output produced by foreign-owned plants is more than 90 percent in the motor vehicle industry.

Although foreign MNEs in the Indonesian manufacturing are not Indonesia-based firms, the prediction of different responses can be applied to the responses of exporters and foreign-owned plants in the Indonesian manufacturing sectors.

3. Methodology and Data

3.1. Previous Empirical Studies

Head and Ries' (1999) paper is one of the few studies that analysed the effects of trade liberalisation on plant size. It empirically examines whether trade liberalisation in the Canadian manufacturing industry promotes efficiency through increased scale. Results suggest that a reduction in Canadian tariffs decreased the average plant size while a reduction in US tariffs increased plant size. Gu, *et al*., (2003) also examine the effects of tariff reduction on plant size and turnovers using Canadian manufacturing data. However, they find no evidence that indicate tariff cut has statistically significant effects on firm size.

More recently, Baldwin and Gu (2009) look into the impact of trade on product diversification in the Canadian manufacturing. A model of trade with multi-product firms/plants was developed to examine the effect of market size and trade on product

specialisation and production-run length. The model predicts that the effect of bilateral tariff reductions on plant size depends on the export status of a plant. Bilateral tariff cuts reduce the plant size of non-exporters as they cut down on the number of products. Meanwhile, the effect of tariff cuts on the plant size of exporters is ambiguous. Results of the empirical analysis suggest that lower tariffs lead to a decline in the size of relatively large non-exporters but the effects on plant size of smaller firms are statistically insignificant.

3.2. Estimation Model

One of the important predictions derived from the firm-based theoretical model developed by Baldwin and Gu (2009) states that bilateral tariff reductions lead to a decline in the size of non-exporters. To provide the empirical evidence, they estimated the following model:

$$\Delta \ln Y_{it} = \beta_1 \Delta\tau_{it} + \beta_2 D^{export}_{i,t-1} + \beta_3 S_{i,t-1} + \beta_4 \Delta\tau_{it} \cdot D^{export}_{i,t-1} + \beta_5 \Delta\tau_{it} \cdot S_{i,t-1} + \alpha_i + \gamma_t + \beta_6 X_{it} + \varepsilon_{it},$$

where Y is real output (a measure of plant size), τ is output tariff, D^{export} is a dummy variable having value "1" if a plant is exporting, S is relative plant size, X is a set of other plant characteristics. In this model, the marginal effect of tariff changes on plant size can be expressed as follows:

$$\textbf{M.E. of tariff changes} = \beta_1 + \beta_4 D^{export}_{i,t-1} + \beta_5 S_{i,t-1}.$$

If the coefficient β_1 is significantly positive, then a reduction in tariff rates decreases the size of non-exporters, as the theoretical model has predicted. The impact of tariff reduction on exporters can be measured by $\beta_1 + \beta_4$. If the sum of the parameters is significantly positive, then a reduction in tariff rates decreases the size of exporters. In their empirical analysis on the impact of bilateral tariff reductions between Canada and United States, tariff change is calculated as the sum of bilateral import tariff changes between the two economies because their theoretical model assumes a symmetric bilateral trade liberalisation.[4]

The model estimated in this paper differs from Baldwin and Gu (2009) on some points. First, this paper examines the impact of the increase in import penetration instead of tariff reduction. Import penetration is thought to have a more direct impact on plant size compared to tariff reduction (where plant size is affected through increases in imports). Second, the impact of a reduction in Indonesia's import tariffs and its trading partners' import tariffs (tariffs on Indonesia's exports) on plant size are examined separately in this paper. The developing country has diversified exports and imports and its trading partners include both developed and developing economies. Thus, in contrast to the assumption used in Baldwin and Gu (2009), Indonesia's case in terms of structure and reduction in tariffs are not always symmetric with that of its main trading partners, although both Indonesia and its trading partners have reduced import tariffs.

