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Foreign Direct Investment, Agglomeration, and Production Networks in Indonesian Manufacturing

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Abstract: *This study examines the importance of globalisation – defined by international production networks – in determining foreign direct investment (FDI) flows into Indonesian manufacturing since 2000. It is motivated by the fact that the extent of connection between the Indonesian and the global economy had increased after the 1997–98 Asian financial crisis. Models of FDI are estimated by utilising plant-level data and various trade and tariff data.*

Production networks or agglomeration are found to play an important role in driving FDI in Indonesia's manufacturing sector, at least for the period 2000–2015. This study provides the insight that agglomeration could be utilised to increase FDI in Indonesia. This not only improves the productivity of the sector targeted by the investment but also promotes productivity growth. Creating more agglomeration areas could therefore be a policy direction taken by Indonesia to help increase FDI.

Keywords: Indonesia, foreign direct investment, production networks, agglomeration

JEL Classification: O14, F12, F21

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1. Introduction

Like the other Southeast Asian countries, Indonesia relies on foreign direct investment (FDI) to develop its economy and industrial sectors. The contribution of FDI to Indonesia and industrialisation in the country in the past is clear. It helped the country to build its manufacturing basis in the late 1980s and early 1990s and has continued to maintain industrial development since then. The contribution of FDI seems to have changed since the 2000s as the structure of the economy changed following the economic crisis in the late 1990s and the changing global environment, which further globalised the Indonesian economy.

Whilst the pattern of FDI inflows to the economy and its determinants are clear for the early phase of economic development in Indonesia, they are not clear for the later years since the 2000s. Factors affecting FDI inflows to Indonesia have changed significantly since then, and our understanding on this is incomplete. This is especially so given the more open Indonesian economy after the 1997/98 crisis. The link between the Indonesian economy and the global economy is expected to have increased following the crisis. This chapter addresses this topic, examining the importance of globalisation, defined narrowly in this study by the extent of the international production network (IPN), in determining the extent of FDI flows into Indonesian manufacturing since 2000.

Focusing on the role or importance of IPN is warranted for the reason that it is a production method that is being increasingly adopted by firms in the world, especially in the Southeast Asian and East Asian regions. In the concept of Baldwin's (2016) 'unbundling' concept, IPN reflects the stage where production activities are fragmented into production processes or tasks, and the task-wise international division of labour, all of which are made possible because of reduced costs due to the information and communication technology (ICT) revolution. The analysis examines not only the role or importance of IPN but also the importance of agglomeration. Agglomeration comes into the picture because of the close connection between it and IPN.

The rest of this chapter is organised as follows. Section 2 presents the trend and basic characteristics of FDI in Indonesia until recently. Section 3 presents a brief literature review of IPN and agglomeration that provides the analytical basis for the analysis.

Section 4 presents the methodology, and Section 5 presents the estimation results. Section 6 concludes and presents some policy implications for the future.

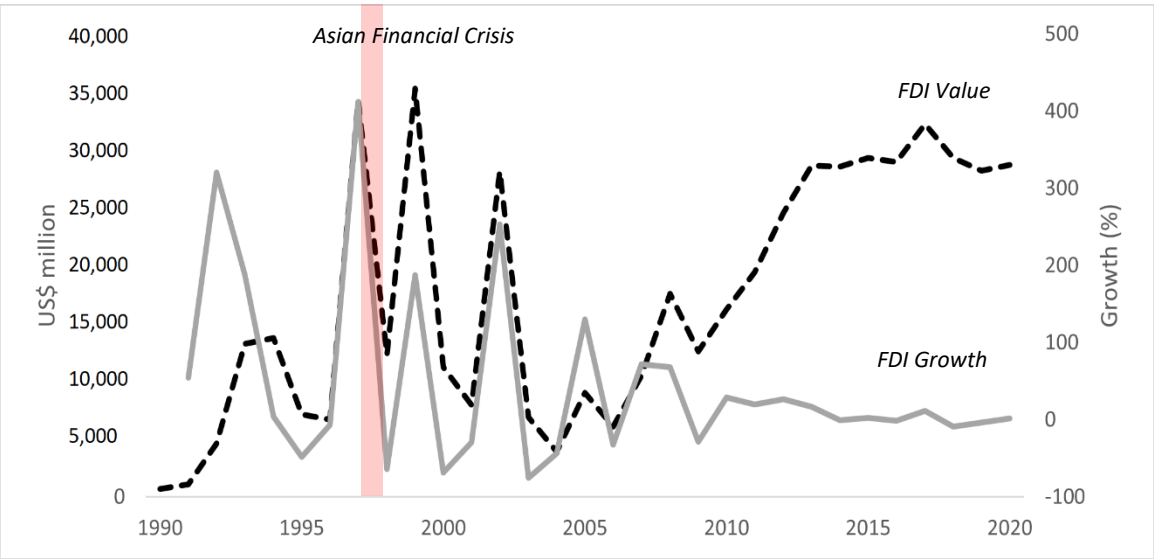
2. Trend and Pattern of FDI in Indonesia

FDI has become one of the main factors in driving economic development and has supported the industrialisation process in Indonesia (e.g. Pangestu, 1996; Aswicahyono, Hill, and Narjoko, 2011). In the last 5 decades, Indonesia has carried out various reforms and investment liberalisation. The country has shifted from an import-substitution strategy during the oil bonanza in the 1970s to being more export-oriented after oil prices fell in the mid-1980s. Various policy reforms in the mid-1980s led to a significant increase in FDI inflows to Indonesia, mainly driven by export-oriented FDI in the labour-intensive manufacturing sector, such as textiles, garments, and footwear.

After the 1997–1998 Asian financial crisis, Indonesia pushed its reform through the structural adjustment programme attached to the International Monetary Fund's lending package. The package included investment liberalisation, the gradual reduction of import tariffs, including those on sensitive products of heavy industries, and the removal of non-tariff barriers (NTBs) and licensing for imports of many agriculture products. However, Indonesia still experienced negative FDI inflows until 2004 due to a temporary aberration associated with economic disruption and political turbulence caused by the crisis (Aswicahyono, Hill, and Narjoko, 2011).

In 2007, the government promulgated a new investment law, Law No. 25 on Capital Investment. The law set an overall framework of providing investment incentives, an institutional arrangement to administer investment projects, and a list of obligations/responsibilities for investors. It also specifies that in principle, all lines of business are open to foreign investment, except for those sectors specifically mentioned in the so-called 'negative list' (*Daftar Negatif Investasi*, DNI) and in other laws and regulations. Although experiencing a reversal during the Asian financial crisis, continued reform policies, together with macroeconomic and political stability, have helped to recover FDI inflows into Indonesia and past pre-crisis levels in recent years.

