ISEAS YUSOF ISHAK INSTITUTE

No. 2016-4

ECONOMICS WORKING PAPER

The Impact of Local Content Requirements on the Indonesian Manufacturing Industry

Siwage Dharma Negara
ISEAS – Yusof Ishak Institute
E-mail: siwage_dharma_negara@iseas.edu.sg

ISEAS Economics Working Paper No. 2016-4

October 2016

Abstract

Local content requirements (LCRs) are prohibited under the WTO law as they violate several WTO provisions including the national treatment principle. Nonetheless, many countries, including Indonesia, persistently use LCRs as part of their industrial policies. Countries implement LCRs for various reasons, including to protect local industries; to create employment; to boost export; to enhance local innovation capacity; and to support broader economic development in the country. This paper examines the impact of LCRs in manufacturing sector in Indonesia, with a particular interest on the machinery and transport industries. Since LCRs discourage foreign imports, hence it is expected they may affect firm's use of imported inputs. The paper uses the Indonesian manufacturing census data, covering the period of 1990 to 2013. It finds the persistence impact of imported inputs on firms' level of productivity, value added, output, export, and employment on the manufacturing sector in Indonesia. Our main finding indicates the ineffectiveness of LCRs in terms of reducing firm's dependency on imported inputs. Given this finding, any unreasonably too restrictive LCRs may adversely affect industrial performance and thus its competitiveness.

Keywords: Local Content Requirement, FDI, Manufacturing, Productivity
JEL Codes: F12, F13, F23

The Impact of Local Content Requirements on the Indonesian Manufacturing Industry

Siwage Dharma Negara*

1. Introduction

Like many other developing countries, Indonesia aspires to upgrade its industrial competitiveness and increase the value added of its manufacturing sector. Traditionally Indonesia's manufacturing sector has high dependency on imported inputs, such as capital, intermediate inputs and raw materials. This has been seen as an undesirable phenomenon by many political leaders[1]. There is a common belief among policymakers that Indonesia should promote localization strategy in order to reduce its high dependency on imported inputs. Also, there is an idea that Indonesia should be able to produce everything from upstream to downstream and achieve 100 percent local content[2].

This nationalistic view is not unique to Indonesia and, in fact, many developing and even some developed countries embrace more or less similar perspective[3]. Australia, Canada, and several European countries have used various local content requirements (LCRs) to develop their automotive industries (Veloso 2006). A typical LCR policy requires a firm to use a given proportion of locally made inputs (e.g., parts and components in the automotive industry) in its final goods production. Failure to meet the LCRs will entail penalty in the form of high tariff on all firm's imports of intermediate inputs. In many cases, LCRs serve as either a precondition to receive government support or an eligibility requirement for inclusion in the national projects.

The proliferation of the use of LCRs is likely to distort world trade and investment flows. In Indonesia, LCRs have been implemented pervasively in some 'strategic' sectors[4]. Common rationales for LCRs are to protect local industries from fierce competition with

* The author would like to thank ERIA and the project organizers, Lili Yan Ing and Mari Pangestu, for commissioning this paper, and also the workshop participants for comments on the earlier draft. Special thanks for Sagap Alik Tipo for providing the data, Imam Setiawan for excellent research assistance, Daniel Suryadarma and Cassey Lee for providing helpful comments and suggestions on the earlier draft. All remaining errors are the author's.

[1] See Yose Rizal Damuri, "Indonesia's Import Phobia", East Asia Forum, 10 August 2012, (http://www.eastasiaforum.org/2012/08/10/indonesia-s-import-phobia/).

[2] http://www.kemenperin.go.id/artikel/7950/Indonesia-Harus-Kuasai-Proses-Produksi-Hulu-Hilir

[3] See OECD 1989 for an assessment of local content requirements in the OECD countries.

[4] For official definition, see Law No. 3 / 2014 on Industry. Also, the 2015-2019 strategic plan of Ministry Industry states the 10 priority industries, including industries on transportation means, capital goods, intermediate goods, parts and components.

imported products; to create jobs for the indigenous workforce and to boost export. In addition, there is a view that LCRs would support broader economic development in the country as they force foreign companies to invest in Indonesia. This in turn will promote innovation and technological capacity of the local firms through the so-called backward and forward linkages.

Despite some 'perceived' benefits of LCRs, in Indonesia in particular, there is lack of thorough analysis on the economic impact of such policy on industrial performance. In fact, policy makers often have little knowledge about the real costs and benefits of such LCRs policy. In view of this, there is a need to study the link between LCRs policy and industrial performance.

Against this backdrop, the purpose of this paper is to investigate the impacts of LCRs on Indonesia's manufacturing sector. Specifically, this paper focuses on the impact of LCRs on sectors like electronic, machinery and transport industries (HS 84, 85 and 87). These industries are part of the global supply chain, in which technology spillovers and regional networks are important. According to data from Statistics Indonesia (BPS), the three classified goods are among the top ten exports from Indonesia. Together they account for around 13 percent of total exports of the country. While they contribute to export revenue, these industries have always been targeted by LCRs policy.

The paper is organizes as follows: Section 2 reviews the literature on local content requirements. Section 3 illustrates some LCRs policy in Indonesia. Section 4 discusses some stylized facts of import dependency in the machinery and transport industries. Section 5 examines the impact of LCRs through the use of imported inputs on firms' productivity, value added, output, export, and employment. And finally the last section concludes and draws some policy recommendations for designing future trade, industrial and investment policies.

2. Literature Review

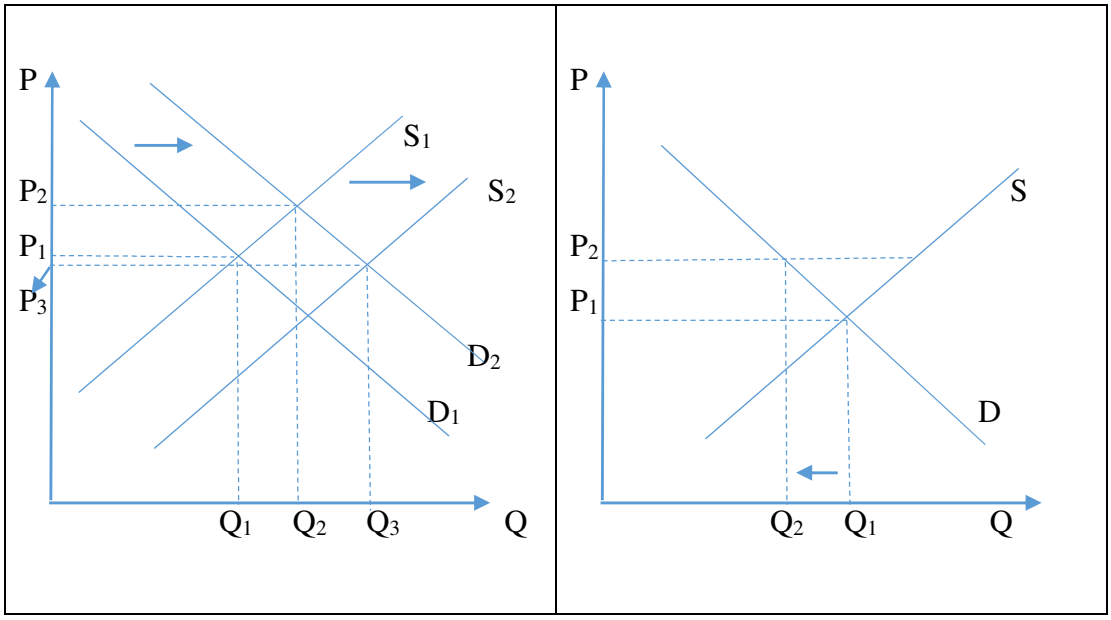
Grossman (1981) pioneers a theoretical analysis on the effects of local content protection on resource reallocation in relation to market structure and domestic intermediate goods industry[5]. He develops a model in which a domestic final goods sector in a competitive market relies on an intermediate sector, either nationally or abroad. Due to inferior technological capability, the domestic cost of intermediate goods is greater than the international price. In this situation, the

[5] In the literature, the term local content protection or local content requirement mean the same thing. This paper uses the two terms interchangebly.

market equilibrium is set such that local producers of the consumer good will choose to import intermediate goods. To protect weaker local firm in the intermediate sector, the government uses an LCR policy. This policy in turn results in two opposite effects (see Figure 1). First, it increases demand for the domestic components sector (from Q_1 to Q_2). Since supply cannot respond fast enough to this artificial demand, the price of local component will increase (from P_1 to P_2). LCR policy is expected to give incentives for local firms to produce and innovate in response to this increased demand, thus increasing the supply of local component (from Q_2 to Q_3). This effect is seen by the proponents of LCRs as important to promote domestic innovation and job creation.

Figure 1: Effects of Local Content Requirement Policy

a. Local Component Market **b. Final Good Market**



Second, due to higher prices of local components, producer has to increase the price of the final good (from P_1 to P_2). And as a result, the quantity sold will go down (from Q1 to Q2) as will domestic welfare. This second effect is used by the opponents of LCRs to point out the economic costs - inefficient resource allocation, higher retail prices for final goods, and negative impact on trade. Moreover, there is no certainty whether LCRs will eventually in the long term lower manufacturing costs through greater competition and innovation. Grossman postulates that the net effect will depend on subsititution possibilities in production, the supply

conditions in the domestic intermediate good industry, and the market structure for intermediate good.