As suggested by Baldwin and Gu (2009), the impact through market-expanding effects due to trade liberalisation is greater for exporters compared to non-exporters. Similarly, the impact through import competition effects can also be different between plants importing intermediate goods (in which advanced technology is thought to be embodied) and non-importers, especially in less developed economies. Therefore, the impact of import penetration on importers and non-importers is compared here. In addition, locally owned plants and foreign-owned plants are also compared because foreign multinational enterprises are thought to have firm-specific intangible assets, including marketing network, which enable them to benefit from trade liberalisation. In this present study, import dummy (D^{import}) and foreign ownership dummy ($D^{foreign}$) and their interactions with trade liberalisation variables are also included in the estimation model.[5] The estimated model can be expressed as follows:

$$\Delta \ln Y_{it} = \beta_1^I \Delta\tau_{it}^I + \beta_2^I \Delta\tau_{it}^I \cdot S_{i,t-1} + \beta_3^I \Delta\tau_{it}^I \cdot D_{it}^{export} + \beta_4^I \Delta\tau_{it}^I \cdot D_{it}^{import} + \beta_5^I \Delta\tau_{it}^I \cdot D_{it}^{foreign}$$
$$+\beta_1^X \Delta\tau_{it}^X + \beta_2^X \Delta\tau_{it}^X \cdot S_{i,t-1} + \beta_3^X \Delta\tau_{it}^X \cdot D_{it}^{export} + \beta_4^X \Delta\tau_{it}^X \cdot D_{it}^{import} + \beta_5^X \Delta\tau_{it}^X \cdot D_{it}^{foreign}$$
$$+\beta_6 S_{i,t-1} + \beta_7 D_{i,t}^{export} + \beta_8 D_{it}^{import} + \beta_9 D_{it}^{import} + \beta_{10} \ln \frac{K}{L_{it}} + \beta_{11} \ln \frac{Ln}{L_{it}} + \alpha_i + \gamma_t + \varepsilon_{it},$$

where the dependent variables is a change in real output in plant i at year t. The $\Delta\tau^I$ refers to the change in import tariffs or import penetration variable (explained below) while $\Delta\tau^X$ refers to the change in tariffs on Indonesia's export as imposed by trading partners or export ratio variable (explained below). $\ln\frac{K}{L}$ is a log of the capital-labour ratio and $\ln\frac{Ln}{L}$ is a log of the non-production worker ratio to total number of labourers employed in the plants. α_i and γ_t are plant and year dummies, respectively.

3.3. *Real Output Variables*

Nominal output data for each manufacturing plant is taken from annual manufacturing surveys conducted by Indonesia's statistical agency (BPS-Statistics).[6] From the raw micro-level data, a panel dataset is constructed for 1993-2011.[7] The survey covers manufacturing plants with 20 or more employees and contains various information on plant performance including output, value added, ownership, capital stock, the number of workers by type, export and import status, and other variables that enable the above model to be estimated. Depending on its main product, each plant is classified based on the Indonesian Standard Industrial Classification (ISIC) at a five-digit sub-sector level, which corresponds to the International Standard Industrial Classification.[8,9] In this empirical analysis, the classification at a three-digit sub-sector level is used to make a concordance between the industrial classification and commodity classification for wholesale price index. For each category, a corresponding wholesale price index is constructed from the most detailed wholesale price index of 190 categories. The real output variable is created at constant year 2000 price using the detailed wholesale price index. The relative size variable (S) is defined as the difference between the log of real output and its corresponding median in each three-digit industry. [10]

3.4. Measuring Import Penetration and Export Orientation

The rise in import and export suggest increases in competition and market size. However, the degree of globalisation's impact is not always proportional to the dollar values of import and export. Import penetration and export orientation would be

more appropriate measures of globalisation's effects. In addition, although tariff change is one of the causes of the hikes in import and export, they do not capture the actual impact of trade liberalisation. A reduction in import tariffs does not always induce the increase in import. Likewise, a reduction in tariffs on exports does not always induce the rise in export. This is because tariff is just a part of the costs incurred to import or export. Other factors include changes in exchange rates and demand in domestic and foreign markets.

To measure the impact of globalisation, which is partially induced by tariff reductions, the import penetration and export orientation variables are included in the estimated model instead of changes in tariffs on imports and exports. The import penetration and export orientation variables are created at the ISIC three-digit level as expressed in the following equation: [11]

$$\textbf{Import penetration} = \frac{\textbf{total import}}{\textbf{total output} + \textbf{total import}},$$

$$\textbf{Export orientation} = \frac{\textbf{total export}}{\textbf{total output}}.$$