Figure 1: FDI Realisation in Indonesia, 1990–2020

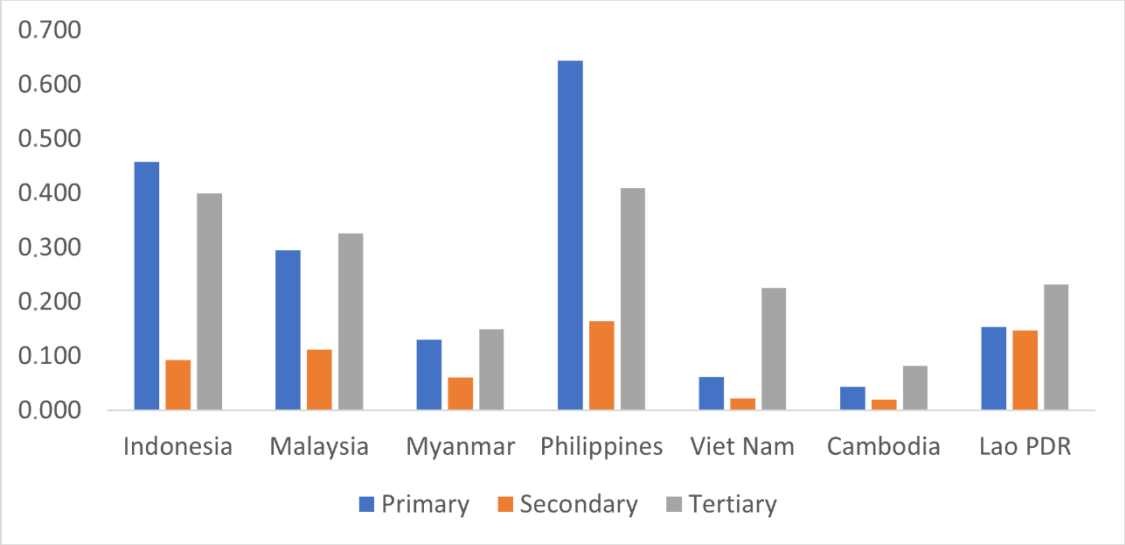


Source: Indonesia Investment Coordinating Board.

In the last 10 years, several trends can be observed in Indonesia's FDI realisation (see Figure 1). First, the FDI inflow trend to Indonesia was relatively stagnant. The vast influx started in 2010 because of the commodity boom and generated abundant foreign investment, especially in the coal and palm oil industry. It finally came to an end after commodity prices dropped significantly in 2014. In 2018, Indonesia's FDI was down by almost 9% and did not meet the government's target. One of the possible reasons was the increasing competition for FDI from countries such as Viet Nam and other countries in ASEAN.

Second, FDI sector composition has changed over time. The services sector has been the most significant contributor to Indonesia's FDI in the last several years, and this is predicted to continue. This trend also happened in the world as the global value chain and servicification trend was becoming more crucial to international trade. All this occurred, rather surprisingly, under a more restrictive FDI regime in Indonesia relative to other countries, especially other ASEAN countries. As Figure 2 shows, Indonesia's services sector is one of the most restrictive in the region after the Philippines. However, the sizable market and its potential demand are the main attractions for foreign service providers.

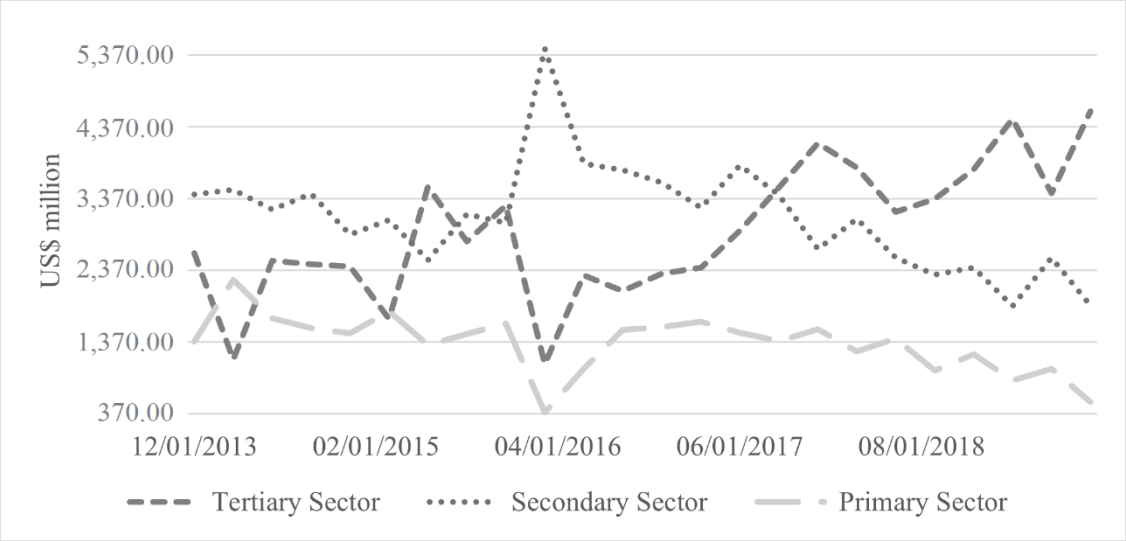
Figure 2: FDI Regulatory Restrictiveness Index 2018



Source: OECD FDI Regulatory Restrictiveness Index (FDI Index) (https://www.oecd.org/investment/fdiindex.htm).

Lastly, the manufacturing sector continues to decline, reflecting problems of attractiveness in this sector. Before the financial crisis in 1998, the manufacturing sector had been a catalyst for Indonesia's economic growth. Some studies (e.g. Aswicahyono et al., 2011; Putra and Narjoko, 2022) found that this was because foreign firms are more efficient and tend to be more export-oriented compared with domestic firms. The increasing labour costs (e.g. minimum wage hike, high severance payment, and labour market rigidity) and stagnated labour productivity in the past decade are pushing foreign investors away to neighbour countries**.**

Figure 3: FDI Realisation in Indonesia, 2014–2019



Source: Indonesia Investment Coordinating Board.

Table 1 shows details of Indonesia's FDI inflows by sector. From 2014 to 2018, mining was the largest subsector contributor compared to the other subsectors. It accounted for 16.4% of Indonesia's total FDI in 2014. However, after the burst of the commodity boom, it started to decline until 2018 to 10.4%. The top three subsectors in the manufacturing sector are the basic metal industry, metal goods, non-machinery, and its equipment; chemical and pharmaceutical; and food industry. The FDI contribution of each of these three subsectors is less than 10%. On the other hand, the services sector shows a positive trend. The proportion of the top three sectors in services i.e. electricity, gas, and water supply; real estate, industrial estate, and business activities; and transport, storage, and communication was about 40% in 2018.

Table 1: FDI Inflows by Sector, 2014–2018

	2014	2016	2018	*2019**	2014–2018	% in 2018
Food Crops, Plantation, and Livestock	2,237.5	1,638.1	1,721.2	*731.5*	9,336.7	5.9
Forestry	53.3	78.2	43.2	*22.1*	241.8	0.1
Fishery	35.3	43.3	24.3	*42.3*	215.3	0.1
Mining	**4,665.1**	**2,742.4**	**3,038.6**	***1,572.8***	**18,839.2**	**10.4**
Food Industry	3,139.6	2,115.0	1,307.3	*1,002.9*	10,053.3	4.5
Textile Industry	422.5	321.3	305.4	*165.8*	1,854.8	1.0
Leather Goods and Footwear Industry	210.7	144.4	243.6	*148.9*	1,129.1	0.8
Wood Industry	63.7	267.5	276.0	*46.9*	1,050.0	0.9
Paper and Printing Industry	708.2	2,789.5	668.1	*401.4*	5,483.9	2.3
Chemical and Pharmaceutical Industry	2,323.4	2,889.1	1,938.3	*1,020.6*	11,685.1	6.6
Rubber and Plastic Industry	543.9	737.3	447.0	*248.6*	3,055.8	1.5
Non-metallic Mineral Industry	916.9	1,076.0	456.3	*274.5*	4,423.7	1.6
Motor Vehicles and Other Transport Equip. Industry	2,061.3	2,369.8	971.3	*497.2*	8,431.0	3.3
Basic Metal Industry, Metal Goods, Non-machinery and Its Equipment	1,428.9	3,067.6	2,219.1	*2,056.8*	12,105.7	7.6
Machinery Industry, Electronic, Medical Instrument, Precision, Optical, and Watch	1,050.3	8,37.9	1,341.1	*282.0*	4,725.3	4.6
Other Industry	151.8	75.2	174.0	*152.7*	988.5	0.6
Electricity, Gas, and Water Supply	**1,248.8**	**2,139.6**	**4,383.8**	***4,430.9***	**15,042.6**	**15.0**
Construction	1,383.6	186.9	248.1	*125.7*	2,997.8	0.8
Trade and Repair	866.8	670.4	609.3	*335.2*	4,065.6	2.1
Hotel and Restaurant	513.1	887.8	868.9	*511.0*	4,009.6	3.0
Transport, Storage, and Communication	**3,000.9**	**750.2**	**3,027.2**	***4,434.3***	**11,967.8**	**10.3**
Real Estate, Industrial Estate, and Business Activities	**1,168.4**	**2,378.2**	**4,302.7**	***2,252.7***	**13,522.5**	**14.7**
Other Services	335.8	758.6	692.9	*431.5*	3,092.0	2.4

