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Effect of Logistics Service on Firms' Performance: Evidence of Southeast Asian Economies

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Effect of Logistics Service on Firms' Performance: Evidence of Southeast Asian Economies

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Abstract:

This paper examines whether firms can do on their own activities to compensate poor quality of logistic infrastructure at the national level, using World Bank's Enterprises survey (ES) of Indonesia (2015), Malaysia (2015) and Thailand (2016). This is the first study analyzing firms' logistics upgrading effort across countries with a view to provide prudential policies to enhance firms' competitiveness. The key finding is that Indonesia was behind the other two ASEAN members especially in terms of physical infrastructure investment but regulatory cumbersome remains the common challenge in these three countries as it was relatively difficult to be measured the progress. Our inter-country firm-level cross-sectional econometric analysis suggest that there is a room for firms to undertake their own logistic service upgrading to mitigate the logistic bottlenecks at the national level. Certain forms of subsidies/tax incentives might be needed to offset additional logistic cost incurred by poor quality of logistic infrastructure services while waiting for logistic service challenges at the national level to be resolved.

Keywords: logistic sector, ASEAN, upgrading, global value chain

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1. Issues

The role of logistics gains policy attention worldwide due to its increasing importance in firms' competitiveness (Lakshman et al. 2001; Devlin and Yee, 2005; OECD/WTO 2013; Song and Yeo, 2017). In general, it involves efficiently managing how resources are acquired, stored, and transported from the origin of raw materials to their final destination where the product is consumed/used. The better the management, the better the firms' performance (Pasadilla and Shephard, 2012, OECD/WTO, 2013). The role of logistics service is even greater in the growing context of global value chains (GVCs)[2], where goods and intermediates frequently cross border. This makes the effect of logistics on firms' performance magnified. This would be in line with the so-called magnification effect of tariff in GVC argued in Yi (2003).

There is a wide range of activities firms can enhance their logistic capability such as material handling, warehouse management, accounting system and procurement procedure (Coycle, et al. 2008; Liang et al. 2016). The positive effect is expected when firms put effort to upgrade their logistic capabilities. It is less likely to be negative. Nonetheless, the extent to which the positive effect of firm effort is not only conditioned by firms themselves but also logistic infrastructure quality at the national level (Gimenez and Ventura, 2005; Marrissey and O'Donoghul, 2013; Doloreux and Shearmur, 2018; Viederyte, 2013). All other things being equal, a better logistic infrastructure quality would enhance the positive effect firms benefit from the effort.

To provide high quality of logistic infrastructure services, it involves a wide range of aspects, ranging from price and quality of basic infrastructure as well as rules

[2]In the literature, an array of alternative terms has been used to describe this phenomenon, including global production sharing, international production fragmentation, vertical specialization, slicing the value chain and outsourcing. In this project, they are used in inter-changeable manner.

and regulations governing the related activities. It is the rules and regulations that make progresses vary across countries (Arvis, et al. 2012; Tham and Das, 2018). Some aspects take times to improve whereas progress of the others is difficult to measure/monitor. Occasionally, some aspects are political sensitive. What remains largely unknown is whether firms can do on their own activities to compensate poor quality of logistic infrastructure at the national level. This is immense policy relevant in developing countries, where making progress in logistic services quality remains challenge. If firms can partly compensate so, certain forms of subsidy/tax incentives might be needed to encourage firms to do so while waiting for logistic infrastructure development to be completed. This will short-run remedy measures to mitigate the inefficiency found at the national level.

Ideally, a systematic firm survey covering more than one country is needed to address this issue. Nonetheless, it is rare to have a systematic survey data at a firm level across countries as conducting firm survey is time and resource consuming. It is even much more difficult to undertaken the similar survey across countries.

One exception is World Bank's Enterprises survey (ES) which is a firm-level survey undertaken by the Enterprise Analysis Unit under a common Methodology was developed applied ever since. By 2021, there are more than 174,000 interviews in 151 countries have taken place.[3] Interestingly, among ASEAN members, ESs of Indonesia (2015), Malaysia (2015) and Thailand (2016) have a direct question about firms' effort to upgrade their logistic services. These ESs were conducted virtually the same time period. Income per capita of these three countries, ranked ascendingly from Indonesia (3,870 USD), Thailand (7,187 USD) and Malaysia (10,412 USD)[4], is within the range of middle-income countries. Quality of logistic infrastructure services proxied by World Bank's Logistic Performance Index (LPI) is different among them. Pooling these ESs together would be a dataset suit to examine the issue in hand.

[3] See more detail at https://www.enterprisesurveys.org/en/about-us

[4] GDP per capita is in 2020 from World Bank Data website at https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=TH

Against this backdrop, this paper examines the effect of firms' upgrading logistics capability on their performance, using ES of Indonesia (2015), Malaysia (2015), and Thailand (2016). This paper contributes to the existing literature by adding empirical evidence based on cross-country firm-level dataset. To the best of our knowledge so far, there has not been a systematic analyses firms' logistics upgrading effort across countries.

The structure of this paper is as follows; The next section presents the literature review to highlight knowledge gaps on the logistic service literature. The third section provides a summary of World Bank enterprises survey, followed by the brief discussion about the logistic challenges in these three countries. Section 5 presents the model specification and variable description whereas results are in Section 6. Summary and policy inferences are in the final section.

2. Analytical Framework

Logistics gain their relative importance as they are among the most important factors creating competitive advantage in businesses (Yorulmaz and Birgun, 2017). In general, logistics involves efficiently managing how resources are acquired, stored, and transported from the origin of raw materials to their final destination where the product is consumed/used. To do so, an attitude, ability, process, knowledge and skill are all needed and implement them collectively to upgrade firms' logistic capability (Morash et al. 1996). Interestingly, a small bottom neck happening somewhere in a supply chain could result adverse impact of the overall supply chain competitiveness. The adverse impact could be magnified when firms intensively involved in GVCs, where goods and intermediates frequently cross border. This seems to be in line with the so-called magnification effect of tariff in GVC argued in Yi (2003).

Empirical studies on the effect of logistic capability are undertaken in two directions, one is at the aggregate analysis and the other is firm-centric. They are often undertaken in a mutual exclusive fashion. In the aggregate-level analysis, the

statistical relationship logistics services and economic performance is examined. One popular used proxy of quality of logistic services is logistic performance index (LPI) developed by World Bank. LPI is a discrete index is undertaken at the national level, covering 167 countries during 2007, 2010, 2012, 2014, 2016, and 2018.[5] A statistical relationship between LPI and aggregate economic indicators such as GDP, and/or external trade is examined by inter-countries panel data econometric analyses.[6] The example of empirical studies in this group include Chu (2012), Lean, et al. (2014), Gani (2017), Sezer and Abasiz (2017) and Richard (2020). Not surprisingly, the positive effect is often found empirically without more detail how the quality of logistic services affects firms and then the overall economy. In other word, the link between logistic services and economic performance is treated as a black box. This makes policy inference drawn rather limited. At best, these studies urge for the government to seriously commit to logistic infrastructure investment both soft and hard infrastructure are discussed.

Another branch of empirical studies focuses on the importance of logistic services on firms' performance. The sample of these studies include Shang and Marlow (2007), Xiaolan (2013), and Yorulmaz and Birgun (2017). The key finding points to the positive correlation between logistic capability and firms' performance, whose measures vary across studies. Some focus on financial performance whereas the others look for behavior-based performance such as organizational flexibility and customer service satisfactory (e.g. Shang and Marlow, 2005; Yorulmaz and Birgun, 2017). All of these measures positively attribute to sales and profit, which seem to be

[5] There are 6 dimensions within the overall index. They are customs (the efficiency of customs and border management clearance), infrastructure (the quality of trade and transport infrastructure), international shipments (the ease of arranging competitively priced shipments), logistic competence (the competence and quality of logistics services), tracking and tracing (the ability to track and trace consignments) and timeliness (the frequency with which shipments reach consignees within scheduled or expected delivery times).
See more detail at https://lpi.worldbank.org/international/aggregated-ranking.

[6] The example of these studies includes Chu (2012), Lean, et al. (2014) Gani (2017), Sezer and Abasiz (2017), Richard (2020)

the ultimate target of firm operation. Nonetheless, the statistic relationship found in these studies is correlation instead of causality because most of the statistic correlation is retrieved from a structural equation model (SEM) approach.[7] In addition, the outcome is rather firm-centric, providing what firms can do. The role of government has been left out from the discussion.

In fact, both firms' effort and quality of logistic infrastructure both matter in determining gains from enhancing logistic capabilities at the firm level.

There are many logistics costs components, which can be categorized into five most common logistics cost components (Pohit et al. 2019; Banomyon et al. 2022). They include transportation cost, warehousing cost, inventory-carrying cost, logistics administration cost, and packing cost, all of which constitutes to logistics costs incurred to firms. Out of them are only packaging costs and inventory-carrying costs solely determined by firms. Costs derived from the other components are jointly determined with quality of logistic infrastructures (e.g. road/maritime/rail freight transport, freight forwarding).

Quality of logistic infrastructure is jointly determined by logistic-related physical infrastructure and rules and regulations governing it. Building/improving the physical infrastructure (e.g. ports, airports, double-track railway) often takes time to start providing decent service quality and experiences long delay. In some cases, construction requires land acquisition so that it could be political sensitive and slows down the project's progress. To a certain extent, nonetheless, poor quality of the infrastructure could be mitigated by logistic management within firms to a certain extent. In particular, a better logistic management within firms could offset delay derived from the infrastructure's poor quality so that it could mitigate the firms' logistic performance to their customers. This would be different from other aspects such as custom clearance, streamlining rules and regulation, which largely depends

[7] SEM approach is often to formulate testable hypotheses instead of revealing the causality relationship.

on the government's commitment and mindsets. It is unlikely for firms to do to mitigate the adverse effect on logistic performance in these respects. Another important feature is about monitoring progress. Physical infrastructure is relatively easier to be measured its progress as opposed to the soft one. The latter needs a well-designed monitoring system on continuous basics.