3.5. *Trade Liberalisation on Indonesian Manufacturing*

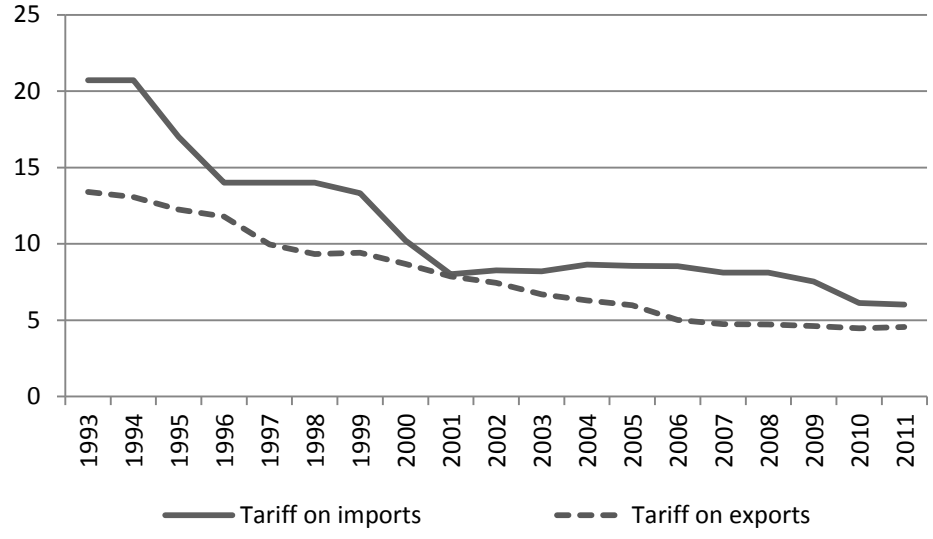
During the last decades, the Indonesian government undertook a massive policy reform that aimed to transform the market from import substitution to export orientation. The trade and investment regime was radically liberalised along with major reforms in the banking sector. Tariffs were further reduced and more non-tariff barriers (NTBs) were eliminated under the reforms per the International Monetary Fund (IMF) agreements after the economic crisis in 1997-1998.

For the empirical analysis in this paper, tariff data at the three-digit sub-sector level of the International Standard Industrial Classification is taken from World Integrated Trade Solution (WITS, World Bank). In the dataset, the tariff data is calculated as an average of effective tariff rates on commodities corresponding to the industrial classification code. To create import and export tariff variables, the top 20 trading partners are selected using total value of import and export with each trading partner during 1993-2011. The import tariff variable is calculated as the simple

average of tariffs imposed on imports from the top 20 origins of imports for each category of the ISIC three-digit level.[12] The export tariff variable is also calculated in a similar fashion.

Figure 1 presents the 1993-2011 period's trend in the Indonesian manufacturing products' average tariff rates, which showed a decrease from 21 percent in 1993 to 14 percent in 1996, and a further drop to 8 percent in 2001 after the economic crisis. In 2004, the rate increased slightly, mainly caused by the adoption of a new tariff classification under the "ASEAN Harmonized Tariff Nomenclature" (AHTN) as part of Indonesia's commitment under AFTA.[13] More recently, the average import tariff declined further from 7.5 percent in 2009 to 6.0 percent in 2011. Indonesia's main trading partners also reduced their tariff rates on exports from Indonesia. Average export tariff rates were much lower than the average import tariffs but continuously declined from 13 percent in 1993 to 4.6 percent in 2011.

Figure 1: Change in Import and Export Tariffs in the Indonesian Manufacturing (%).