Grossman's seminal work generates a variant of theoretical models on LCRs, which were fitted under various settings of market competition. For instance, Davidson, Matusz, and Kreinin (1985) develop a duopolistic model to look at the impact of LCRs on welfare, output and employment. Their model suggests that LCR policy reduces economic welfare in both the source and host countries. Source country's welfare falls because monopoly rents are shifted from the source country's firm to the host country's firm. While the host country's welfare also falls due to the reduction of consumer surplus that outweighs the gain from increase in monopoly rent (Davidson et al. 1985, pp. 889-890). Furthermore, Krishna and Itoh (1988) show that local content protection has qualitatively different effects in oligopolistic markets. The effects vary according to different form of protection scheme and characteristics of the market on the demand and supply side. Their model show that content protection policy alters the nature of interactions between firms (Krishna and Itoh 1988, p.123). They also show that under certain conditions, content protection, even when set at free trade levels, lower the profits of domestic input suppliers.

Some studies use general equilibrium framework to analyze welfare implication of LCRs policy. For instance, Richardson (1993) develops a two-stage general equilibrium production model with foreign capital flows to explore the welfare effect of content protection. The model suggests that the second-best welfare consequences of content protection depend on its effects on imported inputs. It shows that a content requirement will encourage foreign firms to increase their own domestic production of the component input and so will induce capital flows (Richardson 1993, p. 104).

Lopez-de-Silanes, Markusen, and Rutherford (1996) look at the impact of local content policy on the North American automotive industry using an applied general-equilibrium model under oligopolistic structure. Their model assumes foreign multinationals rely much more on imported intermediate inputs than do domestic firms. In such a situation, the model shows that local content policy are anti-competitive. It reduces overall final output of the industry and shifts rents to domestic firms.

Similarly, Belderbos and Sleuwaegen (1997) study the impact of LCRs under an oligopoly structure. Their study reveals that the European Community's LCRs imposed on Japanese firms have substantial anti-competitive output reducing effects. Moreover, LCRs are generally ineffective in increasing domestic welfare and may have undesirable income distribution effects.

Lahiri and Ono (1998) propose a model to link local content protection with firm's strategy. Their model is set such that identical foreign firms move to a host country and export their products in the final form to another country (consuming country). These foreign firms compete with a domestic firm in a consuming country in an oligopolistic market. Their model shows that when there is free entry and exit of foreign firms, the consuming country may ask for a less severe content protection. On the contrary, when the number of foreign firms is exogenously given, the consuming country will ask for a more severe local content protection. This is because a more severe local content policy will only have a limited effect on the total production of the foreign firms.

Qiu and Tao (2001) develop a model with heterogeneous firms to explore why foreign multinationals in the same industry take different international strategies, either through export or FDI to enter the same market. They show that firms face different levels of FDI location advantage and thus may adopt different international strategies depending on their production cost or degree of vertical integration. Their key findings are LCR policy affects firms' modes of entry to a new market, with FDI being more likely to be adopted when there are lower LCRs. Facing the same LCR, a less efficient firm is more likely to adopt the FDI mode compared with a more efficient firm.

Veloso (2006) builds a theoretical model to look at the conditions in which LCRs can affect overall welfare of the economy. Using the automotive sector as his case study, he shows that LCRs can be welfare enhancing under the presence of extra social benefits. This benefit will diminish and the total welfare of the local economy will decline after reaching a certain point. He argues that there are conditions that make LCRs effective. First, if the gap in manufacturing conditions for components forced into local production is small. Second, if forced localization is associated with unique learning process (Veloso 2006, p. 768). He also warns that the policy has a limit, in which too much local content are likely to severely hurt the economy. In a case where production volumes are small, it is not possible to have a positive effect from such regulation.

Furthermore, Veloso (2006) claims that there are apparently a number of successes, where the local industry benefited from local content regulations. These benefits are linked to reasonable content policies, which induce favourable economies of scale and maintain a clear context of competition for individual component suppliers (Veloso 2006, p. 749).

Kwon and Chun (2009) analyze the link between LCR policies and firms' choice of technology transfer using a duopoly model of multinationals in a two-stage production setting. Their model assumes that local supplier in the less developed country (LDC) has inferior

technology. As a result, the multinational prefers importing intermediate inputs from its home country, for the manufacture of final goods in the LDC. The LCR policy of the LDC forces the multinational to purchase a fixed proportion of its intermediate inputs. They show that the magnitude of an LCR policy cannot affect the multinational's decision regarding technology transfer under technology diffusion. In addition, an increase in the LCR may close out technology diffusion because it could make the multinational establish its own intermediate input supplier(s) and become a vertically integrated multinational.

All in all, the literature presents quite mixed results on the impact of LCRs on the economic outcomes. Some studies argue LCRs may result in unexpected and undesirable outcomes (see Davidson et al., 1985; Krishna and Itoh, 1988; Belderbos and Sleuwaegen, 1997; Lahiri and Ono, 1998; Kwon and Chun, 2009). On the other hand, some also show that the LCRs policies can increase the welfare of a country in certain situations (Hollander, 1987; Richardson, 1993). Some studies, Qiu and Tao (2001) and Veloso (2006) find both positive and negative aspects of LCRs and they claim it is possible to derive an optimal LCR policy.

3. Local Content Requirement Policy in Indonesia

Local content requirement policy in Indonesia can be traced back as far back as the early years of independence when the government implemented '*Benteng programme*' (1950). This programme was meant to promote indigenous local entrepreneurs, thus reducing the economic dominance of the Dutch and ethnic Chinese businesses (Thee 2012, pp. 24-35). Then during the New Order period, the government introduced a so called 'deletion program' (1974-1993), which required manufacturing assembly to progressively use locally made parts and components. However, this programme had not been successful in developing viable supporting industries for the car assembling industry, particularly at the second and third tier levels. Thee (2012) attributed the failure to several factors, including low technological capabilities of local suppliers, lack of economies of scale due to relatively small and fragmented domestic market, and the large amount of investment needed to set up local suppliers (Thee 2012, p. 278).

The deletion programme was implemented under protectionist and import-substituting trade regime. The programme was terminated in 1993 because of pressure of liberalization to abandon non-tariff trade protection. Since then, Indonesia replaced the 'deletion programme' with the 'incentive programme', in which the government provides fiscal incentive in the form

of lower or even zero import duty depending on the level on parts and component produced locally by the industry.

In 1996, the government decided to accelerate the incentive programme by launching a 'National Car Programme'. In this programme, in order to receive lower import duty, automotive industry must have local content at least 20 percent in the first year, 40 percent in the second year and 60 percent in the third year (Aswicahyono et al 2000, p. 224). This programme did not last very long as the Indonesian economy was hit hard by the 1997-98 Asian financial crisis. After the crisis, Indonesia undertook major economic reforms, including trade liberalization that lower various barriers to trade. Local content policy was not given priority but it was not fully abandoned as well. This shows Indonesia's ambivalence towards globalization (Aswicahyono and Hill 2011, p.15).

In the last few years, there is a rising concern of increased economic nationalism and protectionism in Indonesia (Patunru and Rahardja 2015). The government started to revisit localization strategy with the aim to increase domestic investment for local supporting industries, particularly parts and components industry. In November 2009, the Ministry of Finance announced regulation 176/PMK.011/2009 which provides a duty exemption for a period of up to four years on machines, goods and materials, under the condition that at least 30 percent of the total value of machines used were purchased locally[6]. This regulation can be considered as a discriminating local content policy since it provides companies with an incentive to buy local goods and the tariff elimination is used as a reward for that.

The regulation, however stated that the exemptions do not hold for the motor vehicle industry. Later this regulation was amended by regulations 76/PMK.011/2012 and 188/PMK.010/2015 which extend the tariff exemption to the motor vehicle and construction industries. Specifically, the regulation no. 76/PMK.011/2012 eliminates import tariffs on machinery, goods and materials used in the motorised vehicles assembling and components industries. In order to benefit from duty exemption, at least 30 percent of the total value of machines used must have been locally purchased.

In September 2014, the Ministry of Industry issued regulation 80/M-IND/PER/9/2014 introducing local content requirements on motor vehicles[7]. The regulation stipulates that the

[6] The term 'purchased locally' can be rather ambigous. An interview with a manager from a shipbuilding company reveals that the company procured machinery from a local distributor. The machine is imported by the distributor but since the company bought the machine from the local distributor so it can claim the machine as a local content.
[7] See Global Trade Alert, "Indonesia: LCR in automotive industry", http://www.globaltradealert.org/measure/indonesia-lcr-automotive-industry.

motor vehicle industry (motor vehicles with at least four wheels, motor vehicles for private use and motorcycles with two or three wheels) is required to support local motor vehicle components industry in their production process. Activities such as welding, painting, assembling of the motorised vehicles and quality control are encouraged to be conducted within the country. Moreover, the companies must report the progress of their support program every six months to the Directorate General of the Ministry[8].