This seems to be consistent with a new research agenda emerged in the logistic literature pointing to the role of government on firms' logistic capabilities. In particular, Coe (2013) highlights the pressing need to incorporate the government role into the analysis and move beyond firm-centric approaches. Logistic research must adopt a broader political–economic perspective that incorporates power and value relationships, institutional and regulatory context, and labour issues and social upgrading. So far, they have been massively underplayed. Hence, subsequent works such as Marrissey and O'Donoghul (2013), Doloreux and Shearmur (2018) and Viederyte (2013) highlight the role of government conditioning benefits of logistic service improvement to firms. The implication of these new research agenda is how firms benefit from their own logistic upgrading is also conditioned by factors external to firms including quality of infrastructure, regulatory framework. Despite immense policy relevant, the extent to which firms effort could compensate the inefficiency incurred by the government remains largely unknown.

3. Logistic Infrastructure Services Challenges in Indonesia, Malaysia and Thailand

Figure 1 presents the LPI indices and its sub indices of the three ASEAN members in our interest, Indonesia, Malaysia, and Thailand. Among them, Malaysia was the best performer, followed by Thailand and Indonesia between 2010 and 2016. In Malaysia, companies have broadly perceived that logistic development could plays a significant role as a strategic tool in acquiring competitive advantage. Particularly,

firms who seek cost competitiveness and economies of scale by outsourcing production aboard. (MIM, 2008).

Interestingly, in 2018, Thailand overtook Malaysia in the overall performance index. This achievement has been a significant milestone of Thailand's National Plan for the Development of Transportation System, initiated in 2017. The transport systems are well integrated with technology and innovation, as well as the revision of regulations and human resource development all together. As resulted in remarkable increasing in all sub-indices, especially in logistic competence, tracking and tracing, and timeliness.

From 2010 to 2016, infrastructure was the area where Indonesia was behind the other two ASEAN members. For example, the difference of infrastructure index between Indonesia and Malaysia (the best performance among three countries) was around 40 per cent. This was the largest gap observed among the other subindices and remained persistent from 2010 to 2016. The exception is 2018 where the gap was narrowed noticeably. This would reflect the fact that it takes time to enhance logistic infrastructure to overcome any bottleneck that might have in the logistic management system. By contrast, the gap of the other subindices moved up and down over the considering periods.

Another important remark from Figure 1 is the most dynamic sub indices is infrastructure and hard infrastructure. Partly, it was relatively easy to be measured and make the progress as opposed to customs, logistic competence, international shipments which are all intensively involved local rules and regulations (soft infrastructure). While many countries express their strong commitment by issuing their national level comprehensive plans, the shortcoming of these plans is the wide coverage. In the context of developing countries, turning these master plan into reality remains a big challenge so that progress of the plans varies across topics/sections. Objectives and goals involving construction are often easily delivered whereas those involving regulatory reforms are in opposite. For example, according to a development of infrastructure and facilities section in *The Third Thailand Logistics*

Development Plan (2017-2022) (NESDC, 2017), Thailand aims to connect sub-regions and to support gateway development. If the goal is achieved, the road traffic is expected to be increased. This seems to be in contrast with the fact that quota on authorized vehicles and driver licenses on road freight transport have kept unchanged until 2020 (OECD, 2020). Another example in the case of Indonesia, while *National Logistic Blueprint of Indonesia (2012-2025)* under actors and logistics service providers section aims to encourage reliable and competitive firms as local and national players (ESCAP, 2020). According to the recent assessment by OECD, price controls on transport rates and other transport-services remain in place (OECD, 2021).

Another important trend is the performance difference between Thailand and Malaysia. In general, Thailand was behind Malaysia in terms of logistic performance indices. Nonetheless, the gap was narrowed noticeably in terms of infrastructure subindices especially between 2012 and 2016. In Indonesia, quality of logistics service remains problematic on firms' export competitiveness as logistic costs in Indonesia are about 14–25 percent of the total cost of exporting (Tongzon, 2012). Meanwhile, such costs in the United States and Japan are around 10 percent and 11 percent, respectively. In addition, vast difference in logistic service quality across provinces is another obstacle to overcome (World Bank, 2010)

Recently, World Bank conducted the Enterprise Survey in various countries. In Southeast Asia, it covers Cambodia (2013 and 2016), Indonesia (2009 and 2015), Lao (209, 2012, 2016 and 2018), Malaysia (2007 and 0215), Myanmar (2014 and 2016), the Phillippines (2009 and 2015), Thailand (2016) and Vietnam (2005, 2009 and 2015). Among them, only Indonesia, Malaysia and Thailand in which there are direct question about firms' effort to upgrade their logistic services in the recent survey. It is worth to discuss trends and patterns related to this section.

Generally, there are 2,703 firms totally covered in the three countries surveys. There are 1,200 Indonesian firms, 830 Malaysian firms and 673 Thai firms, some of which employed less than 20 workers per firms (Table 1). To make the analysis comparable, firms with less than 20 workers are excluded from the analysis as they

are likely to be micro enterprises. Despite their importance, they might behave differently from the others with larger size. The total samples dropped to 1,677 firms, i.e. 750 Indonesian firms, 521 Malaysian firms and 406 Thai firms.

---- Insert Table 1 around here----

When firm location is concerned, the survey covers widely (Figure 2). In the case of Indonesia, these firms covered in the survey are located in 161 provinces. The first 28 largest provinces accounted for 70 per cent of total samples. The other 143 provinces cover less than 5 firms in each province, accounting for 30 per cent of total samples. The five largest provinces are Tangerang, Bandung, Jakarta barat, Surabaya, and Semarang. The number of covered samples are 71, 48, 34, 32, and 27 respectively (Figure 2.1). All of them accounted for 28.3 per cent of total sample.

---- Insert Figure 2 around here----

To a large extent, a similar geographical dispersion of the surveyed firms is also found in the Malaysian sample. Out of 115 provinces covered in the survey, there are 21 provinces in which a number of covered samples in each is greater than or equal to 5 firms. These 21 provinces accounted for 68.3 per cent. The top- five provinces in terms of a number of covered firms are Sungai Petani, Johor Bahru, Kota Bharu, Seremban and Shah Alam. The number of covered samples are 41, 37, 33, 31 and 22, respectively, all of which accounted for 31.5 per cent of total samples (Figure 2.2).

By contrast, the surveyed samples of Thailand are highly concentrated in Bangkok and its vicinities. There are 162 samples in Bangkok, accounted for 42.6 per cent of total sample. Firms in Eastern Economic Corridor (EEC) areas (Chonburi, Rayong, Chachoengsao), which is next to the country's deepest seaport, accounted only 10 per cent (Figure 2.3).

The sample covers both domestic and foreign firms in the survey. In the Indonesian survey, these two firms seem to be different from each other in terms of sales, employment and sale per worker. Illustrated in Figure 3.1, domestic firms tend to be smaller in size measuring by both sales and employment, as well as exhibit lower sale per workers. The kernel density distribution of foreign firms is skewed to the right of that of domestic ones. Nonetheless, there is not much difference between these two groups of firms in terms of capital-labor ratio. Figure 3.2 is the set of kernel density distribution of Malaysian samples. Foreign and domestic firms covered in the survey are quite similar in terms of size, capital labor ratio and sale per workers. This is similar to the Thai survey illustrated in Figure 3.3.

---- Insert Figure 3 around here----

The survey is well distributed across sectors. Majority of the samples are in the manufacturing. In case of Indonesia and Thailand, a number of manufacturing samples accounted for more than 80 per cent (Table 2). Such a percentage share is much higher than Malaysia, whose shares was around 65 per cent. Two service activities, wholesalers and retailers, are the two main components in the service sector covered in Malaysia dataset.

---- Insert Table 2 around here----

In Indonesia manufacturing sample, top-six samples include (1) chemicals, (2) foods, (3) plastics and rubbers, (4) garments, (5) textiles, and (6) non-metallic mineral products, accounting for 14.1, 13.2 , 13.1, 12.5, 11.9, and 9.7 per cent of total samples, respectively. Samples in the other manufacturing activities accounted less than 1 per cent in the total sample.

The industrial coverage in Thailand's enterprise survey is similar to Indonesia to a certain extent. Food, plastics and rubber, garments, and electronics are the top-

four sectors covered in the survey. They accounted for 20, 19.7, 18.2 and 16.5 per cent, respectively. It is important to note that automotive sector, another key manufacturing sector in Thailand, accounted only 0.5 per cent in the survey.

In Malaysian survey, food, chemicals and electronics are the three largest sectors in terms of sample numbers. They accounted for 17.1, 10.2 and 9.8 per cent of total samples.

Generally, there are 28, 194 and 107 firms in Thai, Malaysian and Indonesian surveys indicating their effort to upgrade their logistic capability over the past three years before the survey undertaken. They accounted for 6.9 ,37.2, and 14.2 per cent of total samples in each country, respectively (Table 3). Note that there is no explicit explanation in the survey about whether such upgrading is conducted in-house or contracting out. It seems both in-house and contracting-out upgrading is treated indifferently in the survey.

---- Insert Table 3 around here----

In Thailand, firms upgrading their logistic capability seems to be smaller, perform poorer in terms of sale per worker and exhibits higher export-sale ratio (Table 3). Nonetheless, such difference is not statistically significant at 10 per cent. The former seems to have more than one plants so that logistic capability upgrading is expected to connect their economic activities across plants.

This is different from cases of Malaysia and Indonesia where firms upgrading their logistic capability are larger in size (measured by both sales and employment), perform better in terms of sale/worker, and rely more on export market and input from abroad. In addition, they are more likely to be multi plant firms.

Table 4 illustrates sectoral distribution of firms indicting their effort to upgrading their logistic capabilities over the past three years. This seems to vary across countries. In Indonesia, the survey covers firms in plastics and rubber, food, textiles, and garments upgrading their logistic capabilities. Similarly, the surveyed

firms in Malaysian dataset are in five major economic activities, i.e. (1) electronics-31 firms, (2) food-26 firms, (3) chemicals-23 firms, (4) wholesale services-23 firms, and (5) construction services-19 firms. By contrast, the surveyed firms covered in the Thai dataset are dominated in few economic activities. There are 8 firms in food industry, 5 firms in electronics, 4 firms in tobacco, and 4 firms in retail services, upgrading logistic capabilities over the past three years.

---- Insert Table 4 around here----

Nonetheless, these upgrading firms in all three countries accounted for at least 10 per cent of total samples covered. This allows us to reasonably draw the effect of logistic service upgrading on firms' performance.