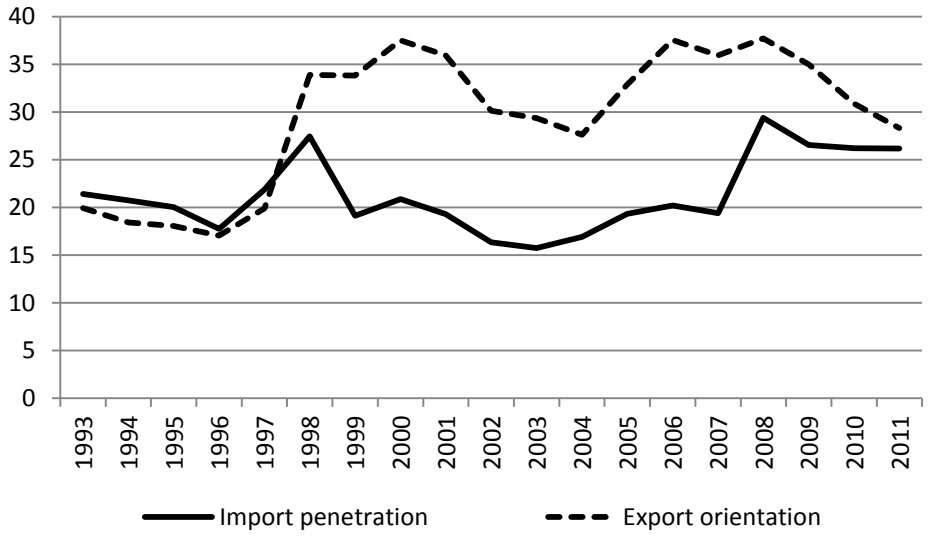


Partially due to the reductions of tariffs, manufacturing imports drastically increased especially after the economic crisis from US$39.3 billion in 2001 to US$116 billion in 2011 while import also rose from US$25.3 billion to US$155 billion during the same period. In Figure 2, the average import penetration and export orientation estimated by the equations explained earlier in this paper were about 20

percent in the manufacturing sector. The import penetration temporally increased during the economic crisis but declined until 2003. Since then, it tended to have risen and levelled off at 26 percent in 2011 after temporally spiking to 29 percent in 2008.

On the other hand, export orientation showed wilder swings compared to import penetration. Partially reflecting a weak rupiah, export orientation hit 37 percent in 2000 before dropping to 28 percent in 2004. More recently, the rate rose again to 38 percent in 2008 before falling to 28 percent in 2011, reflecting a sluggish foreign demand.

Figure 2: Import Penetration and Export Orientation (%).



4. Econometric Results

4.1. Effects of Trade Liberalisation on Plant Size

Estimation results of the above equation are presented in Table 1. As trade liberalisation variables, import penetration is reflected in column 1 and both import penetration and export orientation variables are in column 2. On the other hand, column 3 includes import tariffs and column 4 contains both import tariffs and export tariffs (tariffs imposed by trading partners). In all equations, the initial relative plant

size ($\ln(size)_{-1}$), export dummy, import dummy, and foreign ownership dummy are statistically significant at the 1-percent significance level.

The negative coefficient on the initial plant size suggest that relatively small plants grow at a faster rate compared to larger plants in terms of real output. The positive coefficient on export dummy indicates that there exists size advantage of exporting. Similarly, plants that import intermediate inputs as well as foreign-owned firms grow faster compared to non-importing plants and locally owned plants, respectively. Capital intensity ($\ln\frac{K}{L}$) is positively correlated with the growth of real output, suggesting that plants with higher capital intensity can grow at a faster rate. The coefficient of non-production worker ratio ($\ln\frac{Ln}{L}$), which is sometimes used as a proxy for a ratio of skilled workers, is significantly negative. This suggest that plants with a relatively large number of unskilled workers can grow faster compared to others in the unskilled worker-abundant economy.

In column 1, the coefficient on changes in the import penetration variable is significantly negative. This indicates that the increase in import penetration has a negative impact on the size of manufacturing plants. After including the export orientation variable and its interactions (column 2), the estimated magnitude of the negative effect turns out to be smaller, but still significantly negative. In both columns 1 and 2, the interaction term of initial plant size and import penetration is statistically insignificant. That is, there is no difference in the magnitude of import penetration's negative impact on either the larger or smaller plants' size after accounting for the firm characteristics. This is confirmed by a statistical test whose results are shown in the lower part of the table. The marginal effect of import penetration on the size of smaller plants (evaluated at the lower quartile of the size distribution) is -0.207 while the corresponding effect on larger firms (evaluated at the upper quartile) is -0.219. The difference (-0.012) is statistically insignificant even at the 10-percent significance level.