Local content requirements also affect other sectors such as electricity, oil and gas[9], franchise business, including food, beverage and modern retail sector (World Bank 2016, p. 22). Recently, the Indonesian government legislates an LCR policy, which affects the telecommunication industry. The new regulation requires around 30-40 percent of local content for 4G/LTE equipment by 2017. As it stands, foreign companies that want to sell their 4G/LTE products in Indonesia must build their factory in the country or find local manufacturer as their business partner. The policy is expected to increase the innovation capacity of local industry.

4. Stylized Facts

The composition of Indonesia's main imports has remained unchanged since 1997. As Figure 1 illustrates, imports of intermediates inputs (including raw materials) and capital goods account for the largest share of total imports in Indonesia. On average these two components combined account for around 70 percent of total imports during the period of 1997-2014. Imports of fuel and lubricants have been fluctuated due to price fluctuations.

According to a recent World Bank study, about a quarter of medium and large manufacturing firms in Indonesia used imported inputs in their production process. Within that medium and large category, those firms accounted for 51 percent of employment created, produced about 66 percent of total output, added two-thirds of total value created, and contributed about two-thirds of total manufacturing exports (Rahardja and Varela 2015, p. 5).

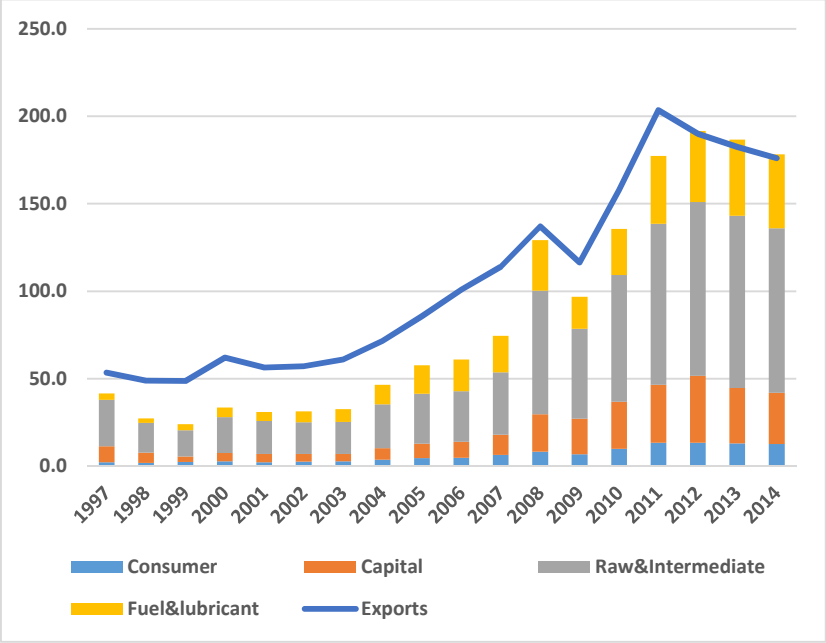
As can be seen in Figure 2, between 2004 and 2012, there was a positive trend of imports of capital goods, raw materials, and intermediate input, which coincides with increased in exports (except for a short-lived drop in 2009 due to the global financial crisis). In particular,

[8] This regulation comes into force on 24 March 2015.

[9] See GBG Indonesia. "Going Local: Understanding Indonesia's Local Content Requirements", 5 May 2014, http://www.gbgindonesia.com/en/main/business_updates/2014/upd_going_local_understanding_indonesia_s_local_content_requirements.php

capital goods imports has increased from an average of 21.4 percent of total imports per year over the period of 2001-2007 to reach 29.3 percent in the period of 2008-2012. The increase in capital goods' share of total imports from 2005 to 2011 has been mainly driven by imports of mechanical & electrical machinery, particularly general electronic devices & parts, ICT-related products & parts, heavy machinery, and generators (World Bank 2013).

Figure 2: Indonesia's Imports by Type of Goods (billion US$)

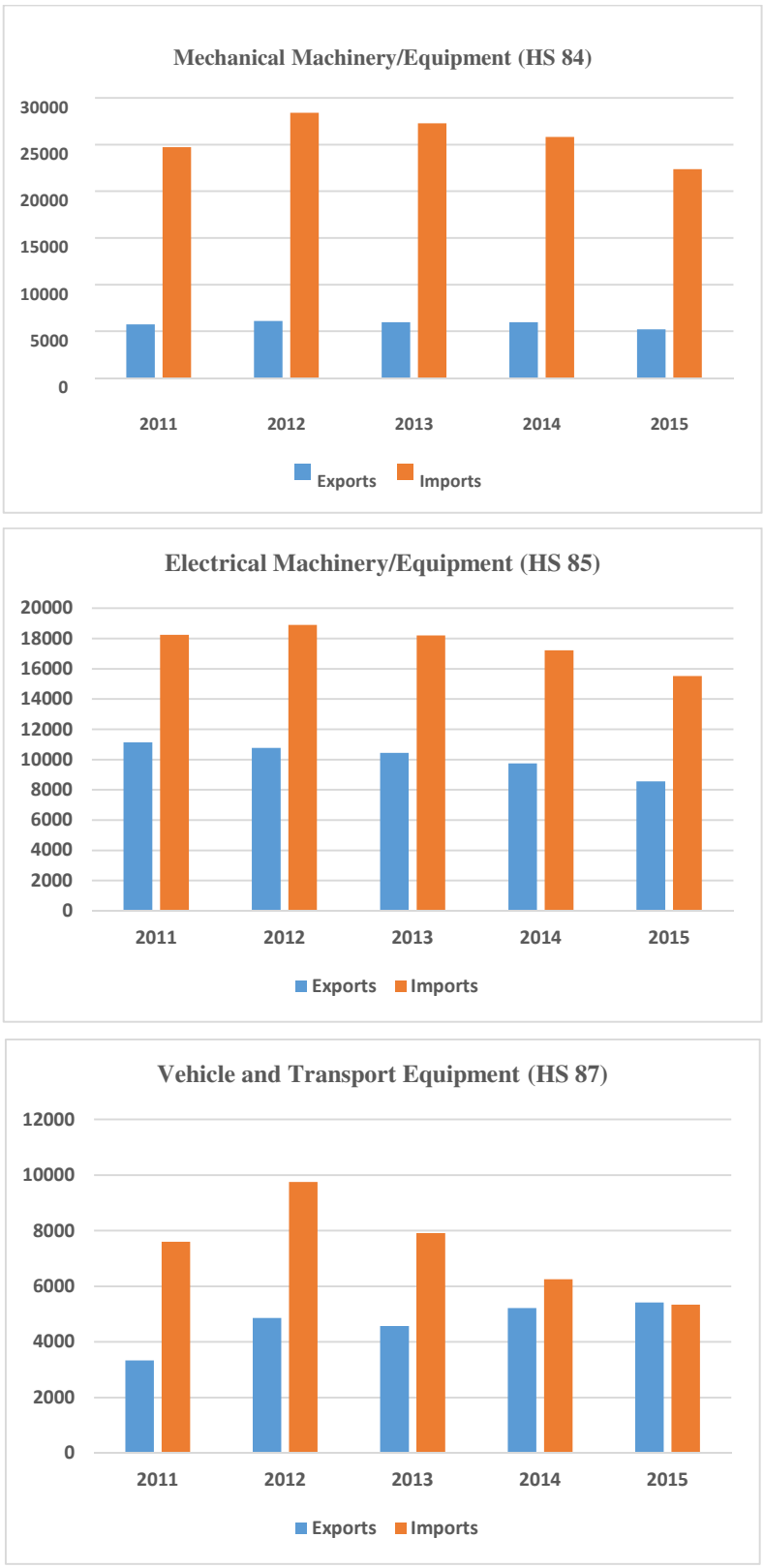


Source: BPS

Increased in capital goods imports is driven by the rise of inward FDI in the telecommunications, machinery, electronics, and mining sectors in Indonesia since 2008. As a result, demand for capital goods imports, especially machinery & equipment has increased significantly.

The rise in machinery imports, has caused significant trade deficit with regards to mechanical machinery & equipment (HS 84) and electrical machinery & equipment (HS 85) sectors (see Figure 3). Imports of machinery for industrial purposes mainly comes from China and Japan (Figure 4). Capital goods imports from China accounted for 7.2 percent of total imports in 2011, increased by 4.6 percentage points from 2005.