When both types of firms are compared, it seems that firms upgrading logistic services tend to be larger in size in the case of Indonesia, measured by sales and employment (Table 5). In the case of Thailand, firms upgrading logistic services are smaller. In the case of Malaysia, both types of firms are more or less the same size. When global integration is concerned, Indonesian and Malaysian firms upgrading logistic services tend to more export-oriented and rely more on foreign inputs. This is different from the case of Thailand where firms upgrading are more domestic-oriented but relying on foreign inputs as opposed to those no upgrading.

---- Insert Table 5 around here----

In terms of nationality, both Indonesian and Malaysian firms upgrading logistic services are likely to be foreign. By contrast, Thai firms upgrading logistic services tend to be indigenous (Table 6). Combined with other firm characteristics above (e.g. larger firms, more export-oriented, better performance), foreign firms in Indonesia and Malaysia are likely to be affiliates of multinational enterprises (MNEs). Such upgrading effort would be to strengthen firms' competency. It looks rather

different from Thai firms which are indigenous, and smaller in size. Their upgrading effort seems to catch up with other leading firms to survive in the business. Such patterns are consistent with the econometric analysis below.

---- Insert Table 6 around here----

Finally, we examine whether logistic upgrading by firms is related to their location. In particular, are firms located far from the sea port more likely to upgrade their logistic services to compensate their locational disadvantage? This is important for both Malaysia and Indonesia whose geographical feature consists of islands, not Thailand whose most of provinces are well connected through road network.

To do so, distance between a firm's location to the nearest port is measured in kilometers. Name of city/town/village of firm is available in question A.3x. In case of Malaysia, there are 18 seaports, 5 seaports in Peninsular Malaysia, and 10 in East Malaysia. There are 16 seaports in Indonesia are considered according to ES (8 seaports in Java, 3 seaports in Sumatra, 2 ports in Sulawesi, and 3 ports in Lesser Sunda Islands). Such a distance is statistically examined with decision to upgrade logistic service by firms, by estimating a simple probit model. The models are estimated for each individual country as well as for pooling two countries dataset together. The result in Table 7 suggests that distance variable turns out to be statistically significant at the conventional level (5 per cent) in all cases. The coefficient associated with distance tends to be larger in the case of Indonesia, i.e. 4 times larger. This suggests that firms' decision to upgrading logistic capabilities is to compensate the disadvantage incurred by the logistic bottleneck at the national level. The statistical significance of firms' age variable is marginal and negative. The younger firms are more likely to realize the important role of logistics on firms' performance and upgrade their logistic capabilities.

Interestingly, firms upgrading logistic capabilities are more likely to undertake other forms of upgrading including product improvement, process improvement,

organizational improvement, and R&D investment. All of these upgrading variables are highly correlated as suggested by a simple regression (Table 8). Such a finding holds in both pooling three countries and individual country regressions.

---- Insert Tables 7 & 8 around here----

4. Empirical Analysis

4.1 Model

An empirical model used in this paper is the standard firm performance equation in the industrial organization literature and SCP paradigm, in which firm performance ($Perform_{i,j,k}$) is used as the dependent variable (Delorme et al. 2002). In principle, firm's profit or productivity is used as a proxy of its performance. Nonetheless, such variables are not available in the ESs. In this study, total sales of firm ($Sales_{i,j,k}$) are used as a proxy of firm performance. The larger the firm, the greater the sale value so that firm's size should be controlled in the analysis. In this study, we introduce the firm's size as one of the controlling variables($size_{i,j,k}$). Two alternative proxies of firm's size, the value of fixed asset and total workers are used in this study. Alternatively, sale per worker ($Sales\_worker_{i,j,k}$) is used as the alternative dependent variable.

The other controlling variables are firm-specific factors such as export-sale ratio ($exp_{i,j,k}$), importing raw materials/intermediates ($imp_{i,j,k}$) and ownership ($own_{i,j,k}$). As echoed in the firm heterogeneity[8], exporting firms are often large in size so that the corresponding coefficient of $exp_{i,j,k}$ is positive. This argument is applicable to $imp_{i,j,k}$ The coefficient associated with $own_{i,j,k}$ is expected to be positive because foreign firms are often more productive as opposed to their indigenous counterparts, all other things being equal. Note that $own_{i,j,k}$ is the share of foreign ownership of firms.

The another set of controlling variables is related to innovation activities firms performed. There are five categories of innovation activities. They are product

[8] See the recent literature survey in Melitz and Redding (2014) and works cited therein.

innovation ($product_{i,j,k}$)process innovation ($process_{i,j,k}$), organization innovation ($org_{i,j,k}$) research and development ($R\&D_{i,j,k}$),. One advantage of WB enterprises survey is there are explicit questions related to these innovation activities. For example, when $product_{i,j,k}$ is concerned, the question in the questionnaire (H1) is ' During the last three years, has this establishment introduced new or significantly improved product or services?'. The similar questions are found for $process_{i,j,k,}$ $org_{i,j,k,}$ and $R\&D_{i,j,k}$. This would make the causality link from these activities to firm's performance more meaningful. All of them are proxied by the binary dummy variable whose value equals to 1 if firms committed to these activities during the past three years and zero otherwise.

To address the core hypothesis, $Logistic_{i,j,k}$ is introduced together with the interaction term with binary country dummies, i.e. Thailand and Malaysia. Hence, the coefficient associated with $Logistic_{i,j,k}$ indicates the effect of logistics service upgrading by Indonesian firms on performance. The coefficients corresponding Thailand and Malaysia dummies reflect the effect on Thai and Malaysian firms different from that on Indonesian one. The paper's core hypothesis examines these interaction terms' estimates. Given the fact that Indonesian logistics service quality is the lowest among three countries indicated by LPI index (see discussion above), the positive coefficient associated with the interaction term will indicate additional positive effect of logistics service upgrading of other countries. This will imply the complementary nature between firm and national logistics service upgrading.

All in all, the empirical model is expressed as Equation 1;

$$Perform_{i,j,k} = \beta_0+\beta_1\ size_{i,j,k} + \beta_2\ exp_{i,j,k} +\beta_3\ imp_{i,j,k} + \beta_4\ own_{i,j,k} + \beta_5\ product_{i,j,k} \quad (1)$$
$$+ \beta_6\ process_{i,j,k,} +\beta_6\ org_{i,j,k,} +\beta_7\ R\&D_{i,j,k}.+\beta_8\ Logistic_{i,j,k}$$
$$+ \beta_9\ Logistic_{i,j,k}*Malaysia +. \beta_{10}\ Logistic_{i,j,k}*Thailand\ \sum_j^n \delta_j ind_j + \epsilon_{i,j}$$

Dependent variables

$Perform_{i,j,k}$ = Performance of firm i in industry j of Country k measured by two alternatives;
(1) $Sales_{i,j,k}$ = sales value (in natural log), and;
(2) $Sales\_worker_{i,j,k}$ = sale value per workers (in natural log)

Independent variables

$size_{i,j,k}$ = size of firm i in industry j of Country k , measured by two alternatives
(1)Fixed asset value ($lnK_{i,j,k}$) (in natural log)
(2)Total workers ($lnL_{i,j,k}$) (in natural log)

$exp_{i,j,k}$ = export-sale ratio of firm *i* in industry *j* of Country *k*

$imp_{i,j,k}$ = intermediate imports as a share of total intermediates of firm *i* in industry *j* of Country *k*

$own_{i,j,k}$ = foreign ownership share of firm *i* in industry *j* of Country *k*

$product_{i,j,k}$ = 0-1 binary dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k* committed product innovation activities in the past three years and zero otherwise.

$process_{i,j,k,,}$ = 0-1 binary dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k* committed process innovation activities in the past three years and zero otherwise.

$org_{i,j,k,}$ = 0-1 binary dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k* committed organization innovation activities in the past three years and zero otherwise.

$R\&D_{i,j,k}$ = 0-1 binary dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k* committed on R&D activities in the past three years and zero otherwise.

$Logistic_{i,j,k}$ = 0-1 dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k* committed logistics service upgrading activities in the past three years and zero otherwise.

Malaysia = 0-1 binary dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k*is from Malaysia

Thailand = 0-1 binary dummy variable which equals to 1 when a firm *i* in industry *j* of Country *k*is from Thailand

ind_j = 0-1 binary dummy variable which equals to 1 when a firm is in industry *j* and zero otherwise.

Data summary and correlation matrix of all the variables are in Tables 9 and 10.

---- Insert Tables 9 & 10 around here----

4.2 Data set and Econometric procedure

As mentioned above, the enterprise survey of Indonesia (2015), Malaysia (2015), and Thailand (2016) are used for the econometric analysis simply because these

three surveys contain direct question about firms' effort to upgrade their logistic services in the recent survey. There are 2,703 firms totally covered in the three countries surveys. There are 1,200 Indonesian firms, 830 Malaysian firms and 673 Thai firms, some of which employed less than 20 workers per firms. In addition, as firms in manufacturing and service sectors are quite different from each other in various aspects especially tradability nature which plays a crucial role

As the dataset is cross-sectional, the ordinary least squares (OLS) method is employed. Since the sample size is rather small and cross countries, it is likely that outliers could impact on and mislead the estimated parameters and therefore the careful treatment of outliers is needed. Cook's Distance[9] was used to identify suspected outliers. To accommodate the outliers, intercept dummies were introduced and the equations were re-estimated to test both changes in estimated parameters and significance of the interested dummy.

One might be concerned about the endogeneity issue between decision to upgrade logistic capabilities and firms' performance that are affected by common factors. Such a concern might not be substantial as decision to upgrade variable is somehow pre-determined. In particular, the question in the survey is asking firms' decision over the past three years.

5.3. Results

All results are presented in Tables 11-13. Table 11 presents the estimates where sales are the dependent variable and firm's size is measured by fixed asset (k). Tables 12 and 13 present alternative estimates where firm's size is measured by a number of workers and sales/worker is the dependent variable, respectively. The overall fit of all models in these three tables passes the statistical significance at 1 per cent level.

[9] Cook's distance is the 'influence statistic' developed by Cook (1977). The statistics take into account both the studentized residuals (the residual divided by its standard error) as well as the estimated variances of the residuals to identify outliers. For details see Belsley *et al.* (1980) and Barnett and Lewis (1994)

The results are not sensitive to the alternative specifications (altering both dependent variable and firm size variable) so that our following discussion is based on Table 10.