* Only until Q3.
Source: Indonesia Investment Coordinating Boar

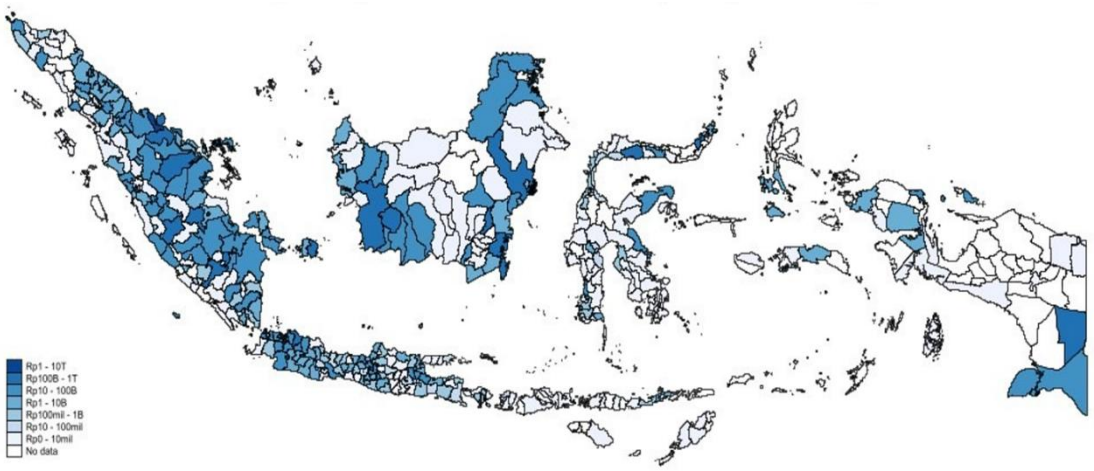
2.1. Distribution of Foreign Direct Investment by Region

Our research also looks into the geographical distribution of foreign investment in Indonesia. The large archipelago of Indonesia affects the creation of agglomeration of industries. Figure 4 presents the distribution of foreign capital stock across regions within Indonesia. A region here is defined at the level of district, or *kabupaten* in the local term, which is one level below province level. One key pattern that emerges from the figure is a clear unbalanced distribution of capital stock between the west and east side of Indonesia. Capital in the manufacturing sector is concentrated in the Java and Sumatera islands, alongside Kalimantan island to some extent. The major provinces in these islands are West Java, Jakarta, and East Java (for Java island), and North Sumatera, Jambi, South Sumatera, and Lampung (for Sumatera island). Natural-resource manufacturing using inputs from agriculture or the plantation sector, especially from palm-oil plantations, likely dominates the accumulated capital in Sumatera, whilst the other type of natural-resource manufacturing, that is, the one that uses coal as input, likely dominates the accumulated capital in Kalimantan.

The west and east unbalanced pattern is not much different from the past. It is persistent, and, therefore, should become an area of attention for policymakers in the country. Fitriandi et al. (2014), for example, reported a similar unbalance for the distribution of FDI inflows for a much longer period, from 1990 to 2011. About 77% of the inflows went to Java island during this period, whilst 31% went solely to the capital-city region of Jakarta.

The stark difference in concentration of capital within the country defines a clear and major policy agenda, which is to balance the extent of the capital located on the east side of the country. There is a risk of increasing inequality between the west and east of Indonesia in the future, as well as possibly an increase in inequality within the east side because services sectors will likely grow faster in this region as it is fuelled by growing consumer demand due to the fast-growing population.

Figure 4: Distribution of Foreign Capital Stock in Manufacturing across Regions in Indonesia, 2010–2015

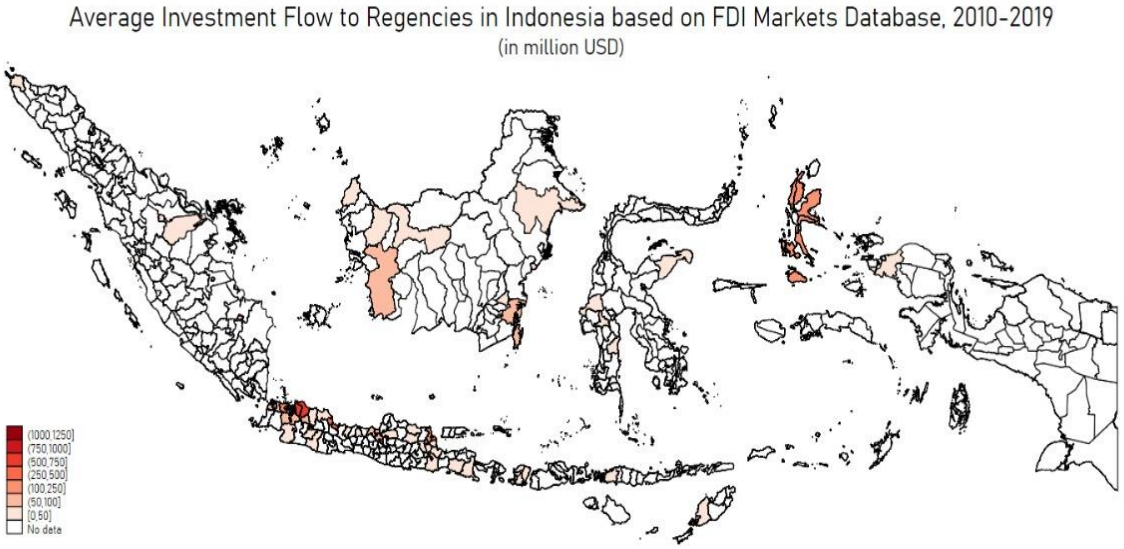


Source: Industrial Statistics (*Statistik Industri*, SI), Indonesia Statistical Agency (*Badan Pusat Statistik, BPS*); author's computation.

Changes in the FDI flow pattern in terms of geographical aspects have also been significant in recent years. This is shown in Figure 5, which presents the distribution of FDI inflows to Indonesian manufacturing in the past decade until 2019. The emerged pattern is very different to the one of capital stocks. Investment flows were only evident mostly in Java and Kalimantan. Within Java, investment came mostly to the west, to the outer parts of greater Jakarta, and to the east, to areas in greater Surabaya. These city regions in Java host the most condensed industrial agglomeration in the country and all this seems to suggest at least a correlation between agglomeration and investment.