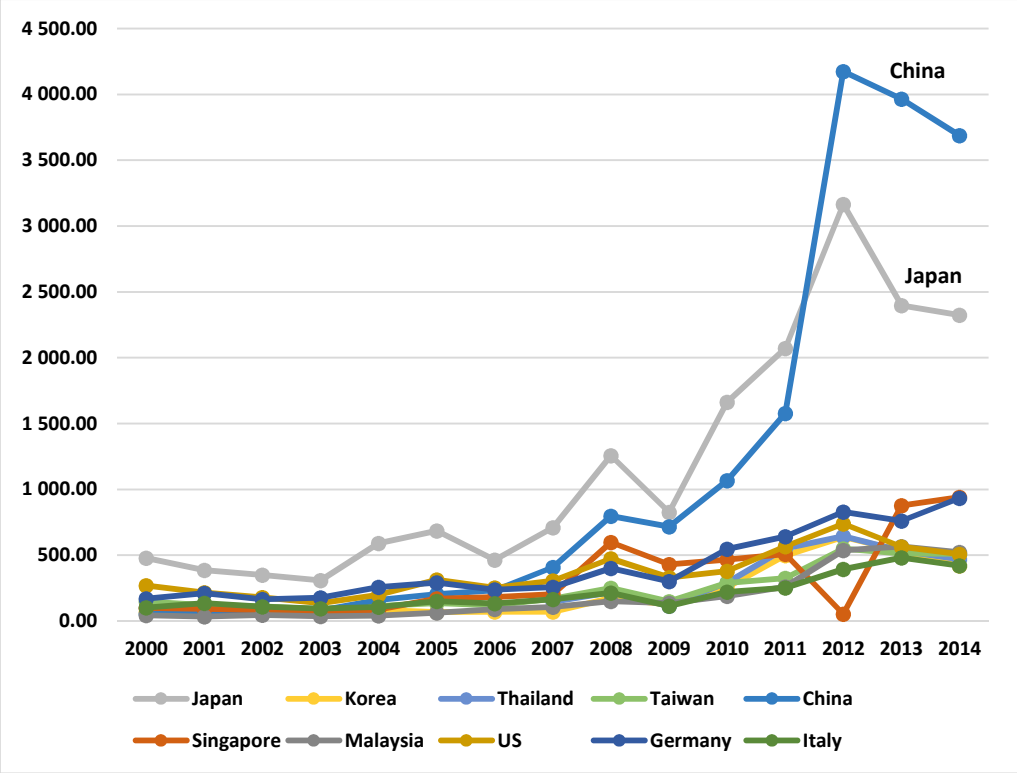
Figure 3: Export and Imports of Electrical, Machinery and Transportation Goods (million US$)



Source: BPS

On the contrary, the trade deficit in vehicle and transport equipment (HS 87) has been declining in the last five years. Looking at the trends, one should not draw the inference that intervention through localization programs has been more 'effective' in the vehicle and transport industry. It can be argued that the vehicle and transport industry's success has been due to a combination of large domestic market base and fewer major international manufacturers compared to that of the machinery industry.

Figure 4: Key Sources of Machinery Imports in Indonesia (million US$)

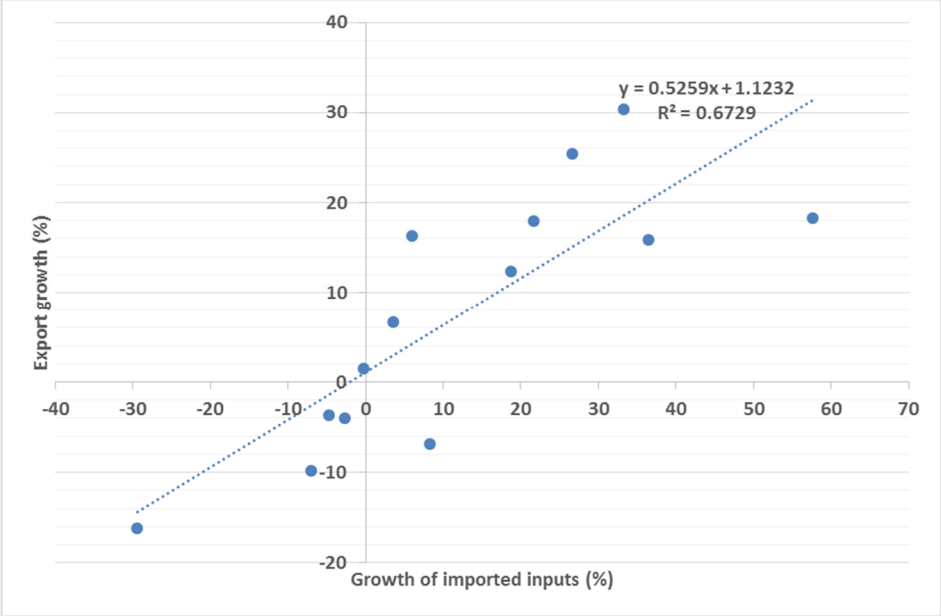


Source: Ministry of Trade

Figure 5 shows that Indonesia's export growth is strongly and positively correlated with the growth of its intermediate goods imports (with correlation coefficient =0.82). Similarly, Indonesia's GDP growth is also positively correlated with the growth of its intermediate goods imports (with correlation coefficient =0.64) (Figure 6).

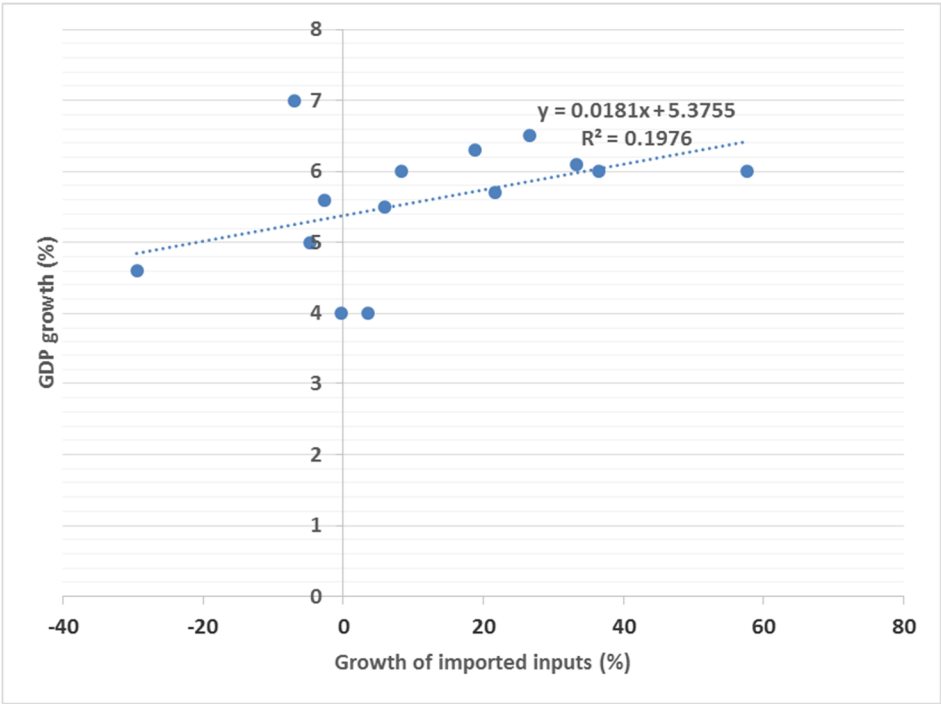
In the next section, we look beyond simple correlation on how the use of imported inputs is associated with firms' productivity, output, export, and employment.

Figure 5: Correlation Between Export Growth and Import Growth



Source: Author's calculation based on BPS trade statistics

Figure 6: Correlation Between GDP Growth and Import Growth



Source: Author's calculation based on BPS trade statistics

5. Model, Data and Estimation Results

5.1. Model

Consider a firm with a Cobb-Douglas production function,

$$(1) \qquad Y_{it} = A_{it}\, K_{it}^{\alpha} L_{it}^{\beta} M_{it}^{\gamma} D_{it}^{\delta}$$

where output in firm i at time t, Y_{it}, is a function of capital, K_{it}, labor, L_{it}, domestic intermediate inputs and raw materials, D_{it} and imported intermediate inputs and raw materials, M_{it}. This Cobb-Douglas technology assumes that the mix of inputs of production used by industries does not change over time. Taking the natural logs of equation (1), and denote by small letters, we have

$$(2) \qquad y_{it} = \beta_0 + \beta_1 k_{it} + \beta_2 l_{it} + \beta_3 m_{it} + \beta_4 d_{it}$$

We then estimate equation (2) and obtain its residuals, which later can be used as a proxy for firm's level Total Factor Productivity (TFP).

5.2. Data

We use data from the Manufacturing Survey of Large and Medium-Sized Firms (*Survei Industri*, SI), covering the period from 1990 until 2013. The SI data is based on annual census of manufacturing firms in Indonesia with 20 or more employees. The data cover firm-level information such as production value, export value, import value, employment, capital, foreign ownership, and value added among others. The data on value added is calculated from firm's output minus its intermediate inputs.

Our main interest is to see the impact of LCRs policy on firm's industrial performances, i.e. productivity measured by total factor productivity (TFP), outputs, value added, exports, and employment. Unfortunately, there is no ideal proxy for LCRs policy. Nevertheless, we know that such policy is meant to control or reduce firm's imports of foreign inputs. The SI data has information on total firm's expenditure on both domestic intermediate inputs and imported intermediate inputs[10]. Given this data, we can use the share of firm's imports of

[10] In our sample, only 20% of the firms use imported inputs. It is important to note, however, that country's import of particular goods may embody some amount of the labor and capital services which originally be from the importing country. Likewise, some of the value added of a country's exports may be of foreign origin. Reimer (2011) calculates that 21.5% of imported labor services are domestic labor, 17.7% of imported capital services

intermediate inputs to its total inputs as an indicator whether there have been changes in firm's dependency on imported inputs due to the LCRs policy. If the policy is effective, we should find a declining trend in the share of imported inputs without adversely affecting firms' level of productivity, value added, outputs, exports, and employment over time.