In Table 11, there are five models. Model (1) is the result based on Equation 1 where all forms of upgrading are included whereas Model (2) keeps only R&D investment dummy as firms tend to undertake these upgrading efforts simultaneously. The results of both Models (1) and (2) are similar except coefficients corresponding to upgrading variables. In Model (1), coefficients corresponding to these upgrading variables except R&D investment turn out to be either statistically insignificant or negative. As illustrated above (Table 7), firms upgrading logistic capabilities are more likely to undertake other forms of upgrading including product improvement, process improvement, organizational improvement, and R&D investment. The estimates in Model (1) might be affected by a multicollinearity problem from putting all upgrading variables simultaneously. Hence, Model (2) is preferred. Models 3-5 are similar to Model 2 but applying to each individual country.

The coefficient corresponding to *k* turns out be positive and statistically significant, capturing the firm size on sales, i.e. the sale volume positively correlates with size. The positive and statistically significant variable of *exp* suggests that export-oriented firms tend to exhibit higher sales than domestic-oriented ones. The coefficient corresponding to *imp* is not statistically significant. A sensible explanation for this statistical insignificance is the effect of the cascading tariff structure that has long been pursued in these three countries. Incentive structures induced by the cascading tariff encourages firms to manufacture finished products using imported raw materials and intermediates. Hence, firms regardless their performance tend to rely on imported raw materials and intermediates.

The coefficient corresponding to logistic itself turns to be positive and statistically significant at one per cent in all but Model 5 specifications. Firms who undertook the logistic upgrading experience higher sales, all other things being equal. The coefficient associated with the interaction term with country dummies (Malaysia and Thailand) turns to be negative and statistically significant. This suggests gain

from the logistic upgrading is even larger for Indonesian firms as opposed to Thailand and Malaysia. This findings seem in line with the fact logistic infrastructure was the most challenging issue for Indonesia as opposed to other aspects. In this aspect of logistic challenge, firms' effort could be complement to mitigate the logistic bottlenecks.

In case of Malaysian firms, the net effect remains positive as the coefficient associated to Malaysian dummy interacted with logistic variable (-1.842) is slightly smaller than that to logistic variable itself (2.017). This seems to be consistent with Model (4) (only Malaysian firms) where the estimated coefficient is positive but statistically insignificant.

Interestingly, in case of Thai firms, the magnitudes of these coefficients are opposite to that of Malaysian ones. It implies Thai firms undertaking logistic service upgrading for the past three years experiences lower sales as opposed to those not undertaking. As illustrated in Section 4, Thai samples which undertook the logistic service upgrading were smaller in size, performed worse in terms of sale per workers, and were indigenous. Such upgrading effort revealed in the survey would indicate their effort to catching up with other competitors. Such negative effect suggests that logistic service upgrading like other forms of upgrading takes time to yield the effect.

7. Conclusion and Policy Inferences

This paper examines whether firms can do on their own activities to compensate poor quality of logistic infrastructure at the national level, using World Bank's Enterprises survey (ES) of Indonesia (2015), Malaysia (2015) and Thailand (2016). Despite immense policy relevance, to the best of our knowledge so far, there has not been a systematic analyses firms' logistics upgrading effort across countries. Analysis of the logistic sector development in these three countries points Indonesia was behind the other two ASEAN members especially in terms of physical infrastructure investment. Interestingly, regulatory cumbersome is the common

challenge in these three countries partly because it was relatively difficult to be measured the progress.

Evidence from their Enterprise Survey suggests that firms undertaking logistic service upgrading vary greatly in terms of their characteristics across countries. There are 28, 194 and 107 firms in Thai, Malaysian and Indonesian surveys indicating their effort to upgrade their logistic capability over the past three years before the survey undertaken, accounting for 6.9 ,37.2, and 14.2 per cent of total samples in each country, respectively. In Thailand, firms upgrading their logistic capability seems to be smaller, perform poorer in terms of sale per worker and exhibits higher export-sale ratio. They are scatter in food industry (8 firms), electronics (5 firms), tobacco (4 firms), and retail services (4 firms). This is different from cases of Malaysia and Indonesia where firms upgrading their logistic capability are larger in size (measured by both sales and employment), perform better in terms of sale/worker, and rely more on export market and input from abroad. In addition, they are more likely to be multi plant firms. These firms are in sectors which are more or less in line with their countries' major export items.

Both Indonesian and Malaysian firms upgrading logistic services are likely to be foreign. This is in a sharp contrast to Thai cases which are dominated by indigenous ones. Whether logistic upgrading by firms is related to their location is also examined for Indonesian and Malaysian firms whose geographical feature consists of islands, not Thailand whose most of provinces are well connected through road network. The result suggests that Firms' decision to upgrading logistic capabilities is influenced by distance from the nearest port, reflecting the effort for firms to compensate the disadvantage incurred by the logistic bottleneck at the national level. Firms upgrading logistic capabilities are more likely to undertake other forms of upgrading including product improvement, process improvement, organizational improvement, and R&D investment.

Our inter-country firm-level cross-sectional econometric analysis suggest that firms who undertook the logistic upgrading experience higher sales, all other things

being equal. Interestingly, gain from the logistic upgrading on sales is larger for Indonesian firms as opposed to Thailand and Malaysia, suggesting logistic infrastructure was the most challenging issue for Indonesia as opposed to other aspects. In this aspect of logistic challenge, firms' effort could be complement to mitigate the logistic bottlenecks.

There are two policy inferences from this study. Firstly, upgrading logistic infrastructure services remain challenges to many countries and take time to overcome. Hence, logistic upgrading efforts at the firm can mitigate while waiting for challenges to be overcome to a certain extent.

Secondly, certain forms of subsidies/tax incentives might be needed to offset additional logistic cost incurred by poor quality of logistic infrastructure services. This is highly relevant for small and medium enterprises whose financial constraints are often severe. Note that like other forms of upgrading, logistic service upgrading takes time for firms to realize the benefit. This points to the first move advantage of the upgrading.

Table 1

Basic Features in Enterprise Surveys of Indonesia, Malaysia and Thailand

1.1 Number of firms covered in the survey

	Thailand	Malaysia	Indonesia
Total Sample	673	830	1200
Manufacturing	476	456	955
Services	197	374	245

1.2 Number of firms according to size and ownership

Size	Thailand	Malaysia	Indonesia
Small (5-19)	267	309	450
Medium (20-99)	234	269	410
Large (>100)	172	252	340
Ownership			
Foreign	37	151	121
Indigenous	636	642	1069
SOE	0	37	10

Note: Original survey has a greater number of firms, however the missing data is eliminated from our analysis.

Source: Authors' compilatiom from ES of each country

Table 2 Sectoral Composition in Enterprise Surveys of Indonesia, Malaysia and Thailand

Description	Number of firms			Share to total sample (%)		
	Indonesia	Malaysia	Thailand	Indonesia	Malaysia	Thailand
Manufacturing	**640**	**342**	**340**	**85.3**	**65.6**	**83.7**
Food	99	89	81	13.2	17.1	20.0
Tobacco	13		12	1.7	0.0	3.0
Textiles	89	12	5	11.9	2.3	1.2
Garments	94	29	74	12.5	5.6	18.2
Leather	10	3		1.3	0.6	0.0
Wood	8	8	4	1.1	1.5	1.0
Paper	3	2	3	0.4	0.4	0.7
Publishing, printing, and recorded media	3	12	1	0.4	2.3	0.2
Refined petroleum products		3		0.0	0.6	0.0
Chemicals	106	53		14.1	10.2	0.0
Plastics and rubber	98	19	80	13.1	3.6	19.7
Non metallic mineral products	73	12	2	9.7	2.3	0.5
Basic metals	5	13		0.7	2.5	0.0
Fabricated metal products	8	9	2	1.1	1.7	0.5
Machinery and equipment	4	14	2	0.5	2.7	0.5
Electronics	6	51	67	0.8	9.8	16.5
Precision instruments		2		0.0	0.4	0.0
Transport machines	8	4	2	1.1	0.8	0.5
Furniture	12	6	5	1.6	1.2	1.2
Recycling	1	1		0.1	0.2	0.0
Services	**110**	**179**	**66**	**14.7**	**34.4**	**16.3**
Construction services	20	39	17	2.7	7.5	4.2
Services of motor vehicles	8	14	8	1.1	2.7	2.0
Wholesale	14	60	11	1.9	11.5	2.7
Retail	41	59	17	5.5	11.3	4.2
Hotel and restaurants	12	4	9	1.6	0.8	2.2
Transport services	15	2	4	2.0	0.4	1.0
IT		1		0.0	0.2	0.0
Total	**750**	**521**	**406**	**100.0**	**100.0**	**100.0**

Source: Authors' compilation from ES of each countryExported Dataset.xls Sheet7

Table 3
Characteristics of Firms upgrading logistic services in Enterprise Surveys of Indonesia, Malaysia and Thailand

	Thailand	Malaysia	Indonesia
Number of firms			
No-upgrading	378	327	643
Upgrading	28	194	107
Sales (in ln)			
No-upgrading	17.2	17.2	17.0
Upgrading	16.7	17.1	19.6***
Employment (in ln)			
No-upgrading	4.5	4.4	4.5
Upgrading	4.6	5.1***	5.2***
Sales/worker (in ln)			
No-upgrading	12.7	12.7	12.5
Upgrading	12.1	12.0***	14.4***
Export_sales (ratio)			
No-upgrading	0.10	0.10	0.10
Upgrading	0.14	0.17***	0.14**
Importing raw materials (ratio)			
No-upgrading	0.095	0.078	0.09
Upgrading	0.12	0.25***	0.17***
Foreign firms (ratio)			
No-upgrading	0.05	0.05	0.05
Upgrading	0.08	0.10***	0.09***
SOE			
No-upgrading	0.009	0.09	0.9
Upgrading	0	0.10	1.0
Multiplant			
No-upgrading	0.16	0.15	0.16
Upgrading	0.28*	0.29***	0.30***

Note:*** and ** indicate the 1% and 5% level of statistical significance
Source: Authors' compilatiom from ES of each country
REFERENCE: Final Report 2022/Descriptive Analyses.docx