In addition, the observation of strong investment into greater Jakarta and greater Surabaya underscores the importance of infrastructure, including connectivity. These two areas are areas of agglomeration, and it may not be a coincidence that both are very close to the two biggest seaports in Indonesia (i.e. Tanjung Priok for Jakarta and Tanjung Emas for Surabaya). This finding suggests that one way to have a balanced distribution of investment between regions can be done by improving the connectivity amongst regions and, at the same time, improving the connectivity with global economies. This is even more important in the context of the value chain model of production, where production units are fragmented and located in different locations.

Figure 5: Distribution of FDI Inflows into Manufacturing across Regions in Indonesia, 2010–2015



Source: FDI Markets; author's computation.

It is important to note that the finding about investment in Sumatera underlines the importance of creating more business opportunities on the island. One direction that the government can take is to increase the value added of manufacturing on the island, especially in food or palm-oil related industries, by increasing the quality of their products. This is important to ensure the sustainability of the growth of the island.

3. Literature Review: International Production Networks and Agglomeration

3.1. International Production Networks

Another approach views IPN from the nature of a production process, often known as fragmentation theory. Production of a final product usually consists of many production processes that are vertically integrated; and here, fragmentation theory postulates that such vertically integrated production processes can be divided into some separable production blocks, and these blocks can be located in various locations that are most suitable for the activities of the blocks (Kuroiwa and Toh, 2008).

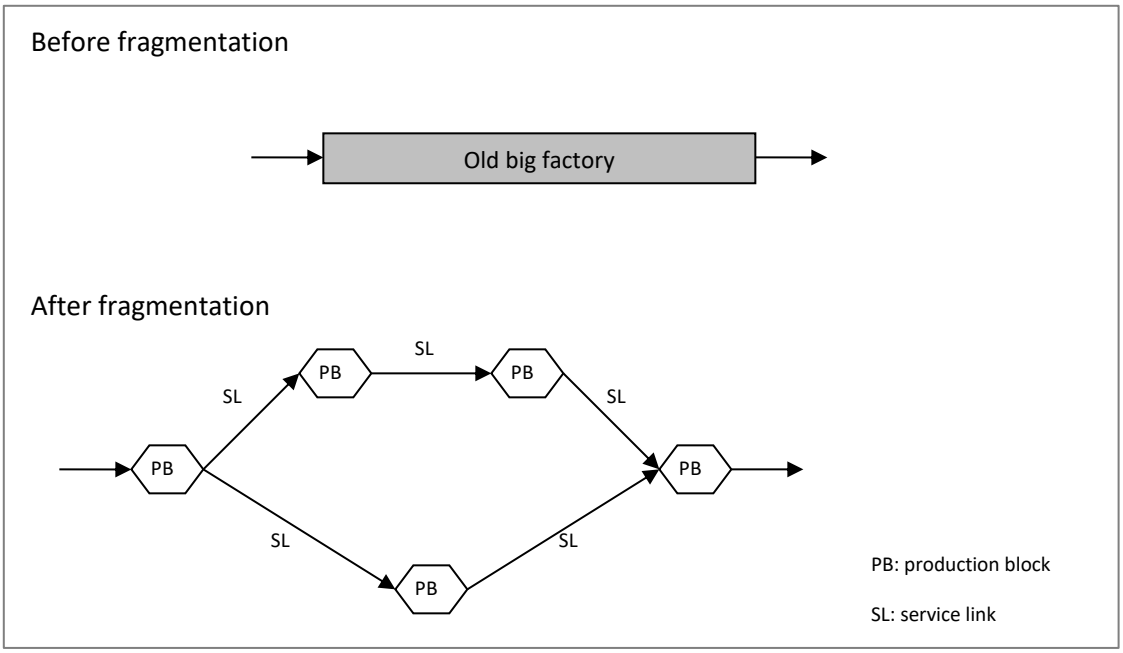
The fragmentation theory approach, in principle, is a newly developed line of research in international trade theory. Sanyal and Jones (1982) and Jones and Kierzkowski (1990) developed an early theoretical model that established the concept of fragmentation. Other studies along this line, including Arndt and Kierzkowski (2001), Cheng and Kierzkowski (2001), and Deardorff (2001) further enhanced the capability of the fragmentation concept in both theoretical and empirical analysis. Kimura and Ando (2005) were amongst the most recent in developing the analytical framework within the fragmentation approach.

The idea of fragmentation can be understood following Deardorff (2001), who defines fragmentation as 'the splitting of a production process into two or more steps that can be undertaken in different locations but lead to the same final product'. Suppose that there is initially a big factory taking care of all the production activities from upstream to downstream. If we carefully look at the individual production blocks (PBs), however, there are some production blocks that require close attention by technicians, whilst the other production blocks are purely labour intensive. Therefore, if the firm can separate the production processes and locate them in appropriate places, total production could thus be saved. Figure 6 illustrates this idea. The relocation of the production blocks can occur across national borders, and this is what we commonly observe in IPNs.

Fragmentation becomes economical when the so-called cost of service links (SL) connecting PBs is low enough. The SL cost includes transport, telecommunication costs, as well as various coordination costs between the production blocks. SL also depends much on the nature of technology. Here, globalisation is argued to reduce SL cost and enables firms to 'fragment' their production blocks, in an attempt to further reduce production costs.

All in all, there are two key elements for the existence of fragmentation (Kimura, 2008: 39). First, there must be some cost-saving in the production blocks, and second, the cost of service links must not be too high.

Figure 6: The Idea of Product Fragmentation



Source: Kimura and Narjoko (2021).

3.2. Two-dimensional Fragmentation (Kimura and Ando, 2005)

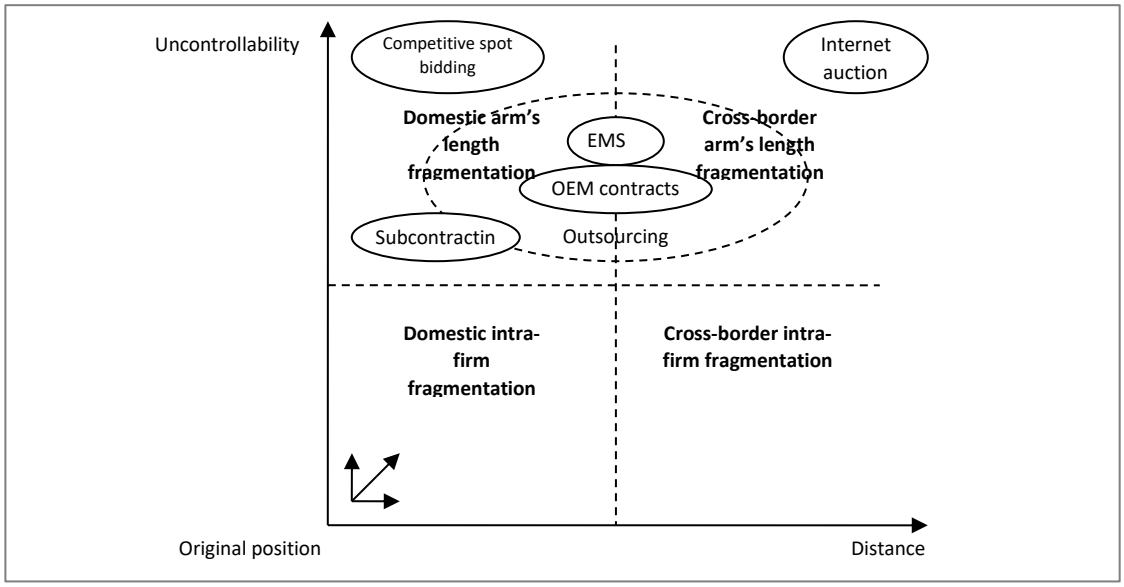
As noted, Kimura and Ando (2005) presented the most recent analytical framework for explaining IPNs, and, therefore, it is worth elaborating on this framework, as presented below.[2] Elaborating on Kimura and Ando's framework is also particularly important because it was proposed to better explain the mechanics of IPNs in East Asia. As noted in many studies, including Kimura (2008), IPNs that occurred in East Asia were more complex and sophisticated than the traditional description of fragmentation as in, for example, Deardoff's (2001) framework.