The SI data must first be cleaned due to a number of missing variables in some observations and some unrealistic numbers. After cleaning the data, the final dataset is an unbalanced panel of around 20,000 firms per year with a total of 526,150 observations. Summary statistics for the full sample (include all manufacturing industries) are provided in Table 1. Meanwhile, Table 2 describes summary statistics for only the transport and machinery industry.

Table 1: Summary Statistics of Medium and Large Manufacturing Industries in Indonesia

Variable	Description	Observations	Mean	Standard deviation
VA/L	Log (Value added per worker)	526,140	9.34	1.68
Y/L	Log (Output per worker)	489,007	10.36	1.71
K/L	Log (Capital per worker)	333,903	9.12	1.77
va	Log (Value added)	526,140	13.53	2.28
y	Log (Output)	489,007	14.57	2.32
x	Log (Export)	47,900	15.01	2.30
k	Log (Capital)	333,903	13.29	2.27
l	Log (Number of worker)	526,150	4.20	1.19
d	Log (Domestic intermediate inputs)	494,535	13.50	2.47
m	Log (Imported intermediate inputs)	103,443	13.92	3.01
FM	FM=1 if Import share> 0	526,150	0.20	0.40
FF	FF=1 if Foreign share>0	526,150	0.08	0.26
FX	FX=1 if exporting>0	526,150	0.48	0.50
TM	TM=1 if industry = machinery & transport	526,150	0.02	0.12
dtfp	TFP growth	33,879	0.10	0.66
dv	Value added growth	458,074	0.15	0.95
dy	Output growth	420,801	0.13	0.86
dx	Export growth	20,280	0.17	0.89
dn	Employment growth	458,088	0.001	0.35
impsh	Share of imported inputs to total inputs	463,657	0.06	0.19

are domestic capital, 12.3% of exported labor services are foreign labor, and 23.3% of exported capital services are foreign capital.

Table 2: Summary Statistics of Transport and Machinery Industry

Variable	Description	Observations	Mean	Standard deviation
VA/L	Log (Value added per worker)	7,780	10.58	1.84
Y/L	Log (Output per worker)	7,228	11.34	1.79
K/L	Log (Capital per worker)	4,393	10.14	1.80
va	Log (Value added)	7,780	15.17	2.46
y	Log (Output)	7,228	15.95	2.45
x	Log (Export)	374	16.18	2.22
k	Log (Capital)	4,393	14.72	2.35
l	Log (Number of worker)	7,780	4.59	1.20
d	Log (Domestic intermediate inputs)	7,133	14.45	2.40
m	Log (Imported intermediate inputs)	2,954	15.41	2.72
FM	FM=1 if Import share> 0	7,780	0.38	0.49
FF	FF=1 if Foreign share>0	7,780	0.22	0.41
FX	FX=1 if exporting>0	7,780	0.55	0.50
dtfp	TFP growth	745	0.13	0.83
dv	Value added growth	6,954	0.16	1.03
dy	Output growth	6,354	0.14	0.93
dx	Export growth	105	0.17	0.85
dn	Employment growth	6,954	0.01	0.40
impsh	Share of imported inputs to total inputs	6,820	0.16	0.29

5.3. Estimation Strategy

Since imported inputs are key for firm's production, in general we expect positive and significant effect of imported inputs on firm's productivity, value added, output, export and employment level. Moreover, we hypothesize that if LCR policy works effectively, the share of imported inputs in production of goods should decrease over time. We use fixed effect method to remove any time-invariant unobserved heterogeneity. The fixed effect method assumes that only time-varying sources of bias that must be controlled for. Later, we explain these control variables.

Basically, we estimate a reduced-form function as follows.

$$(3) \qquad Outcome_{it} = f\,(import\_share_{it},\ t,\ t*import\_share_{it},\ X_{it},\ \mu_i,\ \varepsilon_{it}\,)$$

Five endogenous variables are used to proxy firm's industrial performances, i.e. firm-level total factor productivity (tfp_{it}), value added per worker (va_{it}), output per worker (y_{it}), export (x_{it}) and employment (n_{it}). On the right hand side, our key independent variable is firm's share of imported inputs to its total inputs ($import\ share_{it}$). Time-trend (t) is a variable which is equal

to the time index in a given year (i.e. time trend variable equals 1 for 1990, 2 for 1991, etc.). It allows us to control for the exogenous increase in the dependent variable which is not explained by other variables. The time trend can be used as a proxy for technical progress. Moreover, we interact the import share variable with time trend (t) to capture the change in firm's use of imported inputs over time. Other control variables, X_{it}, include foreign participation dummy (FF_{it}), firm exporting dummy (FX_{it}), and firm importing dummy (FM_{it}).

5.4. Estimation Results

All Manufacturing Industries

Table 3 presents the estimation results of an unbalanced panel with a time trend and firm fixed effects for the reduced-form equation (3)[11]. We include Asian Financial Crisis (AFC) dummy to control for a possible structural break in the economy after the crisis[12]. Robust standard errors are calculated to correct for heteroscedacticity at the firm level.

As can be seen from Table 3, the contribution of imported intermediate inputs to firm's productivity, value added, output, and export remains positive and significant despite the existence of LCR policy. It is however negative and significant in the employment equation. This result may support the opinion that increase use of imported inputs will have a negative impact on employment level. However, if we look at the size of the coefficient, this effect is much smaller than the gains from increased in firm's productivity, value added, output and export.

Table 3 also shows mixed results with respect to the interaction coefficients between the time trend and the imported input share variables. The coefficients are positive and significant for firm's level productivity, export, and employment but they are negative for firm's value added and output. Nevertheless, given that the magnitude of the negative coefficient is relatively small compared to the coefficient estimates for m_{it}, overall the impact of imported inputs on firm's value added and output remain positive.

It is important to note, however, that imports data from SI census only report the value of intermediate import that directly imported by the surveyed firm and imported inputs purchased from local distributors. While some of the local intermediate inputs used by the same firm may

[11] We experimented with year dummies and the results are not much different compared to the estimation using time trend. And since we assume that the effect of LCR policy is not specific to any given year, therefore, we drop the year dummies.

[12] A crisis dummy equal to one for the years 1997 and 1998. We try to include global financial crisis dummy in 2008 and 2009 but the result is not significant. So this is dropped.

consist of imported materials as well, and this cannot be captured in the data. Therefore, the contribution of imported inputs is likely to be underestimated in our data.

Table 3: Basic Results (full sample, all manufacturing)

Dependent variable	**ln TFP_{it}**	**ln VA_{it}**	**ln Y_{it}**	**ln X_{it}**	**ln L_{it}**
Share of imported inputs (m_{it})	1.066***	0.411***	0.78***	0.782***	-0.121***
	(0.075)	(0.033)	(0.034)	(0.103)	(0.022)
Time trend (t)	0.082***	0.142***	0.129***	0.129***	-0.004***
	(0.002)	(0.001)	(0.001)	(0.003)	(0.0004)
$t \times m_{it}$	0.027***	-0.006**	-0.022***	0.018**	0.019***
	(0.006)	(0.003)	(0.003)	(0.009)	(0.002)
Foreign dummy (FF_{it})	0.202***	0.149***	0.191***	0.269***	0.145***
	(0.038)	(0.02)	(0.02)	(0.051)	(0.015)
Exporting dummy (FX_{it})	0.03***	0.067***	0.062***		0.026***
	(0.011)	(0.004)	(0.004)		(0.002)
Importing dummy (FM_{it})		0.031***	0.035***	0.121***	0.085***
		(0.011)	(0.012)	(0.035)	(0.008)
AFC dummy	0.062***	-0.117***	-0.046***	0.048**	0.017***
	(0.013)	(0.005)	(0.004)	(0.023)	(0.002)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	51,846	463,653	430,335	38,378	463,657
R-squared	0.93	0.80	0.82	0.89	0.90

Notes: Robust standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively. R-squared are calculated using 'areg' command with Stata 13. The Hausman test is conducted to choose between the fixed effects and random effects model. The test rejects the null hypothesis, therefore the fixed effects model is selected.
Source: Author's calculation

We find positive and significant effect of foreign participation on firm's level of productivity, value added, output, exports, and employment[13]. Similarly the exporting and importing dummy variables both have positive and significant association with firm's level of productivity, value added, output, export, and employment[14].

The estimated coefficient for AFC dummy is worth further explanation. As expected, the coefficients are negative and significant for firm's value added and output. However, the AFC dummy is positive and significant for firm's productivity, exports and employment level. Amiti and Konings (2007) argued that the large currency depreciations and high level of inflation that Indonesia experienced during the Asian financial crisis could affect measured productivity (and export) without any changes to efficiency (p.1629).