Table 4 Sectoral Composition in the Upgrading Firms

	Number of Firms			Share of total Sample (%)		
Description	**Indonesia**	**Malaysia**	**Thailand**	**Indonesia**	**Malaysia**	**Thailand**
Manufacturing	**92**	**127**	**21**	**86.0**	**65.5**	**75.0**
Food	16	26	8	15.0	13.4	28.6
Tobacco	2		4	1.9	0.0	14.3
Textiles	16	6		15.0	3.1	0.0
Garments	13	8	2	12.1	4.1	7.1
Leather		3		0.0	1.5	0.0
Wood		1		0.0	0.5	0.0
Paper		2		0.0	1.0	0.0
Publishing, printing, and recorded media		5		0.0	2.6	0.0
Refined petroleum products				0.0	0.0	0.0
Chemicals	11	23		10.3	11.9	0.0
Plastics and rubber	19	6	2	17.8	3.1	7.1
Non metallic mineral products	7	2		6.5	1.0	0.0
Basic metals		2		0.0	1.0	0.0
Fabricated metal products		7		0.0	3.6	0.0
Machinery and equipment	2	4		1.9	2.1	0.0
Electronics		31	5	0.0	16.0	17.9
Precision instruments		1		0.0	0.5	0.0
Transport machines	4			3.7	0.0	0.0
Furniture	2			1.9	0.0	0.0
Recycling				0.0	0.0	0.0
Services	**15**	**67**	**7**	**14**	**35**	**25**
Construction services		19	1	0.0	9.8	3.6
Services of motor vehicles		4		0.0	2.1	0.0
Wholesale	2	23		1.9	11.9	0.0
Retail	3	18	4	2.8	9.3	14.3
Hotel and restaurants	4	2	2	3.7	1.0	7.1
Transport services	6			5.6	0.0	0.0
IT		1		0.0	0.5	0.0
Total	**107**	**194**	**28**	**100.0**	**100.0**	**100.0**

Source: Authors' compilation from ES of each countryExported Dataset.xls Sheet10

Table 5: Difference between firms upgrading and those not in in Enterprise Surveys of Indonesia, Malaysia and Thailand

Description	Sales			Employment			Export-sale ratio			Sourcing inputs from abroad		
	Indonesia	Malaysia	Thailand	Indonesia	Malaysia	Thailand	Indonesia	Malaysia	Thailand	Indonesia	Malaysia	Thailand
Manufacturing												
Food	1.154	1.017	0.992	1.107	1.127	1.031	2.208	1.678	1.469	2.282	0.985	5.556
Tobacco	1.108		0.935	1.175		1.108			0.712	0.000		2.750
Textiles	1.063	0.994		1.133	1.088		2.793	1.148		1.273	1.358	
Garments	1.147	1.023	0.915	1.175	1.191	0.874	1.512	1.864	0.000	1.959	1.622	0.000
Leather		1.000			1.000			1.000			1.000	
Wood		1.075			0.997			1.353			7.442	
Paper		1.000			1.000			1.000			1.000	
Publishing, printing, and recorded media		1.007			1.148			1.525			0.571	
Refined petroleum products												
Chemicals	1.180	1.038		1.275	1.165		1.720	1.191		3.061	1.254	
Plastics and rubber	1.197	1.013	0.928	1.136	1.060	1.088	2.857	0.725	2.805	3.314	1.299	2.051
Non metallic mineral products	1.154	1.194		1.139	1.368		1.939	1.013		1.111	2.039	
Basic metals		1.091			1.415			1.686			1.000	
Fabricated metal products		1.022			1.058			1.127			1.079	
Machinery and equipment	1.216	1.046		1.077	1.060		2.000	0.348		0.808	0.761	
Electronics		0.991	0.871		1.006	1.074		0.874	0.639		1.101	5.027
Precision instruments		1.157			1.145			0.620			1.000	
Transport machines	1.113			1.057			1.750			1.750		
Furniture	0.862			0.794			0.000			0.000		
Recycling												
Services												
Construction services		1.062	0.938		1.022	1.138		0.703	0.000			
Services of motor vehicles		1.057			1.012			3.500				
Wholesale	1.024	0.998		1.137	0.991		0.000	1.307		0.000		
Retail	1.242	1.039	0.923	1.022	1.025	0.999	0.000	1.041	0.000			
Hotel and restaurants	1.093	0.956	0.980	1.259	0.985	1.083	3.000	2.000				
Transport services	1.008			1.125								
IT		1.000			1.000			1.000				

Source: Authors' compilation from ES of each countryExported Dataset.xls Sheet11

Table 6: Nationality of Firms upgrading logistic services in Enterprise Surveys of Indonesia, Malaysia and Thailand

Description	Number of foreign firms			% to total foreign firms		
	Indonesia	Malaysia	Thailand	Indonesia	Malaysia	Thailand
Manufacturing						
Food	5	5	0	0.4	0.5	0.0
Tobacco	0		0			
Textiles	4	2	0	0.4	0.4	
Garments	6	2	0	0.4	0.3	0.0
Leather	0	1		0.0	1.0	
Wood	0	0	0			
Paper	0	1	0		1.0	0.0
Publishing, printing, and recorded media	0	1	0		1.0	
Refined petroleum products		0			0.0	
Chemicals	8	9		0.4	0.5	
Plastics and rubber	6	4	1	0.5	0.6	0.5
Non metallic mineral products	3	1	0	0.2	0.2	
Basic metals	0	1			0.3	
Fabricated metal products	0	4	0	0.0	1.0	
Machinery and equipment	1	0	0	1.0	0.0	
Electronics	0	19	3		0.7	0.2
Precision instruments		1			0.5	
Transport machines	1	0	0	1.0	0.0	0.0
Furniture	0	0	0		0.0	0.0
Recycling	0	0				
Services						
Construction services	0	3	0		0.6	
Services of motor vehicles	0	0	0	0.0		
Wholesale	0	5	0		0.4	0.0
Retail	1	1	2	0.2	0.1	1.0
Hotel and restaurants	1	2	0	1.0	0.7	0.0
Transport services	0		0			
IT		0				

Source: Authors' compilation from ES of each countryExported Dataset.xls Sheet11

Table 7
Probit model Estimation
(Decision to upgrade logistic services as the dependent variable)

VARIABLES	(1) Indonesia	(2) Malaysia	(3) Indonesia+Malaysia
lndist	0.166***	0.0826*	0.149***
	(0.0586)	(0.0466)	(0.0362)
firmage	-0.000233	-0.000376*	-0.000261
	(0.000642)	(0.000221)	(0.000209)
Constant	-1.635***	-0.614***	-1.237***
	(0.222)	(0.185)	(0.140)
Observations	721	521	1,242

Note: Number in the parenthese is standard errors and, ***, **, * indicate the statistical significance at 1%, 5% and 10% respectively.
Source: Author's Estimation

Table 8
OLS Estimation of Various Types of Upgrading Effort
(Decision to upgrade logistic services as the dependent variable)

VARIABLES	Pooled Samples	Indonesia	Malaysia	Thailand
product improvement	0.145***	0.135***	0.161***	0.0931**
	(0.0262)	(0.0307)	(0.0616)	(0.0436)
Process/method improvement	0.309***	0.454***	0.143***	0.390***
	(0.0248)	(0.0334)	(0.0477)	(0.0426)
Organizational improvement	0.270***	0.225***	0.247***	0.242***
	(0.0261)	(0.0374)	(0.0490)	(0.0446)
R&D investment	0.135***	0.0498	0.157***	0.130**
	(0.0264)	(0.0367)	(0.0488)	(0.0584)
Constant	0.0552***	0.0216**	0.180***	0.00512
	(0.00868)	(0.0101)	(0.0244)	(0.00938)
Observations	1,677	750	521	406
R-squared	0.396	0.507	0.236	0.514

Note: Number in the parenthese is standard errors and, ***, **, * indicate the statistical significance at 1%, 5% and 10% respectively.
Source: Author's Estimation

Table 9
Summary Statistics

Variable	# obs.	Mean	Standard Deviation	Min	Max
$Sales_{i,j,k}$	1,677	17.2	2.4	10.6	25.7
$Sales\_worker_{i,j,k}$	1,677	12.7	2.1	4.7	22.0
$lnK_{i,j,k}$	1,097	18.0	4.0	7.6	27.7
$lnL_{i,j,k}$	1,677	4.5	1.2	3.0	8.9
$exp_{i,j,k}$	1,677	0.1	0.2	0.0	0.7
$imp_{i,j,k}$	1,313	0.1	0.2	-0.1	1.0
$own_{i,j,k}$	1,677	0.1	0.1	0.0	0.7
$product_{i,j,k}$	1,677	0.1	0.3	0.0	1.0
$process_{i,j,k,,}$	1,677	0.2	0.4	0.0	1.0
$org_{i,j,k,}$	1,677	0.2	0.4	0.0	1.0
$R\&D_{i,j,k}$	1,677	0.1	0.3	0.0	1.0
$Logistic_{i,j,k}$	1,677	0.2	0.4	0.0	1.0

Source: Authors' compiled from ES of each country

Table 10
Correlation Matrix

	$Sales_{i,j,k}$	$Sales\_worker_{i,j,k}$	$lnK_{i,j,k}$	$lnL_{i,j,k}$	$exp_{i,j,k}$	$imp_{i,j,k}$	$own_{i,j,k}$	$product_{i,j,k}$	$process_{i,j,k,}$	$org_{i,j,k,}$	$R\&D_{i,j,k}$
$Sales\_worker_{i,j,k}$	0.9022	1									
$lnK_{i,j,k}$	0.2173	0.168	1								
$lnL_{i,j,k}$	0.6099	0.2084	0.1839	1							
$exp_{i,j,k}$	0.2582	0.1307	-0.0977	0.3454	1						
$imp_{i,j,k}$	0.2216	0.1308	-0.0918	0.2622	0.2078	1					
$own_{i,j,k}$	0.2357	0.1102	-0.0098	0.3319	0.262	0.3632	1				
$product_{i,j,k}$	0.0833	0.0238	0.0123	0.1451	0.1636	0.209	0.0979	1			
$process_{i,j,k,,}$	0.1722	0.0881	-0.047	0.2286	0.2036	0.2303	0.1691	0.5473	1		
$org_{i,j,k,}$	0.1648	0.0779	-0.0924	0.2305	0.2297	0.2426	0.1566	0.3787	0.5265	1	
$R\&D_{i,j,k}$	0.2062	0.1002	-0.0705	0.2835	0.2527	0.2211	0.206	0.2749	0.4652	0.4995	1
$Logistic_{i,j,k}$	0.1976	0.1012	-0.0201	0.2621	0.1901	0.2279	0.168	0.4207	0.5409	0.5069	0.4034