Kimura and Ando (2005) organised and categorised various types of fragmentation activities into two groups in a two-dimensional space (see Figure 7). The first dimension is the 'distance', which captures the physical distance between the original position and the new location of the fragmented production blocks. This dimension is represented by the horizontal (x) axis in Figure 7, with the origin being the 'original position'. Thus, when the distance is short, or not far from the origin, the fragmentation tends to occur

[2] The elaboration presented here borrows, largely, from Kimura and Ando (2005) and Kimura (2008).

within the national/country border, but, when the distance is rather far from the origin, the fragmentation most likely occurs beyond the national/country border (i.e. cross-border fragmentation).

Figure 7: Two-dimensional Fragmentation of Kimura and Ando (2005)



Source: Kimura and Ando (2005).

The other dimension is 'uncontrollability', which captures the extent of managerial controllability over the fragmented production blocks. The dimension is represented by the vertical (*y*) axis of Figure 7. Managerial controllability over production blocks reduces as a point moves further from the origin. Given that ownership should be the important factor that links the controllability, it is thus presumed that the ownership of a parent (or perhaps the flagship) company is smaller when a point moves away from the origin, although the relationship between control and ownership might not be linear. A point near to the origin represents intra-firm fragmentation, whilst a point that is quite far from the origin represents inter-firm, or arm's-length, fragmentation.

The fragmentation along the vertical (*y*) axis, in short, represents the type of fragmentation in the form of outsourcing to (possibly) unrelated firms. Various forms of outsourcing are observed, such as original equipment manufacturing (OEM), original

design manufacturing (ODM), and electronics manufacturing services (EMS). These forms are particularly observed in East Asian fragmentation. Fragmentation in this form is the element that adds to the traditional conception of fragmentation, and, as argued, this is particularly specific to the fragmentation model of East Asia.

The basic economics for fragmentation is separating production blocks but with some potential cost-saving benefits. Table 2 summarises this for the two-dimensional fragmentation model, along with the (service-link) costs borne by conducting the fragmentation. The 'distance' fragmentation faces service-link costs that are borne because of the geographical distance to production blocks, including transportation cost, communication cost, and intra-firm coordination cost, etc. The cost-saving benefit, therefore, needs to be borne from location-specific advantages. These include not only traditional economic factors, such as wage levels and resource availability, but also the existence and quality of infrastructure and infrastructure services and the policies of the host country's government (e.g. favourable investment climate, liberal trade policy, flexible labour policy, etc.).

Meanwhile, as for 'uncontrollability' fragmentation, the cost-saving in principle should come from advantages of 'de-internalisation', and, therefore, this should come from the counterparts' competitive advantages. The cost-saving is feasible when the counterparts have better technology and managerial capability, which allows some production-cost saving when the production processes are conducted by the counterparts, rather than by the parent, or flagship, firm. There are, however, some service-link costs that need to be paid for the 'uncontrollability' fragmentation, and these are everything that occurs due to the loss of managerial control over the production blocks.

Table 2: Service-link Cost and Cost-saving Elements of the Two-dimensional Fragmentation Model

	Service Link Cost	Production Cost Per Se
Fragmentation (distance)	Cost due to geographical distance	Location advantages
Fragmentation (uncontrollability)	Cost due to weaker controllability	'De-internalisation' advantages (counterpart's ownership advantages)

Source: Kimura and Ando (2005).

3.3. IPN and Agglomeration

The observation of IPNs, particularly those that occurred in East Asia, suggests that the mechanics of production networking is not as simple as described by the analytical frameworks above. Some researchers (e.g. Kimura and Ando, 2005; Yeung, 2008) have argued that there is a close relationship between IPNs and agglomeration, and in fact, the two work hand-in-hand. Kimura and Ando (2005) argued that fragmentation and agglomeration are important when the relationship amongst firms is at issue.

Yeung (2008: 100–103) defined three major types of industrial clusters in which agglomeration processes take place, according to the division by Gordon and McCann (2000):

Type 1: Classical model of pure agglomeration;

Type 2: Industrial-complex model;

Type 3: Social-network model.

These types of models are summarised in Table 3. The Type 1 model postulates that industrial clusters are developed through natural agglomeration economic activities, and, therefore, firms in the clusters enjoy externalities from the embeddedness. These firms, however, do not necessarily have to have some interdependency amongst them. The agglomeration that underlies the Type 1 model originates from the availability of some specific input that can be used by all firms in the clusters, such as specialised labour. Type 2 models agglomeration from the deliberate construction of industrial complexes that have the objective of minimising transaction costs for inter-firm trade through spatial concentration and proximity. Firms in this model enjoy low transportation and logistics

costs, as well as low uncertainties through mutual interactions, which are facilitated by physical proximity. Unlike the Type 1 model, firms of the Type 2 model assume some interdependencies amongst them. Finally, Type 3 refers to the importance of local networks of interpersonal relationships, trust, and institutionalised practices. According to this model, strong social and institutionalised networks should help some specific knowledge to be developed in the clusters, which, in turn, should contribute to technological innovation and knowledge development. Firms in Type 3 are often recognised as being highly localised in their innovative and production activities.

Back to the discussion on the relationship between fragmentation and agglomeration, Kimura and Ando (2005) further argued that there are two channels by which agglomeration connects to fragmentation. First, the connection comes as the result of the increasing-returns nature of service-link costs. Service-link costs, either in terms of 'distance' or 'uncontrollability', typically have a characteristic of strong economies of scale. Therefore, it is natural to postulate that there should be some locations that are specifically built to provide a low service-link cost – utilising the scale economies nature of the costs. In what follows, it is also natural to predict that there should be many production blocks that tend to be located in these locations, which are often observed in practice as industrial clusters.

Looking at the typology of industrial clusters (see Table 3), low service-link costs are present in all three types of clusters. For the Type 2 model, for example, the low service-link costs are offered in terms of transport and logistics costs, and this fits with the idea of fragmentation along the 'distance' dimension.

The other channel is to provide support for the arm's-length fragmentation inside agglomeration. This is a situation where some critical transactions involving inputs for the arm's-length production block, such as exact delivery timing, are needed. In this situation, upstream and downstream firms need to be located in a nearby location.

All in all, the key point for the relationship between fragmentation and agglomeration is that it gives an element of locational advantages along the 'distance' dimension – through the existence of low distance-related service-link costs (i.e. transportation and logistics, etc.). At the same time, agglomeration moderates

fragmentation along the 'uncontrollability' dimension through the opportunities for control separation that stem from the existence of many kinds of potential business partners growing in industrial clusters.