Table 1: Effects of Tariff Reduction/import Penetration and Export Orientation

	[1]	[2]	[3]	[4]
	Import penetration and export orientation		Import tariffs and export tariffs	
	β/se	β /se	β /se	β /se
Δimport tariff or import penetration	-0.245	-0.128	0.074	0.063
	[0.039]***	[0.040]***	[0.054]	[0.054]
X ln (size)-1	-0.011	-0.005	-0.04	-0.038
	[0.023]	[0.023]	[0.029]	[0.029]
X Dexport	-0.043	-0.211	0.168	0.151
	[0.112]	[0.115]*	[0.133]	[0.133]
X Dimport	-0.301	-0.19	-0.342	-0.345
	[0.086]***	[0.092]**	[0.131]***	[0.131]***
X Dforeign	-0.184	-0.202	0.263	0.271
	[0.145]	[0.151]	[0.182]	[0.182]
Δexport tariff or export orientation		-0.244		0.779
		[0.025]***		[0.124]***
X ln (size)-1		-0.011		-0.194
		[0.014]		[0.072]***
X Dexport		0.27		0.297
		[0.049]***		[0.333]
X Dimport		-0.116		-0.113
		[0.054]**		[0.385]
X Dforeign		0.064		0.024
		[0.081]		[0.687]
ln $(size)_{-1}$	-0.502	-0.502	-0.502	-0.503
	[0.005]***	[0.005]***	[0.005]***	[0.005]***
Dexport	0.042	0.042	0.044	0.046
	[0.007]***	[0.007]***	[0.008]***	[0.008]***
Dimport	0.182	0.182	0.177	0.176
	[0.010]***	[0.010]***	[0.011]***	[0.011]***
Dforeign	0.171	0.17	0.172	0.173
	[0.029]***	[0.029]***	[0.029]***	[0.030]***
ln (K/L)	0.017	0.017	0.017	0.017
	[0.002]***	[0.002]***	[0.002]***	[0.002]***
ln (Ln/L)	-0.015	-0.015	-0.014	-0.015
	[0.003]***	[0.003]***	[0.003]***	[0.003]***
Plant dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
M.E. of import at p25 of size	-0.308***	-0.207***	0.101***	0.084
M.E. of import at p75 of size	-0.331***	-0.219***	0.014	0.002
- difference	-0.024	-0.012	-0.087	-0.083
M.E. of export at p25 of size	-	-0.201***	-	1.000***
M.E. of export at p75 of size	-	-0.226***	-	0.577***
- Difference	-	-0.024	-	-0.423***
# of plants	34,278	34,278	34,419	34,419
# of observations	203,936	203,936	204,727	204,727
Adj. R^2	0.272	0.272	0.271	0.272
F-stats.	514.622	439.332	516.697	439.298

Notes: β = parameter, se = standard error, "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively.

On the other hand, an increase in import penetration has more of a negative impact on the size of those plants that import intermediate inputs than on that of non-importing firms, as indicated by the significantly negative coefficient on the interaction term of import dummy and import penetration. In other words, the size advantage of firms importing intermediate inputs is lowered when import penetration is increased.

Estimation results also indicate that some plants importing intermediate inputs that feature advanced technology can enjoy a size advantage. However, this advantage is diminished whenever the country's importation of the same products is increased because such advanced technology is also embodied in the imports. Therefore, import competition has a greater negative impact on firms that import intermediate inputs as compared to the non-importing plants.

The coefficient on the export orientation variable is significantly negative, suggesting that the increase in export orientation at an industry level has negative impact on plant size. However, its interaction term with the export dummy is significantly positive, and the sum of the two coefficients is statistically insignificant. These imply that the rise in export orientation does not affect the size advantage of exporting. However, the findings also suggest that the increase in export orientation has a negative impact on the size of non-exporters. When export orientation at an industry level rises, exporters can keep growing while non-exporters lose their share in the domestic market.

The interaction term of export orientation and initial plant size is not statistically significant. Similarly, with import penetration effect, there is no difference in the magnitude of the export orientation's negative impact on the size of larger and smaller plants after accounting for other plant characteristics.

The negative coefficient on the interaction of export orientation and import dummy suggests that export orientation lowers the size advantage of importing firms. One possible interpretation of this finding could be that the increase in export orientation improves the technology of upstream industries in local markets; thus, this narrows the size advantages of firms that import intermediate inputs, although further examination of the backward linkage effects is required before any conclusive statements can be made.

In columns 3 and 4, the coefficients on changes in import tariffs are positive. These results are consistent with the findings on import penetration as explained above and imply that import tariff reduction has a negative impact on the size of plants. However, the coefficients are not statistically significant. On the other hand, the coefficients on changes in export tariffs is significantly positive, suggesting that a reduction in tariffs imposed by Indonesia's trading partners on its exports negatively impacts plant size.

Note that unlike the results shown in column 2, the interaction term of export tariffs and initial relative size is significantly negative in column 4. This indicates that any export tariff reduction has more negative impact on the size of smaller plants than of larger plants. Furthermore, the interaction term of import tariffs and import dummy is significantly negative, indicating that import tariff reduction negatively impacts the size of non-importers more than of importers.

These results are inconsistent with the results on import penetration and export orientation. Such inconsistency probably arose from the fact that tariff reductions are weakly correlated with import penetration and export orientation. After all, import penetration and export orientation depend not only on tariff reductions but other factors, including foreign exchange rates, domestic and foreign demand, and characteristics of products.