Source: Authors' compiled from ES of each country

Table 11
Estimation Results ($Sales_{i,j,k}$ as the dependent variable)

VARIABLES	(1) Pooled	(2) Pooled	(3) Indonesia	(4) Malaysia	(5) Thailand
$lnK_{i,j,k}$	0.120***	0.121***	0.241***	0.424***	0.477***
	(0.0187)	(0.0187)	(0.0503)	(0.0582)	(0.0293)
$exp_{i,j,k}$	3.066***	2.984***	2.185***	0.788	1.342***
	(0.359)	(0.359)	(0.668)	(0.504)	(0.437)
$imp_{i,j,k}$	0.642	0.464	3.585***	-1.504**	-0.505
	(0.477)	(0.471)	(1.068)	(0.632)	(0.683)
$own_{i,j,k}$	2.229***	2.367***	3.591***	1.130*	1.799**
	(0.514)	(0.525)	(0.999)	(0.614)	(0.862)
$product_{i,j,k}$	-1.315***				
	(0.179)				
$process_{i,j,k,}$	0.359*				
	(0.186)				
$org_{i,j,k,}$	0.261				
	(0.203)				
$R\&D_{i,j,k}$	0.540***	0.591***	1.186***	0.197	0.0470
	(0.174)	(0.175)	(0.434)	(0.174)	(0.313)
$Logistic_{i,j,k}$	2.432***	2.017***	2.051***	0.491***	-1.050***
	(0.311)	(0.328)	(0.371)	(0.170)	(0.244)
$Logistic_{i,j,k}$*Thailand	-2.841***	-2.609***			
	(0.413)	(0.433)			
$Logistic_{i,j,k}$*Malaysia	-2.317***	-1.842***			
	(0.351)	(0.367)			
Constant	14.06***	13.86***	10.33***	11.82***	11.81***
	(1.189)	(1.214)	(1.705)	(0.921)	(0.564)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	1,015	1,015	485	219	311
R-squared	0.263	0.241	0.405	0.414	0.597

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' Estimates.

Table 12
Estimation Results
($Sales_{i,j,k}$ as the dependent variable)

VARIABLES	(1) Pooled	(2) Pooled	(3) Indonesia	(4) Malaysia	(5) Thailand
$lnL_{i,j,k}$	1.112***	1.130***	1.180***	0.725***	1.183***
	(0.0668)	(0.0671)	(0.108)	(0.0993)	(0.0867)
$exp_{i,j,k}$	1.306***	1.197***	0.950*	0.0690	1.057**
	(0.317)	(0.315)	(0.572)	(0.570)	(0.431)
$imp_{i,j,k}$	-0.0765	-0.260	1.980**	-2.452***	-0.423
	(0.426)	(0.420)	(0.936)	(0.622)	(0.591)
$own_{i,j,k}$	0.513	0.614	1.656	0.329	-0.264
	(0.536)	(0.544)	(1.046)	(0.688)	(0.946)
$product_{i,j,k}$	-1.058***				
	(0.156)				
$process_{i,j,k,}$	0.160				
	(0.192)				
$org_{i,j,k,}$	0.164				
	(0.213)				
$R\&D_{i,j,k}$	0.171	0.142	0.609	0.0922	-0.0121
	(0.195)	(0.201)	(0.531)	(0.184)	(0.449)
$Logistic_{i,j,k}$	2.148***	1.726***	1.682***	0.418**	-1.505***
	(0.311)	(0.331)	(0.387)	(0.201)	(0.315)
$Logistic_{i,j,k}$*Thailand	-2.712***	-2.524***			
	(0.435)	(0.432)			
$Logistic_{i,j,k}$*Malaysia	-2.686***	-2.273***			
	(0.342)	(0.363)			
Constant	12.58***	12.36***	11.27***	16.20***	12.64***
	(0.994)	(0.994)	(1.169)	(0.320)	(0.612)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	1,015	1,015	485	219	311
R-squared	0.448	0.434	0.534	0.420	0.544

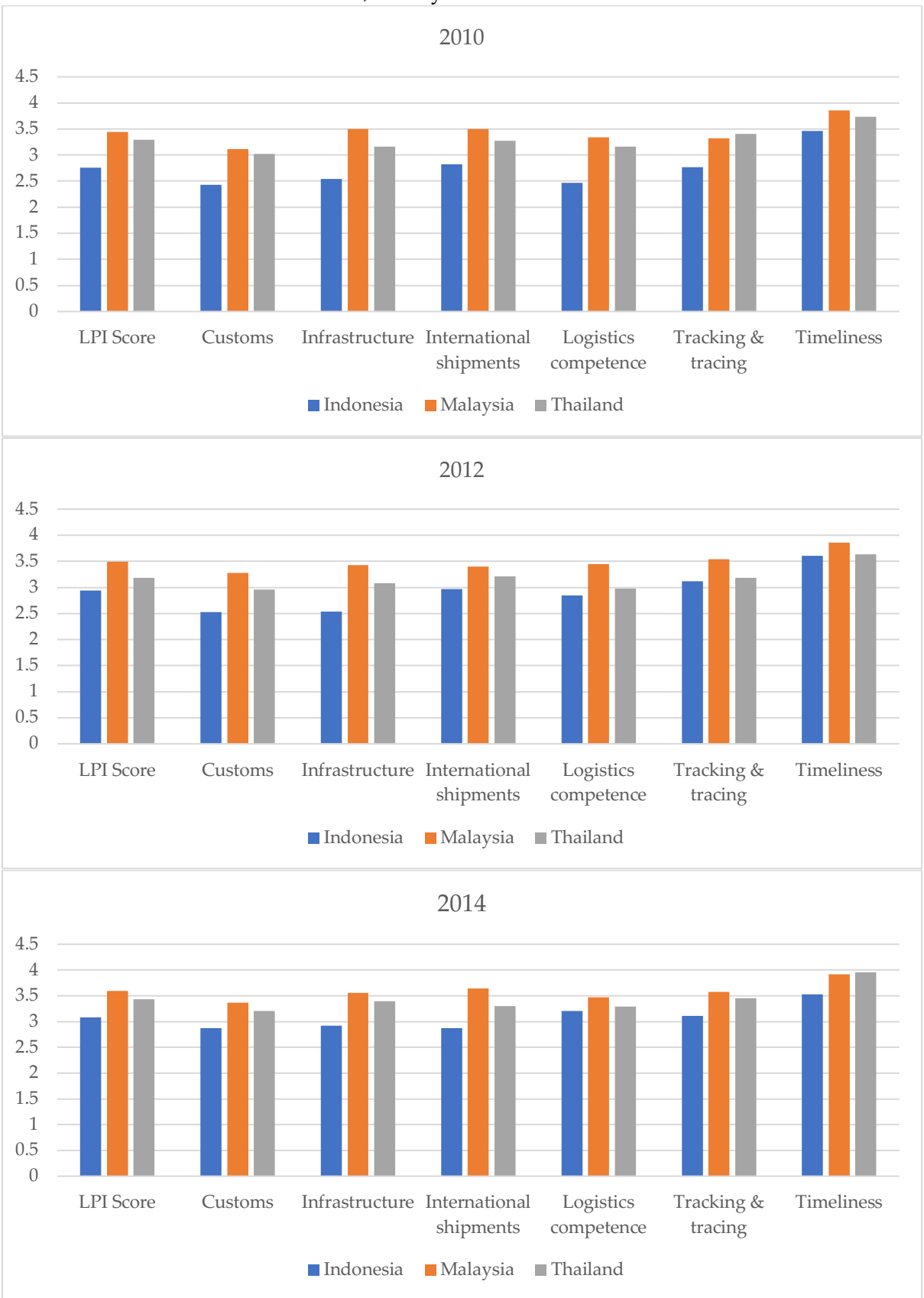
Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' Estimates.