Table 3: Models of Industrial Clusters

Cluster Model	Intellectual Traditions	External Economies Accrued to Firms in Clusters	Territorial Sources
Type 1 Pure agglomeration economies model	Neoclassical economics after Alfred Marshall	1. A local pool of specialisation labour (lower search costs) 2. Local provision of non-traded inputs (economies of scale) 3. Maximum flow of information and ideas (product and market knowledge)	Within clusters
Type 2 Industrial complex model	Location theory after Alfred Weber	1. Lower transport and logistics costs 2. Greater certainty in transactions	Within clusters
Type 3 Social network model	Embeddedness in new economic sociology	1. Localised trust and inter-personal relationship (relational assets) 2. Institutionalised practices, e.g. conventions and norms (institutional thickness)	Within clusters

Source: Gordon and McCann (2000).

Recent studies have suggested that the IPN determines the extent of FDI into a country (inward FDI). Whilst the theory typically runs the other direction, that is, FDI determines the building or extension of the IPN, studies have shown an increasing association between GVCs and FDI. UNCTAD (2013) showed a statistically significant positive contribution of GVC participation in 187 countries over the periods 1990–2000 and 2001–2010. Similarly, estimation done by Martinez-Galan and Fontoura (2018) showed that a country's degree of IPN participation contributes positively to the inward

FDI of the country, controlling for other FDI determinants. Some different but similar explanations given to these findings are the following. First, an established GVC/IPN in a country could help MNEs to link deeper with GVCs/IPNs. The established GVC/IPN facilitates MNEs to access global markets and integrate into the global economy. Second, similarly, an MNE may invest in another country with an established GVC/IPN as a strategic action to acquire cheaper inputs through intra-firm transactions in the investment destination country. Having noted these findings, it is important to mention that the analytical framework is not yet established as more empirics are needed. Nonetheless, Amador and Cabral (2014) claimed that FDI inflows and intra-firm trade in the investment destination country are mostly a consequence of the expansion of GVCs.

4. Methodology

This study identifies several variables of the determinants of FDI in Indonesian manufacturing, focusing on variables that represent the IPN and agglomeration. In order to capture the movement of FDI over the period after the 1997/98 crisis, data are collected from 3 years over the period since the 2000s, that is 2005, 2010, and 2015. The variables are computed using data from a few different sources. The first is plant-level data on medium and large Indonesian manufacturing, which represent around 70% of the total manufacturing output in the country (*Statistik Industri*, SI). The second is WITS (World Integrated Trade Solutions) data, which are used to draw export and tariff rate data. The third is the OECD Trade in Value Added (TiVA) data, which are used to compute the extent of the backward linkage of an industry within the manufacturing sector.

The dependent variable is defined as the foreign value added, based on foreign shares at the plant level aggregated to the two-digit ISIC. The list of determinants (independent variables) is provided in Table 4. The variable that proxies IPN is backward linkage (BL), and the one that proxies agglomeration is the Ellison and Glaeser Index (EGI). A table of the summary statistics of the variables is provided in Appendix A, and another table presents the correlation values between the variables in Appendix B.

Table 4: Description of the Variables

Dependent Variable	Proxy Variables	Formula	Source
Foreign direct investment	Foreign value added share (FDI_{jt})	$FDI_{jt} = \frac{\sum_{i=1}^{n}(dasing_{ijt} \times vtlvcu_{ijt})}{\sum_{i=1}^{n} vtlvcu_{ijt}} x\ 100$ Where $dasing$ is the foreign share (%) and $vtlvcu$ is the nominal value added at plant i in industry j defined at the two-digit ISIC at time t.	SI (*Statistik Industri*)
Independent Variable	**Proxy Variables**	**Formula**	**Source**
Market size	Value added ($lnVA_{jt}$)	Industry-level value added at time t (VA_{jt}) is the total of plant-level nominal value added VA_{it} in an industry$j$defined at the two-digit ISIC ($\sum_{i=1}^{n} vtlvcu_{ijt}$)	SI
Openness	Applied tariff ($Tariff_{jt}$), export intensity, defined as the share of exporters in an industry(EXP_{jt})	$Tariff_{jt}$ is a weighted effective tariff (%) for a product at the two-digit ISIC of industry$j$. The weight is the product's trade value defined by its corresponding two-digit ISIC industry. Industry-level export share at time t (EXP_{jt}) is calculated as the following: $EXP_{jt} = \frac{\sum_{i=1}^{n}(prprex \times vtlvcu)}{\sum_{j=1}^{n} vtlvcu} x\ 100$ Where $prprex_{ijt}$ is the export share (%) of plant i in industry j defined at the two-digit ISIC at time t.	World Integrated Trade Solutions (WITS) and SI
International production network	Backward linkage (BL_{jt})	*Backward linkage* is defined as the foreign value added embodied in gross exports (FVA_EX) as a percentage of total gross exports (EX). $BL_{jt} = \frac{\sum_{p=1}^{m} FVA\_EX_{jt}}{EX_{jt}}\ x\ 100$ where j, t, p denotes industry at two-digit ISIC, time period, and partner countries, respectively.	OECD Trade in Value Added (TiVA)

Independent Variable	Proxy Variables	Formula	Source
Agglomeration	Ellison and Glaeser index (EGI_{jt})	$EGI_{jt} = \frac{\sum_k (s_k - x_k)^2 - \left(1 - \sum_k x_k^2\right)\sum_i z_i^2}{\left(1 - \sum_k x_k^2\right)\left(1 - \sum_i z_i^2\right)}$ where i, j, k, t denotes plant, industry (five-digit ISIC), district, and time, respectively. s is the share of employment (or any other variable, such as value added or output) in industry j, x is the share of employment in region k, and z is the size of plant i in industry j. The index is aggregated to the two-digit ISIC.	SI
Wage	Minimum wage (MW_{jt})	Minimum wage for industry j at the two-digit ISIC at time j (MW_{jt}) is the average (median) of the minimum wage defined at the three-digit ISIC.	SI
Infrastructure	Infrastructure intensity, defined as the value added share of firms located inside industrial zone ($ZONE_{jt}$)	$ZONE_{jt} = \frac{(zone_{ijt}\ x\ vtlvcu_{ijt})}{\sum_{j=1}^{n} vtlvcu_{ijt}}$ $zone_{ijt}$ is a dummy variable for the location of plant i that belongs to industry j at time t, that is, $zone_{ijt} = 1$ if the plant is located in an industrial zone otherwise $zone_{ijt} = 0$.	SI

Source: Author.

EGI_{jt} measures the extent of concentration of plants (or firms) in a region that is motivated by (i) observed cost advantages, such as logistical costs, (ii) unobserved cost advantages, such as the culture of the workers in a particular region, and (iii) positive spillovers coming from other plants or firms that have long been established in the region (Ellison and Glaeser 1999). The variable ranges from 0 to 1, and a higher value means greater agglomeration in the region.