Considering the possibility of structural change after the AFC, we divide the sample into two groups, pre-AFC (1990-1996) and post-AFC (2001-2013), and re-estimate equation (3) with fixed effect method. We omit the crisis period (1997-98) and the early recovery period (1999-2000). Table 4 presents estimation results for the sub-samples period.

Comparing the estimation results between pre- and post- Asian financial crisis, there are three things stand out. First, the contribution of imported intermediate inputs on firm's level of productivity, value added, output, and exports have been increasing significantly after the crisis. This may arguably indicate increased firm's integration with the global value chain. We can also argue that measures to control or reduce the use of imported inputs are ineffective given firm's far-reaching dependency on imported inputs.

Second, the impact of imported inputs on firm's level of employment has changed from negative and significant to not significant post-AFC. Interestingly, importing dummy is consistently positive and significant between the two periods, indicating the positive effect of importing inputs on firm's employment level. This result may refute the opinion that increase use of imported inputs will have a negative impact on employment level. What happen is that the use of imported inputs improve firm's productivity and output, so firm can expand its operation and create more jobs.

Third, foreign and exporting dummy variables show overall positive and significant effect on firm's productivity, value added, output and exports. This effect seems consistent between pre- and post- AFC.

[13] This finding is similar to the findings in the literature in which firms which are foreign-owned, export-oriented, and particularly both, have higher productivity, value added, output and employment (see for instance Blomstrom and Sjoholm 1998, Tybout 2000, Takii 2004, Aswicahyono 2009, World Bank 2012)..

[14] The importing dummy is omitted in the TFP equation, while the exporting dummy is dropped in the export equation due to colinearity.

Table 4: Estimation Results Comparing Pre- and Post- Asian Financial Crisis

(all manufacturing industries)

Dependent variable	ln TFP_{it}		ln VA_{it}		ln Y_{it}		ln X_{it}		ln L_{it}	
	1990-96	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**
Share of imported inputs (m_{it})	0.502***	1.484***	0.135**	0.481***	0.593***	0.835***	0.463***	0.597**	-0.116***	-0.051
	(0.088)	(0.124)	(0.061)	(0.052)	(0.053)	(0.056)	(0.136)	(0.277)	(0.029)	(0.033)
Time trend (t)	0.083***	0.05***	0.113***	0.13***	0.098***	0.115***	0.145***	0.077***	0.026***	-0.006***
	(0.004)	(0.003)	(0.002)	(0.001)	(0.002)	(0.001)	(0.007)	(0.007)	(0.001)	(0.001)
$t \times m_{it}$	0.075***	0.013	0.037***	-0.01***	-0.006	-0.019***	0.12***	0.013	0.073***	0.008
	(0.015)	(0.008)	(0.012)	(0.003)	(0.01)	(0.004)	(0.028)	(0.021)	(0.006)	(0.002)
Foreign dummy (FF_{it})	0.239***	0.068*	0.189***	0.054**	0.263***	0.108***	0.216***	0.11	0.179***	0.078***
	(0.065)	(0.04)	(0.046)	(0.024)	(0.041)	(0.025)	(0.082)	(0.091)	(0.028)	(0.016)
Exporting dummy (FX_{it})	0.075***	-0.017	0.111***	0.019***	0.088***	0.011**			0.112***	0.02***
	(0.018)	(0.011)	(0.015)	(0.004)	(0.012)	(0.004)			(0.009)	(0.002)
Importing dummy (FM_{it})			0.13	-0.002	0.032**	0.009	0.097**	0.053	0.087**	0.055***
			(0.019)	(0.017)	(0.016)	(0.018)	(0.046)	(0.091)	(0.011)	(0.01)
Firm fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	18,654	23,576	109,406	266,282	102,866	245,798	17,486	10,819	109,408	266,284
R-squared	0.97	0.93	0.81	0.74	0.88	0.77	0.93	0.95	0.95	0.91

Notes: Robust standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively. R-squared are calculated using 'areg' command with Stata 13.

Source: Author's calculation

Transport and Machinery Industry

One may argue that the transport and machinery industry may have very different characteristics compared with the overall manufacturing industry. This is because they are relatively more technology intensive. To see how the result may differ, we pick out and estimate the transport and machinery industry only. Table 5 exhibits the estimation result for this particular industry. Similar like our basic result in Table 3, the contribution of imported inputs on firm's productivity, value added, output and export remain positive and significant. Comparing the magnitude of the coefficient estimates with the results in Table 3, one can see that the coefficients are larger in the transport and machinery industry, indicating bigger impact of imported inputs in this industry. However, we don't find any significant change in the trend of imported inputs use except for firm's value added and output per worker after the crisis. The continuously important role of imported inputs in firm's performance may indicate that LCR policy again is not quite effective, especially if the objective is to reduce the use of imported inputs in this sector.

Table 6 compares the results between pre- and post- AFC. We find that the contribution of imported inputs on firm's productivity has increased more than double. However, we don't find significant result of imported inputs on firm's value added, exports, output (post-AFC) and employment (post-AFC).

Interestingly, different from our estimation results using the full sample, now foreign participation dummy is not significant for firm's productivity, output and value added. In fact, foreign dummy has a negative and significant effect on export. This may indicate that most of foreign firms in this industry target domestic market as opposed to export market.

All in all, there are mixed effects of imported inputs in the transport and machinery industry. Imported inputs have positive and significant effect on firm's productivity and on firm's output before the AFC. However, it has no significant effect on firm's value added, export, and output in the period after AFC. Similarly, the interaction between time trend and share of imported inputs shows a mixed picture. It is positive and significant for firm's value added and output after the AFC. Given this mixed results, we cannot fully confirm whether LCR policy has reduced the dependency on imported inputs in transport and machinery sector.

Table 5: Estimation Results for Transport and Machinery Industry (full sample)

Dependent variable	**ln TFP_{it}**	**ln VA_{it}**	**ln Y_{it}**	**ln X_{it}**	**ln L_{it}**
Share of imported inputs (m_{it})	2.414***	0.534**	0.99***	1.42*	-0.121
	(0.452)	(0.225)	(0.214)	(0.727)	(0.183)
Time trend (t)	0.132***	0.161***	0.144***	0.193***	0.001
	(0.015)	(0.006)	(0.006)	(0.034)	(0.004)
$t \times m_{it}$	-0.042	-0.002	-0.016	-0.043	0.005
	(0.026)	(0.017)	(0.017)	(0.05)	(0.012)
Foreign dummy (FF_{it})	0.483	0.063	0.047	0.242	0.315***
	(0.319)	(0.137)	(0.146)	(0.326)	(0.079)
Exporting dummy (FX_{it})	0.044	0.169***	0.183***		0.023
	(0.087)	(0.041)	(0.038)		(0.019)
Importing dummy (FM_{it})		-0.067	-0.07	-0.447	0.167***
		(0.091)	(0.102)	(0.375)	(0.055)
AFC dummy	-0.285***	-0.366***	-0.242***	0.071	-0.062**
	(0.092)	(0.057)	(0.046)	(0.254)	(0.024)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	1,265	6,820	6,306	276	6,820
R-squared	0.92	0.80	0.82	0.92	0.87

Notes: Robust standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively. R-squared are calculated using 'areg' command with Stata 13. The Hausman test is conducted to choose between the fixed effects and random effects model. The test rejects the null hypothesis, therefore the fixed effects model is selected for equation (3)-(7).
Source: Author's calculation

Table 6: Estimation Results for Transport and Machinery Industry

(Pre- and Post- AFC)

Dependent variable	ln TFP_{it}		ln VA_{it}		ln Y_{it}		ln X_{it}		ln L_{it}	
	1990-96	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**
Share of imported inputs (m_{it})	1.156***	2.927***	0.931	-0.25	2.072***	0.152	2.523	-1.292	-0.279*	0.03
	(0.387)	(1.086)	(0.596)	(0.278)	(0.593)	(0.278)	(2.808)	(0.909)	(0.149)	(0.302)
Time trend (t)	0.047	0.105***	0.085***	0.162***	0.084***	0.139***	0.316*	0.209***	0.013	0.008
	(0.041)	(0.031)	(0.02)	(0.01)	(0.017)	(0.009)	(0.182)	(0.07)	(0.01)	(0.005)
t x m_{it}	0.082	-0.057	-0.069	0.041**	-0.077	0.041**	-0.255	0.015	0.111***	-0.015
	(0.089)	(0.057)	(0.084)	(0.02)	(0.067)	(0.019)	(0.717)	(0.05)	(0.041)	(0.017)
Foreign dummy (FF_{it})	0.184	0.382	0.131	-0.126	0.075	-0.175	-1.565***	-1.579***	0.087	0.171**
	(0.178)	(0.614)	(0.304)	(0.189)	(0.171)	(0.18)	(0.234)	(0.342)	(0.104)	(0.087)
Exporting dummy (FX_{it})	0.164**	-0.041	0.322*	0.163***	0.283	0.136***			0.208**	-0.008
	(0.075)	(0.11)	(0.183)	(0.039)	(0.181)	(0.035)			(0.097)	(0.021)
Importing dummy (FM_{it})			-0.167	-0.087	-0.246	-0.245*	0.552	1.338	0.228***	0.115
			(0.177)	(0.117)	(0.214)	(0.13)	(0.451)	(0.993)	(0.068)	(0.079)
Firm fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	360	692	1,379	4,423	1,275	4,077	62	127	1,379	4,423
R-squared	0.97	0.93	0.76	0.74	0.84	0.76	0.93	0.97	0.94	0.89