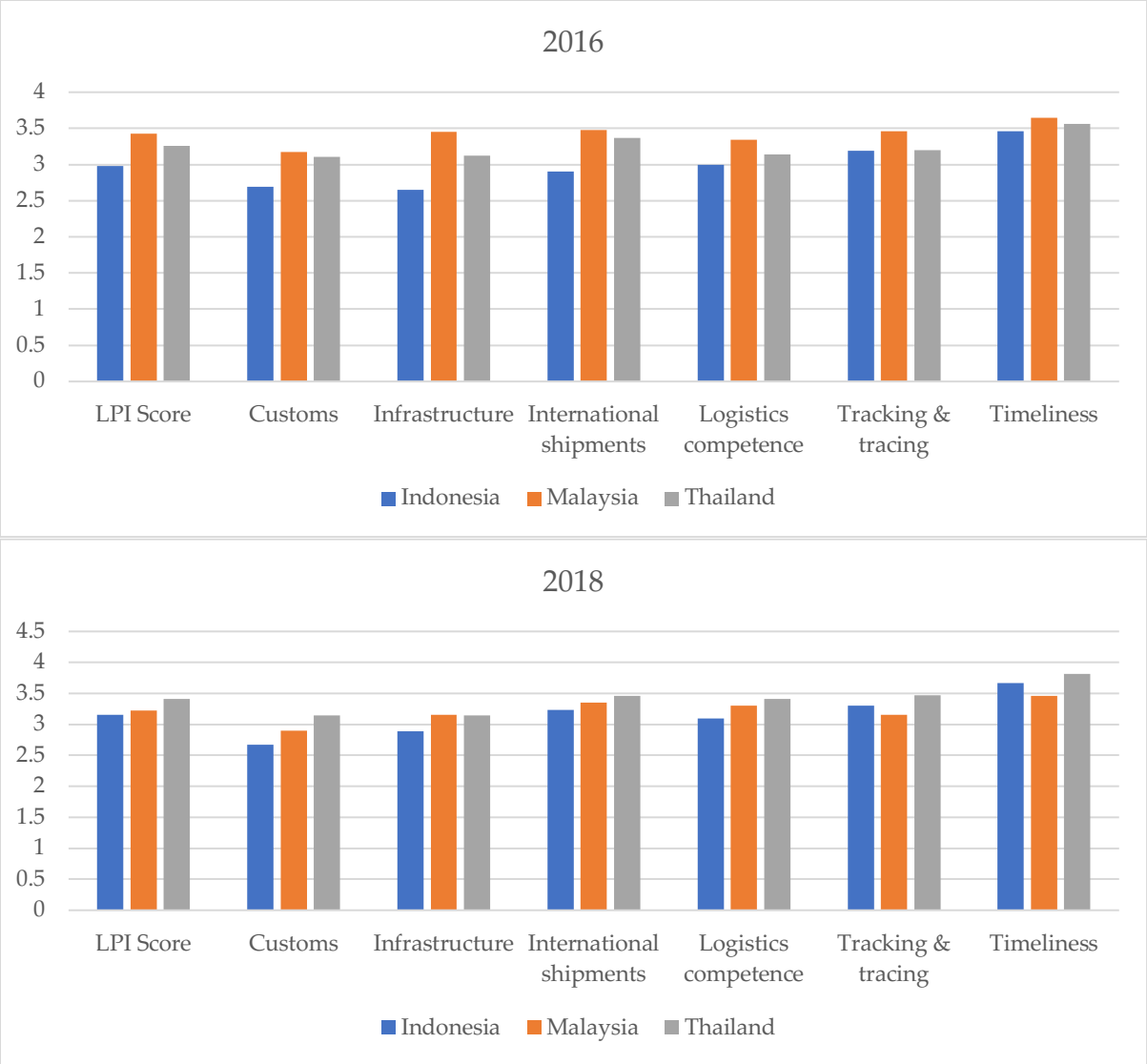
Table 13
Estimation Results
(*Sales_worker*$_{i,j,k}$ as the dependent variable)

VARIABLES	(1) Pooled	(2) Pooled	(3) Indonesia	(4) Malaysia	(5) Thailand
$exp_{i,j,k}$	1.472***	1.389***	1.175**	-0.363	1.393***
	(0.297)	(0.298)	(0.571)	(0.565)	(0.397)
$imp_{i,j,k}$	-0.0347	-0.216	2.172**	-2.382***	-0.439
	(0.427)	(0.422)	(0.939)	(0.648)	(0.608)
$own_{i,j,k}$	0.685	0.818	1.987**	-0.128	-0.304
	(0.517)	(0.524)	(0.986)	(0.711)	(0.914)
$product_{i,j,k}$	-1.086***				
	(0.155)				
$process_{i,j,k,}$	0.169				
	(0.186)				
$org_{i,j,k,}$	0.168				
	(0.208)				
$R\&D_{i,j,k}$	0.209	0.188	0.715	0.0257	-0.00734
	(0.190)	(0.195)	(0.520)	(0.199)	(0.420)
$Logistic_{i,j,k}$	2.232***	1.814***	1.760***	0.261	-1.494***
	(0.303)	(0.324)	(0.374)	(0.202)	(0.298)
$Logistic_{i,j,k}$*Thailand	-2.792***	-2.612***			
	(0.426)	(0.423)			
$Logistic_{i,j,k}$*Malaysia	-2.726***	-2.310***			
	(0.339)	(0.359)			
Constant	12.97***	12.81***	11.88***	15.31	13.74***
	(0.977)	(0.981)	(1.165)		(0.252)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	1,015	1,015	485	219	311
R-squared	0.139	0.115	0.248	0.192	0.176

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' Estimates.

Figure 1
LPI Indices of Indonesia, Malaysia and Thailand from 2010 to 2018

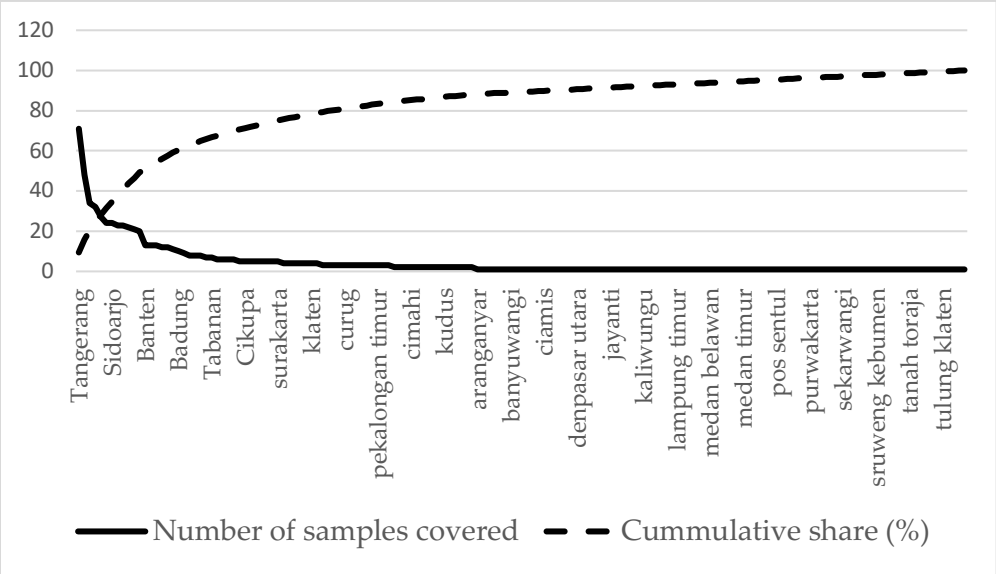




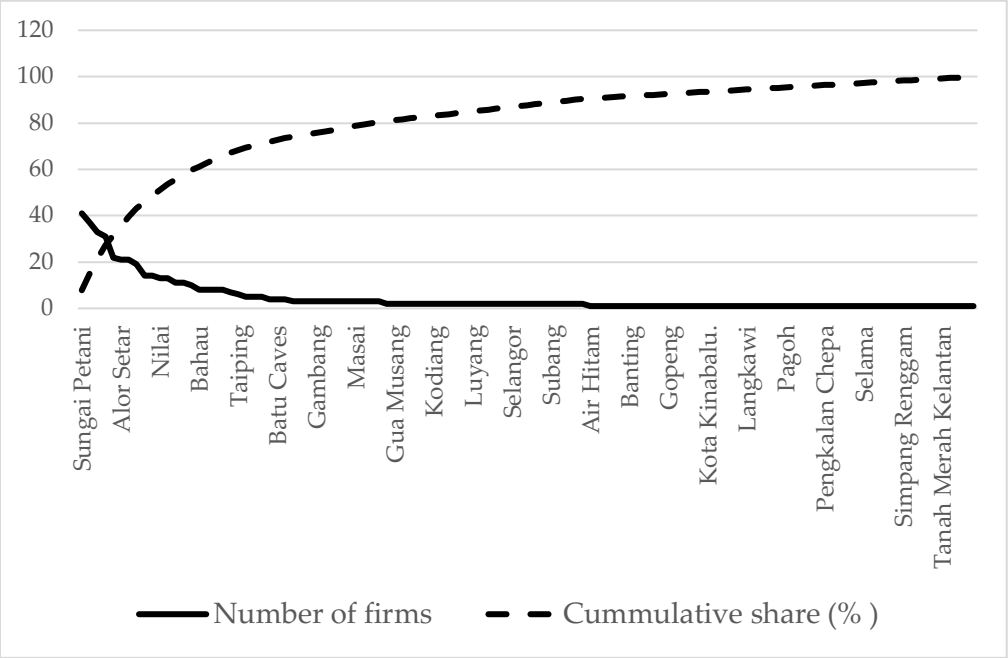
Sources: World Bank available at https://lpi.worldbank.org/