To examine the importance of IPN and agglomeration, controlling for market size and the extent of a country's openness, this study estimates the following model specifications

(1) $$FDI_{jt} = \beta_0 + \beta_1 lnVA_{ij(t-1)} + \beta_2 EGI_{j(t-1)} + \beta_3 Tariff_{j(t-1)} + \beta_4 EXP_{j(t-1)} + \beta_5 BL_{j(t-1)} + \beta_6 MW_{j(t-1)} + \beta_7 ZONE_{j(t-1)} + \phi_j + \phi_t + \varepsilon_{jt}$$

(2) $$FDI_{jt} = \beta_0 + \beta_1 lnVA_{ij(t-1)} + \beta_2 EGI_{j(t-1)} + \beta_3 Tariff_{j(t-1)} + \beta_4 EXP_{j(t-1)} + \beta_5 BL_{j(t-1)} + \beta_6 MW_{j(t-1)} + \beta_7 ZONE_{j(t-1)} + \beta_8 (EGI_{j(t-1)}) * \left(EXP_{j(t-1)}\right) + \phi_j + \phi_t + \varepsilon_{jt}$$

(3) $$FDI_{jt} = \beta_0 + \beta_1 lnVA_{ij(t-1)} + \beta_2 EGI_{j(t-1)} + \beta_3 Tariff_{j(t-1)} + \beta_4 EXP_{j(t-1)} + \beta_5 BL_{j(t-1)} + \beta_6 MW_{j(t-1)} + \beta_7 ZONE_{j(t-1)} + \beta_9 (EGI_{j(t-1)}) * (BL_{j(t-1\_)} + \phi_j + \phi_t + \varepsilon_{jt}$$

Specification (1) is the benchmark, whilst the rest of the specifications include interactions of EGI_{jkt} with the other variables in the model. The interaction variables are introduced to test whether agglomeration depends on the extent of openness or whether indeed agglomeration is well connected to the IPN as theory postulates. All explanatory variables are lagged one year $(t-1)$ to improve the exogeneity of the variables, and all of these specifications are estimated using a fixed-effect panel method with $\phi_j \; and \; \phi_t$ as industry and time fixed effects, respectively.

5. Empirical Results

Table 5 presents the share of foreign value added, reflecting the contribution of foreign ownership to the output of Indonesian manufacturing over the period 2005–2015. The trend has been up and down over this period; increasing from 2005 to 2010 but declining from then up to 2015. The pattern is often observed in other countries or industries, that is, investment increases to respond to the available opportunities and remains until saturation. This is what may have been reflected in the later period (2010–2015).

Table 5: Foreign Share of Value Added by Broad Industries, Indonesian Manufacturing, 2005–2015

(%)

Sector	2005	2010	2015
Food products, beverages	23.5	30.3	38.0
Tobacco	9.9	4.2	9.0
Textiles	19.4	19.7	16.3
Wearing apparel	32.5	41.6	40.3
Leather and related products	42.5	56.0	43.0
Wood and products of wood and cork	11.3	21.1	12.3
Paper products and printing	21.2	24.5	17.4
Printing	5.5	6.7	3.1
Coke and refined petroleum products	49.5	12.0	25.1
Chemicals and pharmaceutical products	17.2	52.5	21.2
Rubber and plastic products	23.4	27.8	23.0
Other non-metallic mineral products	19.7	21.2	20.5
Basic metals	23.7	28.8	16.8
Fabricated metal products	26.8	42.1	26.8
Machinery and equipment, nec	43.4	83.3	41.0
Computer, electronic, and optical products	98.6	93.3	98.0
Electrical equipment	55.2	60.5	34.4
Electronic	57.4	85.8	82.6
Optical products	69.9	70.8	66.3
Motor vehicles, trailers and semi-trailers	67.7	71.7	60.3
Other transport equipment	37.2	60.0	42.2
Other manufacturing; repair and installation of machinery and equipment	29.3	32.5	32.3
Average	35.7	43.01	35.00

Source: SI; author's computation.

More interesting and encouraging are the industries that had become the target of FDI over the whole period; that is, electronics (including computers), optical products, food products, and garments. Electronic, food products, and garments recorded the highest growth over the whole period, whilst food products, electronics, and optical products were the highest-growing industries for the later period (2010–2015). Two of these four industries, i.e. electronics and optical products, are industries that rely heavily on the IPN (Table 6). Food products and garments also depend on the IPN, although the extent is not as strong as for electronics and optical products. In general, there was a

decline in Indonesia's IPN from 2005 to 2015, as illustrated in Table 6. The top three industries in 2015 were other transport equipment, machinery and equipment and computer, and electronic and optical products.

Table 6: Backward Linkage by Broad Industries, Indonesian Manufacturing, 2005–2015 (%)

Sector	2005	2010	2015
Food products, beverages, and tobacco	11.86	7.88	8.00
Textiles, wearing apparel, leather, and related products	22.33	19.88	22.24
Wood and products of wood and cork	12.18	6.10	7.67
Paper products and printing	23.70	15.85	17.55
Coke and refined petroleum products	31.47	20.32	18.97
Chemicals and pharmaceutical products	20.89	17.04	15.75
Rubber and plastic products	29.20	26.14	28.56
Other non-metallic mineral products	8.64	7.78	7.85
Basic metals	20.90	13.84	14.99
Fabricated metal products	31.57	26.46	28.56
Computer, electronic and optical products	37.87	38.24	31.55
Electrical equipment	26.77	24.84	24.75
Machinery and equipment, nec	50.11	33.33	33.29
Motor vehicles, trailers and semi-trailers	21.39	19.26	18.08
Other transport equipment	44.45	40.90	37.97
Other manufacturing; repair and installation of machinery and equipment	24.24	17.44	18.71
Average	26.10	20.96	20.91

Source: SI; author's computation.

Table 7 presents the Ellison and Glaeser (1997) Index (EG_{jt}) for industries in Indonesian manufacturing over the period 2005–2015. There is great variation in the over-time pattern between industries. A few observations are worth mentioning here. First, was not much dynamism in agglomeration in Indonesian manufacturing in this period. The extent of industrial concentration in general did not change over the past 10 years and in fact, there is a sign of a declining trend.

Second, there are industries that have become more agglomerated over time, albeit only few of them. These are tobacco products, other non-metallic products, optical products, and electronics. The EG Index in these industries went up over the period. Optical products and electronics are industries with strong IPN characteristics, lending

support to the theory of the connection between agglomeration and the IPN. At the same time, the foreign share is also high in many of these industries, except for tobacco products (see in conjunction with Table 5). The pattern observed here suggests a positive relationship between agglomeration and FDI,[3] and the fact that agglomeration is connected with IPN implies that FDI also has a positive relationship with the IPN.

Table 7: Ellison and Glaeser (1997) Index (EG_{jt}) by Broad Industries, Indonesian Manufacturing, 2005–2015

Sector	2005	2010	2015
Food products, beverages	0.026	0.023	0.020
Tobacco	-0.058	0.019	0.154
Textiles	0.090	0.012	0.067
Wearing apparel	0.042	0.034	0.033
Leather and related products	0.058	0.019	0.032
Wood and products of wood and cork	0.041	0.040	0.047
Paper products and printing	0.014	0.001	-0.008
Printing	0.038	-0.022	-0.013
Coke and refined petroleum products	0.078	0.008	0.002
Chemicals and pharmaceutical products	0.019	0.005	-0.009
Rubber and plastic products	0.023	0.015	0.006
Other non-metallic mineral products	0.008	0.017	0.017
Basic metals	0.024	0.029	0.020
Fabricated metal products	0.039	0.028	0.018
Machinery and equipment, nec	0.048	0.028	0.030
Computer, electronic, and optical products	-1.612	0.193	-0.180
Electrical equipment	0.057	0.057	0.010
Electronic	0.101	0.269	0.194
Optical products	0.170	0.033	0.040
Motor vehicles, trailers, and semi-trailers	0.138	0.063	0.072
Other transport equipment	-0.116	-0.084	-0.011
Other manufacturing; repair and installation of machinery and equipment	0.012	0.030	0.023
Average	-0.032	0.037	0.026

Source: SI; author's computation.