4.2. Analysis by Industry Group

To further investigate the relationships between import penetration and export orientation vis-à-vis size advantages of importing, exporting, and foreign ownership, an equation is estimated using sub-samples from the plant-level panel dataset. Models based on firm heterogeneity suggest that responses to tariff reduction vary not only among firms of different sizes and export status but also across industries with difference characteristics. For example, in the Melitz and Ottaviano model, the marginal effect of tariff change on plant size is a function of the fixed sunk entry cost as well as parameters of utility function and distribution function of productivity. These are generally thought to differ across industries.

In the Baldwin and Gu model, the marginal effect is a function of fixed overhead cost, which affects the extent of scale economies within variety. These indicate that

the effect of tariff reduction on plant size differ across industries. Instead of incorporating the effects of the required cost of initial investments at an industry-level, this empirical analysis first classifies industries into groups, then estimate the above model using the sub-samples and compare the results.

The first grouping at an industry level is done based on shares of relatively large plants to total output. Here, large plants are defined as plants with 300 or more workers. If the share of large plants to total output is more than 70 percent in an industry, then the industry is classified into the large enterprise (LGE)-dominated group.[14] Other industries are categorized into the less LGE-dominated group. In this group, both large and small plants are surviving, indicating that the extent of scale economy and initial entry cost are relatively small.

The second grouping is based on average capital intensity. Industries where capital intensity is higher than the median of the industries' averages are classified into the Capital-intensive group. Traditional trade theory suggests that a labour-abundant economy has comparative advantages in labour-intensive industries and comparative disadvantages in capital-intensive industries. Therefore, the negative impact of import penetration is expected to be greater for the Capital-intensive group than for the Labour-intensive classification.

The third grouping is based on the dominance of foreign-owned plants. Similar with LGE-dominated group, the MNE-dominated group includes industries where the share of foreign-owned plants in total output is greater than 30 percent.

The fourth grouping is based on concentration measured by the Herfindahl index. Industries where the index is higher than the median of the total manufacturing sector are classified into the Concentrated group.

Estimation results using these sub-samples are presented in Table 2. For some groups, the findings differ from the results of the estimation using total sample in Table 1. First, the impact of import penetration is not statistically negative in the LGE-dominated (column 1), Labour-intensive (column 3), Less MNE-dominated (column 5), and Concentrated (column 8) groups. The coefficient is significantly positive in the Concentrated group (but only for local non-importers because the foreign ownership dummy is significantly negative) and is weakly positive in LGE-dominated groups. These results indicate that the impact of import penetration varies

across industries, but the negative effect is smaller for non-importers in industries dominated by large plants.

Table 2: Effects of Import Penetration and Export Orientation by Industry Group.

	[1] LGE-dominated β/se	[2] Less LGE-dom. β /se	[3] Labour-intensive β /se	[4] Capital-intensive β /se
Δimport penetration	0.106	-0.377	0.012	-0.478
	[0.056]*	[0.062]***	[0.045]	[0.091]***
x ln (size)-1	-0.014	-0.028	0.004	-0.072
	[0.030]	[0.033]	[0.028]	[0.039]*
x Dexport	-0.255	-0.192	-0.210	0.153
	[0.166]	[0.159]	[0.157]	[0.178]
x Dimport	-0.477	0.016	-0.330	-0.027
	[0.128]***	[0.129]	[0.130]**	[0.145]
x Dforeign	-0.057	-0.276	0.011	-0.258
	[0.208]	[0.213]	[0.241]	[0.201]
Δexport orientation	-0.266	-0.204	-0.209	-0.243
	[0.034]***	[0.040]***	[0.028]***	[0.064]***
x ln (size)-1	-0.009	-0.005	-0.017	-0.005
	[0.017]	[0.022]	[0.015]	[0.028]
x Dexport	0.227	0.258	0.317	-0.246
	[0.063]***	[0.077]***	[0.054]***	[0.121]**
x Dimport	-0.14	-0.034	-0.111	0.092
	[0.071]**	[0.080]	[0.063]*	[0.103]
x Dforeign	0.188	-0.081	0.046	0.235
	[0.107]*	[0.129]	[0.103]	[0.136]*
$\ln (size)_{-1}$	-0.516	-0.552	-0.517	-0.524
	[0.006]***	[0.007]***	[0.006]***	[0.008]***
Dexport	0.036	0.05	0.035	0.063
	[0.010]***	[0.011]***	[0.008]***	[0.014]***
Dimport	0.19	0.187	0.179	0.2
	[0.014]***	[0.016]***	[0.012]***	[0.020]***
Dforeign	0.153	0.191	0.193	0.161
	[0.039]***	[0.047]***	[0.038]***	[0.047]***
ln (K/L)	0.021	0.016	0.018	0.017
	[0.003]***	[0.004]***	[0.003]***	[0.005]***
ln (Ln/L)	-0.014	-0.017	-0.016	-0.014
	[0.004]***	[0.006]***	[0.004]***	[0.007]**
Plant dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
M.E. of import at p25 of size	-0.001	-0.407***	-0.071	-0.400***
M.E. of import at p75 of size	-0.031	-0.471***	-0.063	-0.589***
- difference	-0.03	-0.064	0.008	-0.189*
M.E. of export at p25 of size	-0.234***	-0.158***	-0.153***	-0.229***
M.E. of export at p75 of size	-0.252***	-0.169***	-0.188***	-0.242***
- difference	-0.018	-0.01	-0.035	-0.014
# of plants	20,325	15,388	26,416	8,715
# of observations	117,078	86,858	153,076	50,860
Adj. R^2	0.284	0.294	0.279	0.291
F-stats.	260.083	244.441	320.664	156.438