Figure 2
Location and Surveyed Firms in World Bank's Enterprises Survey

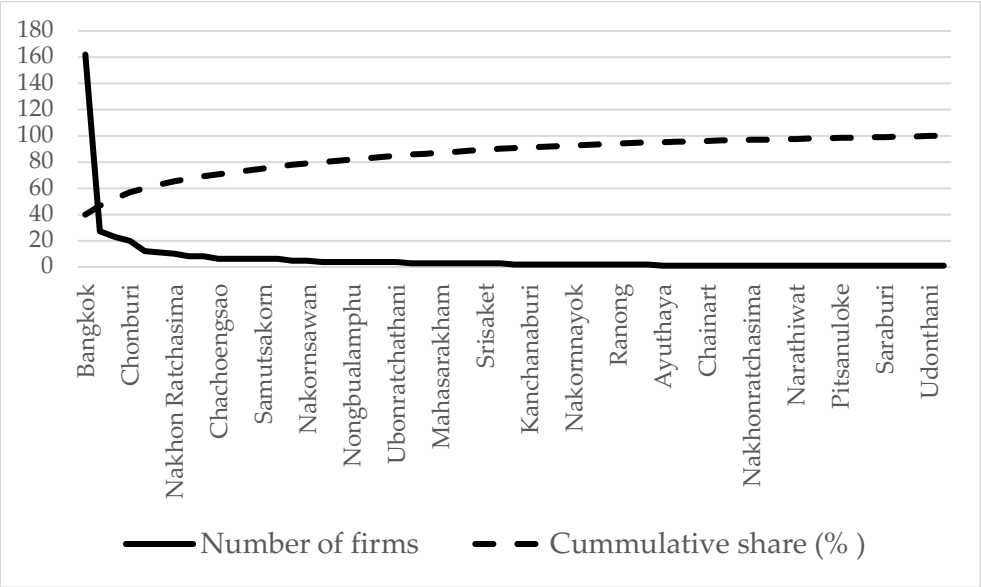
2.1 Indonesia



2.2 Malaysia



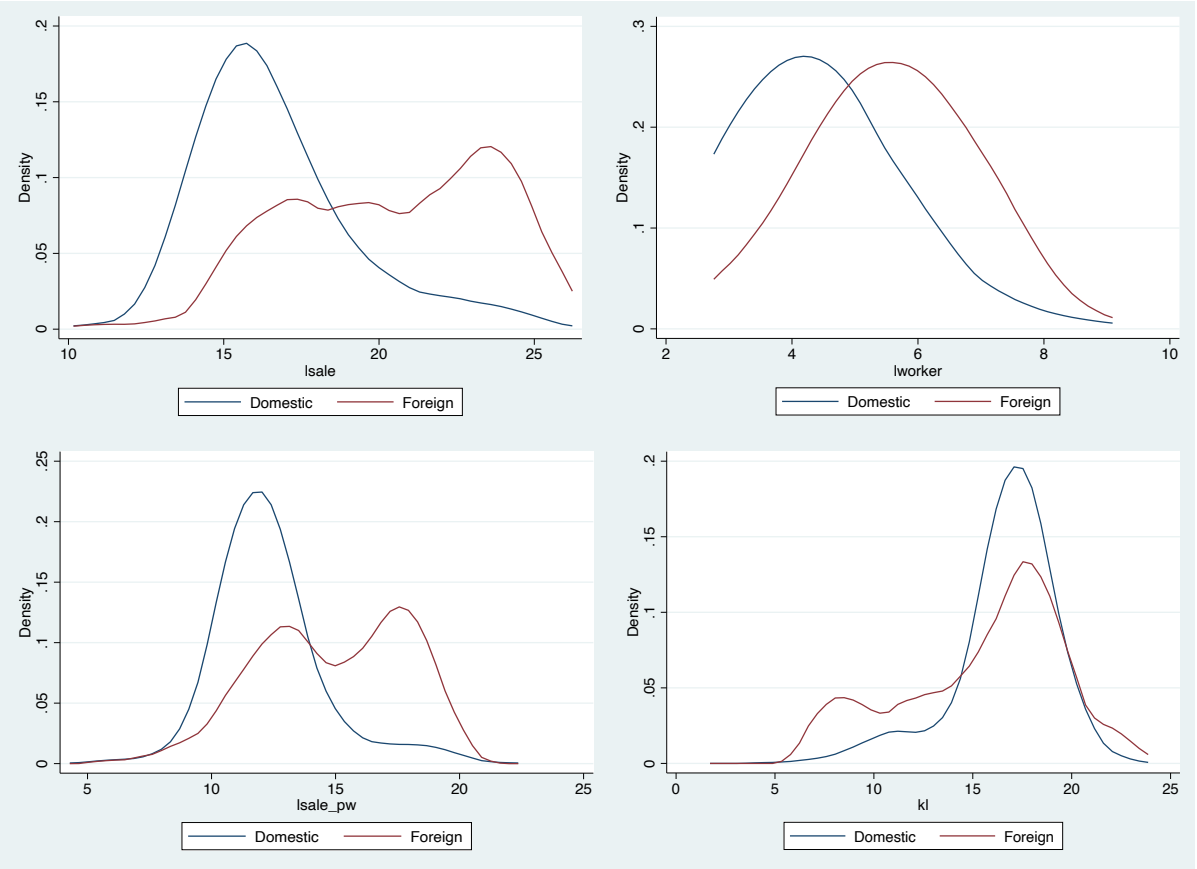
2.3 Thailand



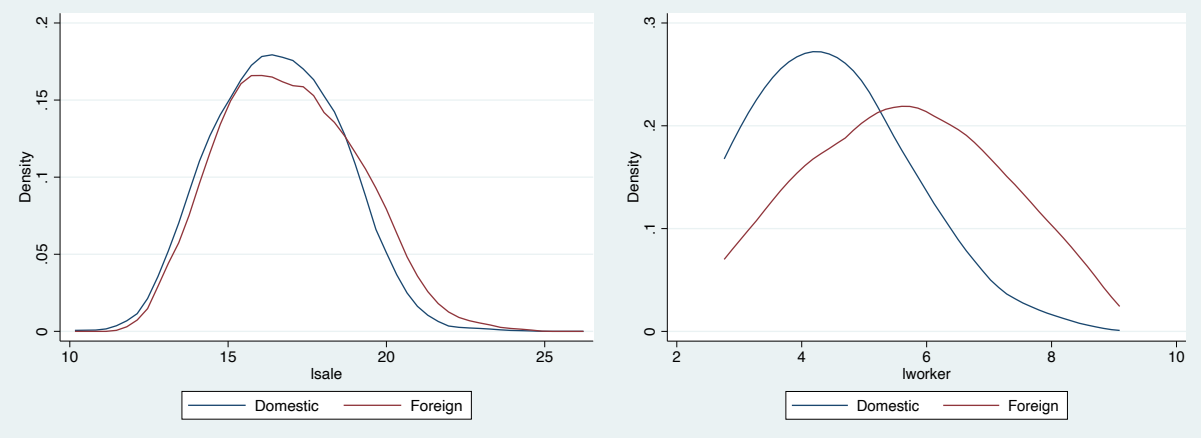
Source: Authors' complying from the official dataset

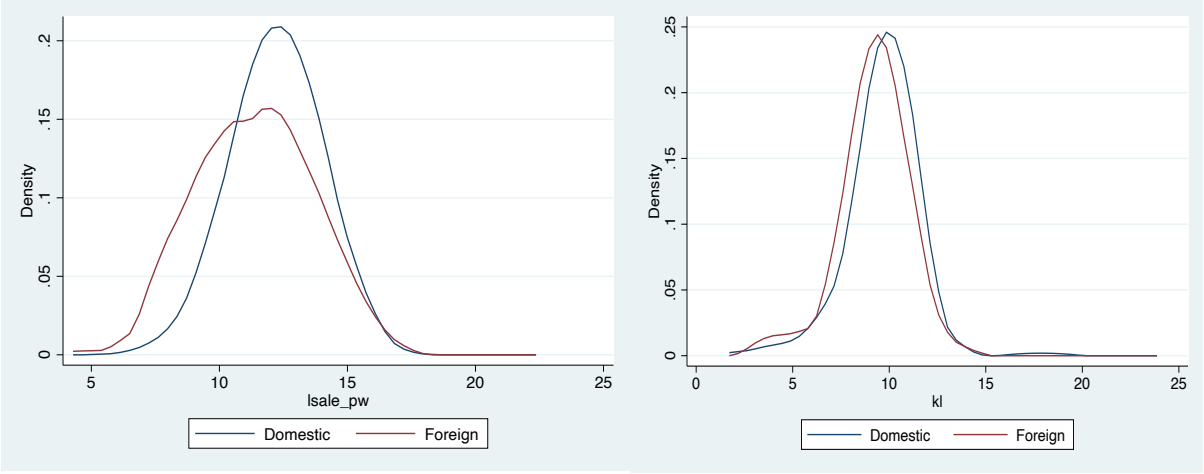
Figure 3
Kernel Density Distribution of Selected Firms Characteristics

3.1 Indonesia

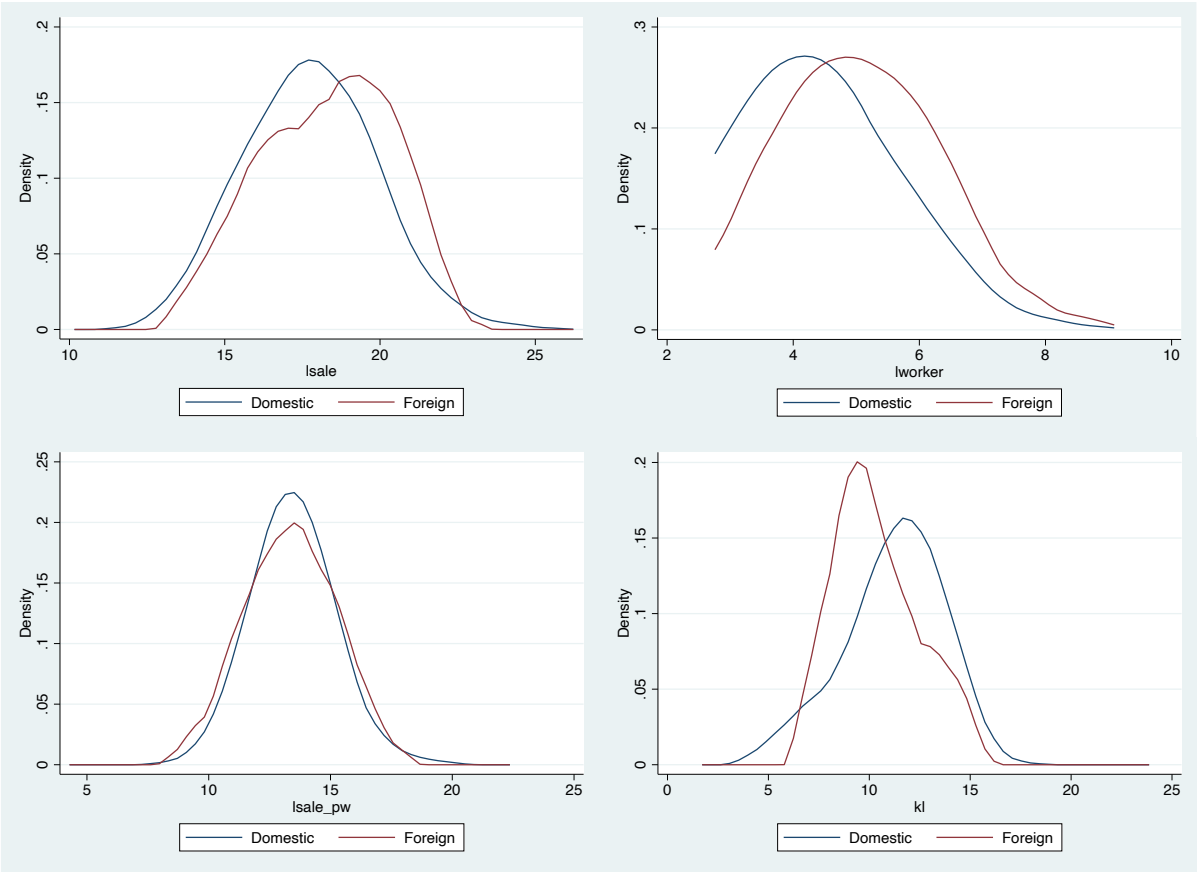


3.2 Malaysia





3.3 Thailand



Notes: lsale = sales value; lworker = a number of workers; lsale_pw = sales value per workers; kl = capital-labor ratio, all in natural logarithm

Source: Authors' compilation from the official data sources

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