Notes: Robust standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively. R-squared are calculated using 'areg' command with Stata 13.
Source: Author's calculation

Electronic and Electrical Goods Industry

We now want to see whether similar picture happens in the electronic and electrical goods industry. Compared with the transport and machinery industry, arguably electronic and electrical goods industry has experienced less LCR. Table 7 exhibits the estimation result for the electronics and electrical goods industry. Like the transport and machinery industry, we find that imported inputs contribute positively to firm's productivity, value added, output and export in this industry as well. Comparing the magnitude of the coefficient estimates with the results in Table 5 (for transport and machinery industry), one can see that the impact of imported inputs on firm's value added, output, and exports is slightly higher in the electronics and electrical goods industry. And unlike in the transport and machinery industry, we find positive and significant association between imported inputs and firm's productivity in this industry. Confirming our previous finding, the significance share of imported inputs indicate that LCR policy may not be effective in reducing the use of imported inputs in this sector.

Table 8 compares the results between the period of pre- and post- AFC. Like the previous case, we find that the contribution of imported inputs on firm's productivity has increased more than double between the two periods. Moreover, we find positive and significant impact of imported inputs on firm's output (in both periods), value added (post-AFC), and employment (pre-AFC).

Foreign dummy has positive and significant impacts on firm's output and value added in the period pre-AFC. However, it has negative and significant impacts on firm's productivity (pre-AFC); negative and significant impact on firm's export (post-AFC); and positive and significant on firm's employment (post-AFC). Arguably, the negative and significant effect of foreign dummy on export is likely due to most of the foreign firms target the domestic market in this sector.

In general the picture in the electronic and electrical goods industry shows that imported inputs have positive and significant effect on firm's productivity, value added and output per worker. Given this finding, we can argue that LCR policy is also ineffective in reducing import dependency in this sector. One of the reason could be weak enforcement of the LCR regulation.

Table 7: Estimation Results for Electronic and Electrical Goods Industry (full sample)

Dependent variable	**ln TFP_{it}**	**ln VA_{it}**	**ln Y_{it}**	**ln X_{it}**	**ln L_{it}**
Share of imported inputs (m_{it})	1.265***	0.853***	1.47***	1.831***	0.153
	(0.381)	(0.182)	(0.208)	(0.49)	(0.11)
Time trend (t)	0.048***	0.16***	0.13***	0.19***	0.011*
	(0.016)	(0.007)	(0.01)	(0.032)	(0.006)
$t \times m_{it}$	0.051*	-0.018	-0.03*	-0.038	-0.006
	(0.03)	(0.014)	(0.017)	(0.068)	(0.01)
Foreign dummy (FF_{it})	0.745**	0.421**	0.577***	0.384	0.324***
	(0.319)	(0.169)	(0.209)	(0.496)	(0.105)
Exporting dummy (FX_{it})	0.046	0.071	0.021		0.037
	(0.097)	(0.058)	(0.064)		(0.027)
Importing dummy (FM_{it})		-0.225**	-0.259*	-1.291***	0.086
		(0.114)	(0.143)	(0.368)	(0.072)
AFC dummy	-0.051	-0.0.38	0.119*	0.268	-0.033
	(0.123)	(0.065)	(0.065)	(0.249)	(0.038)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	1,344	5,374	4,714	566	5,374
R-squared	0.89	0.74	0.72	0.88	0.88

Notes: Robust standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively. R-squared are calculated using 'areg' command with Stata 13.
Source: Author's calculation

Table 8: Estimation Results for Electronic and Electrical Goods Industry

(Pre- and Post- AFC)

Dependent variable	ln TFP_{it}		ln VA_{it}		ln Y_{it}		ln X_{it}		ln L_{it}	
	1990-96	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**	**1990-96**	**2001-13**
Share of imported inputs (m_{it})	1.324***	3.035***	0.08	1.079***	0.722***	1.545***	0.831	-3.404	0.357**	0.142
	(0.405)	(0.734)	(0.318)	(0.358)	(0.251)	(0.404)	(0.584)	(2.755)	(0.177)	(0.166)
Time trend (t)	0.079	0.019	0.114***	0.161***	0.078**	0.132***	0.198**	0.118	0.1***	-0.008
	(0.049)	(0.036)	(0.028)	(0.014)	(0.032)	(0.017)	(0.093)	(0.121)	(0.02)	(0.008)
t x m_{it}	0.089	-0.036	0.146*	-0.016	0.077	-0.008	0.264*	0.023	0.044	-0.011
	(0.104)	(0.047)	(0.076)	(0.023)	(0.063)	(0.027)	(0.152)	(0.193)	(0.047)	(0.012)
Foreign dummy (FF_{it})	-0.457*	0.006	0.518*	0.285	0.647**	0.344	0.27	-2.727**	0.288	0.312**
	(0.262)	(0.267)	(0.307)	(0.28)	(0.271)	(0.345)	(0.545)	(1.036)	(0.209)	(0.151)
Exporting dummy (FX_{it})	0.372***	-0.198	-0.132	-0.053	0.01	-0.13			0.228***	-0.007
	(0.138)	(0.135)	(0.121)	(0.071)	(0.131)	(0.089)			(0.071)	(0.029)
Importing dummy (FM_{it})			-0.033	-0.231	-0.209	-0.377*	-1.436***	-2.102**	-0.022	0.127
			(0.175)	(0.167)	(0.171)	(0.209)	(0.428)	(1.007)	(0.13)	(0.086)
Firm fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	411	674	855	3,576	788	3,093	293	66	855	3,576
R-squared	0.97	0.88	0.81	0.62	0.89	0.67	0.91	0.98	0.94	0.91

Notes: Robust standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively. R-squared are calculated using 'areg' command with Stata 13.
Source: Author's calculation

5.5. Endogeneity

In this section we address the issue of the potential endogeneity in our model. Amiti and Konings argue that in the case of Indonesia, it is unclear whether there is in fact a serious endogeneity issue in a firm fixed-effects model (Amiti and Konings 2007, p. 1631). Nevertheless, it is possible that firms in low-productivity industries used more domestic inputs thus less imported inputs, which would lead to reverse causality. We try to address this problem by estimating the impact of the growth of imported inputs on the growth of firm's productivity, output, value added, export and employment. Table 9 presents the estimation results for the transport and machinery industry. Table 10 presents the estimation results for the electronic and electrical goods industry.

The results show that there is positive and significant impact of imported inputs growth on firm's productivity growth in both industries. The growth of imported inputs has positive and significant impact on the output growth in the transport and machinery industry. However, it is negative and significant in the electronic industry. In addition, the growth of imported inputs has positive and significant impact on the export growth in the electronic and electrical goods industry but it is not significant in the transport and machinery industry. The interaction variable is positive and significant, suggesting positive association between firm's productivity and output growth and the upward trend of imported inputs growth in the two industries.

The estimates in Table 9 and Table 10 corroborate our previous findings that imported intermediate inputs have positive and significant impacts on firm's productivity, output, and export.

Table 9: Alternative Econometric Specification (Transport and Machinery)

Dependent variable	**Δ TFP$_{it}$**	**Δ VA$_{it}$**	**Δ Y$_{it}$**	**Δ X$_{it}$**	**Δ L$_{it}$**
Growth of share of imported inputs (Δm_{it})	0.007***	-0.00003	0.002***	-0.166	-0.00006
	(0.001)	(0.0004)	(0.0002)	(0.129)	(0.0001)
Time trend (t)	-0.041***	0.001	-0.021***	-0.157***	-0.003
	(0.01)	(0.008)	(0.008)	(0.018)	(0.006)
t x Δm_{it}	0.107***	0.023**	0.04***	0.223	-0.015**
	(0.019)	(0.011)	(0.01)	(0.017)	(0.007)
Foreign dummy (FF_{it})	0.124	-0.269	-0.219		0.094
	(0.174)	(0.212)	(0.207)		(0.129)
Exporting dummy (FX_{it})	-0.123	-0.175**	-0.047		-0.008
	(0.092)	(0.069)	(0.054)		(0.025)
AFC dummy	-0.573***	-0.229	-0.143		-0.402***
	(0.143)	(0.189)	(0.128)		(0.046)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	745	1,721	1,661	53	1,721
R-squared	0.34	0.17	0.21	0.95	0.21

Notes: Standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively.
Source: Author's calculation

Table 10: Alternative Econometric Specification (Electronic and Electrical Goods)