Notes: β = parameter, se = standard error, "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively.

Table 2 (continued): Effects of Import Penetration and Export Orientation by Industry Group.

	[5] Less MNE-dominated. β /se	[6] MNE-dominated β /se	[7] Less concentrated β /se	[8] Concentrated β /se
Δimport penetration	-0.047	-0.376	-0.287	0.221
	[0.045]	[0.096]***	[0.051]***	[0.079]***
X ln (size)-1	-0.022	-0.056	0.022	-0.036
	[0.026]	[0.045]	[0.032]	[0.032]
X Dexport	-0.212	-0.027	-0.234	-0.121
	[0.147]	[0.193]	[0.156]	[0.173]
X Dimport	-0.247	-0.043	-0.166	-0.347
	[0.115]**	[0.163]	[0.124]	[0.140]**
X Dforeign	0.083	-0.325	-0.01	-0.517
	[0.206]	[0.219]	[0.225]	[0.200]***
Δexport orientation	-0.219	-0.264	-0.189	-0.398
	[0.027]***	[0.071]***	[0.029]***	[0.054]***
X ln (size)-1	-0.034	0.055	-0.022	-0.004
	[0.014]**	[0.035]	[0.016]	[0.025]
X Dexport	0.343	-0.089	0.312	0.159
	[0.053]***	[0.131]	[0.056]***	[0.110]
X Dimport	-0.136	-0.026	-0.112	-0.018
	[0.061]**	[0.117]	[0.063]*	[0.102]
X Dforeign	0.084	0.068	-0.1	0.412
	[0.098]	[0.145]	[0.104]	[0.136]***
ln $(size)_{-1}$	-0.52	-0.506	-0.52	-0.516
	[0.005]***	[0.010]***	[0.005]***	[0.011]***
Dexport	0.039	0.054	0.041	0.062
	[0.008]***	[0.016]***	[0.008]***	[0.019]***
Dimport	0.17	0.208	0.176	0.225
	[0.012]***	[0.023]***	[0.011]***	[0.029]***
Dforeign	0.152	0.194	0.167	0.177
	[0.039]***	[0.045]***	[0.032]***	[0.079]**
ln (K/L)	0.018	0.013	0.017	0.019
	[0.003]***	[0.006]**	[0.003]***	[0.006]***
ln (Ln/L)	-0.015	-0.014	-0.014	-0.017
	[0.004]***	[0.009]	[0.004]***	[0.007]**
Plant dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
M.E. of import at p25 of size	-0.092	-0.383***	-0.385***	0.142**
M.E. of import at p75 of size	-0.139***	-0.532***	-0.337***	0.069
- difference	-0.047	-0.149	0.048	-0.074
M.E. of export at p25 of size	-0.143***	-0.344***	-0.132***	-0.352***
M.E. of export at p75 of size	-0.213***	-0.198***	-0.181***	-0.359***
- difference	-0.071**	0.146	-0.049	-0.008
# of plants	27,969	7,039	27,073	8,233
# of observations	166,206	37,730	158,651	45,285
Adj. R^2	0.279	0.291	0.282	0.281
F-stats.	346.433	112.487	374.794	96.297

Notes: β = parameter, se = standard error, "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively.