Dependent variable	**Δ ln TFP_{it}**	**Δ ln VA_{it}**	**Δ ln Y_{it}**	**Δ ln X_{it}**	**Δ ln L_{it}**
Growth of share of imported inputs (Δm_{it})	0.0001***	-3.18e-07***	-0.0001**	0.119***	1.29e-07***
	(0.00002)	(8.01e-09)	(0.00004)	(0.028)	(6.09e-09)
Time trend (t)	-0.03***	0.003	-0.003	-0.089**	-0.021***
	(0.011)	(0.011)	(0.011)	(0.037)	(0.006)
$t \times \Delta m_{it}$	0.087***	0.008	0.042***	0.034	0.003
	(0.023)	(0.011)	(0.012)	(0.081)	(0.009)
Foreign dummy (FF_{it})	-0.109	-0.01	0.211*	0.544	0.109
	(0.082)	(0.139)	(0.125)	(0.343)	(0.164)
Exporting dummy (FX_{it})	-0.195	-0.308***	-0.355***		0.104***
	(0.139)	(0.082)	(0.083)		(0.027)
AFC dummy	-0.017	0.234	0.431***	0.26	-0.079*
	(0.167)	(0.151)	(0.101)	(0.172)	(0.043)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	734	2,082	2,003	218	2,082
R-squared	0.30	0.23	0.22	0.57	0.26

Notes: Standard errors are in parentheses. Based on them ***, **,* mean coefficients statistically significant at 1%, 5%, and 10% level, respectively.
Source: Author's calculation

6. Conclusions

This paper examines the impact of local content requirements (LCRs) in the manufacturing sector in Indonesia. During the last two decades, Indonesia has been using LCRs policy to promote local supporting industries and to reduce the dependency on imported inputs (including raw materials). However, there is lack of empirical evidence that the LCRs policy has either strengthen the capacity of local supporting industries or effectively reduce firm's dependency on imported inputs over time.

For the case of Indonesia, our estimation results show that the contribution of imported intermediate inputs remain positive and significant to firm's productivity, output, value added,

exports, and employment even though the LCRs policy has been implemented for most of the period of observation. This finding indicates that the LCRs policy so far is ineffective in reducing firm's dependency on imported inputs. One possible reason is possibly due to weak law enforcement in Indonesia. Furthermore, our results also indicate that the possibility to use imported inputs is very important for firm's competitiveness. With better access to imported inputs, local firms have access to foreign knowledge and technology, thus they can produce higher-quality and more competitive products. Increased use of imported inputs in recent periods may also indicate that the manufacturing sector in Indonesia has been continuously integrating into the global production network. This can be a potential subject for future research.

Given the above findings, we argue that any unreasonably too restrictive measures to limit the use of imported inputs may adversely affect firm's industrial performance. Adopting a more restrictive LCRs policy will increase the cost of inputs for local firms. Given strong positive association between the use of imported inputs with firms' exports and output, such policy will harm the industry and adversely affect its competitiveness for exports. Moreover, evidence suggests that increased access to imported inputs, facilitated by the trade liberalization process, was a significant productivity-enhancing factor for the Indonesian firms. A study conducted by Amiti and Konings (2007), using the manufacturing census data from 1990-2001, found that a 10-percentage point fall in input tariffs led to a firm-level productivity gain of 12 percent via learning, quality and variety effects. This gain was found to be at least twice as high as the gains from reducing output tariffs that may arise via tougher competition effects. Likewise, World Bank (2012) shows that firms that are more integrated with the global economy (exporting a larger part of their output and using imported inputs) tend to be on average 16-17 percent more productive than non-integrated firms.

In addition, it is important to note that country's import of particular goods may embody some amount of the labor and capital services which originally be from the importing country. Likewise, some of the value added of a country's exports may be of foreign origin. The SI data cannot fully capture the import content of local inputs as well as the local content of foreign inputs. Certainly more research is needed to fully understand the net effect of LCRs on the country. Future research may look at how to better measure foreign and domestic value added in the production of goods. In particular, it would be useful to confirm the findings of this paper using data that allow for identification of foreign and domestic value added. Moreover, it would be interesting to learn more about firm's characteristics that determine the extent of localization of its parts and components.

Finally, localization policy is a strategic business decision. The way it is implemented needs to consider many factors, including the nature of the industry and how it operates on a global context. LCRs policy needs to consider subsititution possibilities in production, the supply conditions in the domestic intermediate good industry, and the market structure for the intermediate good. It must be carefully targeted, continuously monitored and should not be implemented for too long and too restrictive.

References

Amiti, M., & J. Konings. 2007. "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review,* 97(5): 1611-38.

Aswicahyono, H., Basri, M.C, and Hill, H. 2000. "How Not to Industrialise? Indonesia's Automotive Industry," *Bulletin of Indonesian Economic Studies*, 36:1, 209-241.

Aswicahyono, H. 2009. "A Survey of Micro-data Analyses in Indonesia," in Corbett, J. and S. Umezaki (eds.), *Deepening East Asian Economic Integration*. ERIA Research Project Report 2008-1, pp.456-472. Jakarta: ERIA.

Aswicahyono, H. and Hill, H. 2015. "Is Indonesia Trapped in the Middle?," Discussion Paper Series, Department of International Economic Policy, University of Freiburg, No. 31.

Belderbos, R.,G. Capannelli, and K. Fukao. 2001. "Backward Vertical Linkages of Foreign Manufacturing Affiliates: Evidence from Japanese Multinationals," *World Development*, 29(1), 189–208.

Belderbos, R. A., and L. Sleuwaegen. 1997. "Local Content Requirements and Vertical Market Structure," *European Journal of Political Economy*, 13(1), 101–119.

Blomstrom, Magnus and Sjoholm, Fredrik. 1999. "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?" *European Economic Review*, 43 (4-6): 915-23.

Damuri, Y. R. "Indonesia's import phobia", *East Asia Forum*, 10 August 2012. http://www.eastasiaforum.org/2012/08/10/indonesia-s-import-phobia/

Davidson, C., S. J.Matusz, and M. E. Kreinin. 1985. "Analysis of Performance Standards for Direct Foreign Investments," *Canadian Journal of Economics*, 18(4), 876–890.

Grossman, G. M. 1981. "The Theory of Domestic Content Protection and Content Preference," *The Quarterly Journal of Economics*, 96(4), 583–603.

Hollander, A. 1987. "Content Protection and Transnational Monopoly," *Journal of International Economics*, 23(3/4), 283–297.

Krishna, K., and M. Itoh. 1988. "Content Protection and Oligopolistic Interactions," *The Review of Economic Studies*, 55(1), 107–125.

Kwon, C., and Chun, B.G. 2009. "Local Content Requirement under Vertical Technology Diffusion," *Review of Development Economics*, 13(1): 111-124.

Lahiri, S., and Ono, Y. 1998. "Foreign Direct Investment, Local Content Requirement, and Profit Taxation," *Economic Journal*, 108(447), 444–457.

Lahiri, S., and Ono, Y. 2003. "Export-Oriented Foreign Direct Investment and Local Content Requirement," *Pacific Economic Review*, 8(1): 1-14.

Lopez-de-Silanes, F., J. R. Markusen, and T. F. Rutherford. 1996. "Trade Policy Subtleties with Multinational Firms," *European Economic Review*, 40(8), 1605–1627.

OECD. 1989. *Investment Incentives and Disincentives: Effects on International Direct Investment*. Paris: OECD.

Patunru, A.A. and S. Rahardja. 2015. Trade Protectionism in Indonesia: Bad Times and Bad Policy, Lowy Institute, Sydney.

Qiu, L.D., and Tao, Z.G. 2001. "Export, Foreign Direct Investment and Local Content Requirement," *Journal of Development Economics*, 66(1): 101-125.

Rahardja, S and Varela, G. J. 2015. *The Role of Imported Intermediate Inputs in the Indonesian Economy*, World Bank Policy Note 3, April 2015.

Reimer, J.J. 2011. "The Domestic Content of Imports and the Foreign Content of Exports," *International Review of Economics and Finance*, 20: 173-184.

Richardson, M., 1993, "Content Protection with Foreign Capital," *Oxford Economic Papers,* 24, 103-117.

Takii, S. .2004. "Productivity Differentials between Local and Foreign Plants in Indonesian Manufacturing, 1995", *World Development*, 32: 1957-1969.

Thee Kian Wie. 2012. *Indonesia's Economy Since Independence*. ISEAS.

Tybout, J.R. 2000. "Manufacturing firms in developing countries: how well do they do and why," *Journal of Economic Literature*, 38, pp. 11–44.

UNCTAD. 2003. *Foreign Direct Investment and Performance Requirements: New evidence from selected Countries*. United Nations, New York and Geneva.

UNCTAD. 2014. *Local Content Requirements and the Green Economy*. United Nations, New York and Geneva.

Veloso, F.M. 2006. "Understanding Local Content Decisions: Economic Analysis and an Application to the Automobile Industry," *Journal of Regional Science*, 46(4): 747-72.

World Bank. 2012. *Productivity Performance in Indonesia's Manufacturing Sector*, Policy Note 5, September 2012.

World Bank. 2015. *Indonesia Economic Quarterly: In times of global volatility*, October 2015.

World Bank. 2016. *Indonesia Economic Quarterly: Private investment is essential*, March 2016.