Another difference is the negative coefficient on the interaction of export orientation and export dummy in the Capital-intensive group (column 4). In this group, on the other hand, the interaction term with foreign ownership dummy is statistically positive at the 10 percent level. These results suggest that an upsurge in export orientation reduces the size advantage of exporting but increases the advantage of foreign ownership. In industries having comparative disadvantages, an exporting status is not enough to benefit from the export orientation: In fact, foreign ownership proves to be the more important factor.

5. Concluding Remarks

Using a plant-level panel dataset from the Indonesian manufacturing sector, this paper has examined the impact of trade liberalisation on the varied sizes of plants measured by real output. Several findings emerged from empirical analyses. First, there exist size advantages of exporting, importing intermediate inputs, and foreign ownership. Second, the increase in import penetration has a negative impact on the plant size and decreases the size advantage of importing. Third, the increase in export orientation negatively impacts the size of non-exporting plants while enhancing the size advantage of exporting. Fourth, contrary to fears that only relatively large firms can benefit from globalisation while smaller firms would lose their market shares, results of the empirical analysis suggest that both import penetration and export orientation do not have differential impacts on the size of larger and smaller plants after accounting for other plant characteristics.

These results have some policy implications. First, plant size is not necessarily the appropriate characteristic to consider when deciding on how the government can help manufacturing plants benefit from globalisation. Second, public policies should direct support towards getting non-exporters to start exporting. The empirical results suggest that exporters can benefit from trade liberalisation while non-exporters are negatively impacted. Third, promoting inward foreign direct investment is also important because (1) foreign MNEs are thought to have firm-specific intangible assets, including world-wide marketing network; and (2) exporters in capital-

intensive industries that have comparative disadvantages in Indonesia can benefit from the foreign ownership. Finally, although the increase in import penetration reduces the size advantage of importing intermediate inputs, promoting importation can be an important measure because the decrease in the size advantage of importing may be reflective of better technology embodied in local products.

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ENDNOTES

[1] On the subject of productivity advantage of exporting, some previous studies found supporting evidence for "learning-by-exporting effect" (e.g., Lileeva and Trefler, 2010) while other studies find no such effects (e.g., Clerides, Lach and Tybout, 1998; Bernard and Jensen, 1999). See Wagner (2012) for review.

[2] Other papers that developed models with multi-product firms include Nocke and Yeaple (2006); Eckel and Neary (2010); Bernard, Redding, and Schott (2011); and Mayer, Melitz, and Ottaviano (2011).

[3] On the other hand, Vogel and Wagner (2010), which examined panel dataset from German manufacturing, could not find clear evidence for productivity gain from being importers although their analysis provides evidence of productivity's positive impact on importing.

[4] Another reason is to avoid a multi-colinearity problem arising from high correlation of import tariffs between Canada and United States.

[5] Kasahara and Lapham (2013) indicate that there is also a difference in the responses to trade liberalization between importers and non-importers.

[6] The aggregated figures are published in *Large and Medium Industrial Statistics* (BPS-Statistics).

[7] The survey data is available from 1975 but data on capital stock is available since 1988. Data for 1993-2011 is used in this analysis because detailed trade data are available since 1993.

[8] The two classifications are almost same. One of the main differences is in detailed classification of Other Non-metallic Mineral Industry (ISIC #26).

[9] The surveys used ISIC revision 2 for 1993-1998 and revision 3 for 1999-2011. The codes of ISIC revision 2 for 1993-1998 were converted to ISIC revision 3 using concordance provided by BPS-Statistics.

[10] Another definition is to use industrial mean of the log of real output instead of median. To avoid undesirable effects of outliers, median was used instead of mean.

[11] These indices should be measured in real term. However, the import and export price indices are only available at a broader category level (16 categories) compared to wholesale price index (131 categories at a four-digit level of ISIC). Partially, this causes unreliable estimates of import penetration and export ratios for some industries. Therefore, these indices are measured in nominal term.

[12] In the WITS dataset, there are several years where tariff rates are missing for some countries. Those missing values are replaced with available tariff rates for previous years.

[13] Due to the change, total tariff lines increased drastically from 7,540 in 2003 to 11,163 in 2004.

[14] Note that plants employing 100 or more workers are defined as large plants in the manufacturing survey. During this classification process, some industries were dropped from the sample because of their small number of observations.

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