[3] It is worth mentioning that the correlation between FDI and EDI is actually negative (see Appendix B), contrasting the observation here; however, this is merely a partial correlation that is shown in Appendix B and not yet a relationship. Therefore, it is important to hold the final inference about the relationship until we see the estimation results (reported in Table 12).

Third, there are, however, industries with a declining EG Index over time during the period. Many are those that have moderate to strong IPN characteristics, such as machinery and equipment, motor vehicles, and electrical equipment. This seems to contradict the earlier observation and the theory. Therefore, further examination is necessary. Meanwhile, the industries that experience declining agglomeration are textile, garment, and fabricated metal products.

One possible explanation for the declining EGI is the dispersion of industrial activity from one region to another region. This is shown in Table 8, whereby the index is observed to have increased in some regions, especially in Central and East Java. This is likely to have been the result of the relocation of factories in Jakarta or Banten. There are some factors that could have triggered this, one of which is congestion in the original location (Jakarta or Banten). Whilst this could be what happened, for Indonesia at that time, it is more likely to have been because of the difference in regional minimum wages. Figure 8 shows that the regional minimum wage in Central and East Java in fact was significantly lower than that in Greater Jakarta or Banten in 2015.

Figure 8: Provincial Minimum Wage in 2015

Source: BPS; author's computation.

Table 8: Ellison and Glaeser (1997) Index, Indonesia Manufacturing by Province, 2005–2015

Province	2005	2010	2015
Aceh	0.029	0.017	0.019
North Sumatra	0.027	0.023	0.021
West Sumatra	0.036	0.020	0.024
Riau	0.021	0.020	0.018
Jambi	0.031	0.021	0.021
South Sumatra	0.026	0.020	0.018
Bengkulu	0.030	0.021	0.017
Lampung	0.026	0.022	0.020
Bangka Belitung Islands	0.013	0.017	0.019
Riau Islands	0.038	0.059	0.041
Jakarta	0.038	0.021	0.021
West Java	0.039	0.025	0.032
Central Java	0.025	0.023	0.040
Yogyakarta	0.030	0.024	0.031
East Java	0.023	0.021	0.033
Banten	0.033	0.020	0.021
Bali	0.035	0.025	0.028
West Nusa Tenggara	0.003	0.019	0.079
East Nusa Tenggara	0.029	0.016	0.020
West Kalimantan	0.028	0.022	0.016
Central Kalimantan	0.040	0.028	0.026
South Kalimantan	0.029	0.021	0.021
East Kalimantan	0.023	0.015	0.017
North Kalimantan			0.022
North Sulawesi	0.016	0.015	0.017
Central Sulawesi	0.033	0.025	0.030
South Sulawesi	0.030	0.021	0.027
Southeast Sulawesi	0.023	0.018	0.023
Gorontalo	0.037	0.024	0.034
West Sulawesi		0.025	0.033
Maluku	0.017	0.002	0.014
North Maluku		-0.043	0.011
West Papua	0.020	0.016	0.023
Papua	0.029*	0.026	0.025

Source: SI; author's computation.

To capture the wage level as one of the determinants of FDI, Table 9 presents the minimum wage at the industry level (see Table 4 for the formula for this variable). As is clearly shown over the 3 years, the very high industry-level minimum wages were recorded mostly in industries with IPN characteristics, that is transport equipment, basic metals, and the electronic sector. These are also industries with high shares of foreign ownership.

Table 9: Industry-level Minimum Wage by Broad Industries, Indonesian Manufacturing, 2005–2015 (Rp '000)

Sector	2005	2010	2015
Food products, beverages	487.4	800.5	1,386.9
Tobacco	98.5	272.5	1,174.8
Textiles	558.9	904.2	1,563.5
Wearing apparel	592.6	1,070.6	1,643.4
Leather and related products	685.2	929.9	1,858.8
Wood and products of wood and cork	538.5	819.2	1,635.5
Paper products and printing	867.1	1,275.7	2,445.2
Printing	814.5	1,134.4	2,380.4
Coke and refined petroleum products	958.7	1,306.5	2,459.7
Chemicals and pharmaceutical products	932.8	1,629.0	2,563.2
Rubber and plastic products	731.9	1,131.0	2,222.2
Other non-metallic mineral products	408.7	660.2	1,328.3
Basic metals	1,232.7	1,693.1	3,113.5
Fabricated metal products	763.6	1,313.1	2,419.3
Machinery and equipment, nec	780.4	1,536.7	2,540.4
Computer, electronic, and optical products	520.4	2,407.1	694.9
Electrical equipment	10,06.5	1,488.0	2,703.3
Electronic	11,10.9	1,192.7	2,914.5
Optical products	797.2	1,134.7	2,489.9
Motor vehicles, trailers, and semi-trailers	962.3	1,988.2	2,623.4
Other transport equipment	812.1	1,424.1	3,156.1
Other manufacturing; repair and installation of machinery and equipment	558.5	881.2	1,802.3

Source: SI; author's computation.

Table 10 shows the industry export intensity in Indonesian manufacturing. There are quite a number of industries that have strong export orientation, namely food and

beverages, garments, leather products, wood and products from woods, electronics, and motor vehicles. Some of these industries, especially electronics and motor vehicles, are those with high foreign ownership (see Table 5) as well as with strong IPN characteristics.

Table 10: Share of Exported Value Added by Broad Industries, Indonesian Manufacturing, 2005–2015 (%)

Sector	2005	2010	2015
Food products, beverages	19.2	12.9	23.9
Tobacco	6.3	5.5	10.2
Textiles	21.4	29.4	17.5
Wearing apparel	32.3	32.5	39.5
Leather and related products	36.4	14.6	50.4
Wood and products of wood and cork	59.5	44.7	45.6
Paper products and printing	27.7	8.6	17.9
Printing	2.8	3.3	4.3
Coke and refined petroleum products	10.5	1.8	3.5
Chemicals and pharmaceutical products	12.0	6.1	12.3
Rubber and plastic products	34.0	32.3	27.0
Other non-metallic mineral products	12.2	3.3	14.8
Basic metals	11.7	32.1	18.6
Fabricated metal products	13.7	11.8	12.6
Machinery and equipment, nec	24.6	17.9	19.5
Computer, electronic, and optical products	98.1	90.0	87.5
Electrical equipment	25.1	26.2	37.1
Electronic	20.3	32.0	44.9
Optical products	5.7	10.5	50.9
Motor vehicles, trailers, and semi-trailers	17.0	13.7	19.1
Other transport equipment	6.8	14.0	8.7
Other manufacturing; repair and installation of machinery and equipment	48.7	28.4	46.5
Average	24.8	17.4	27.8

Source: SI; author's computation.

Table 11 presents infrastructure intensity at the industry level as proxied by the value added of firms located inside an industrial zone measured at the industry level (see Table 4 for the exact definition and measurement). There is wide variation across industries, and it is challenging to pick up a non-random pattern. For example, looking between industries, not all industries with an IPN characteristic are found to exhibit high

infrastructure intensity. That is, whilst the intensity in machinery and equipment industries was very high (around 11%), the intensity in electronics and motor vehicles was very low. This is against the conception that foreign investors are attracted to locate in areas with better infrastructure, which typically occurs in agglomerated areas, but the lack of infrastructure in Indonesia post the 1997/98 crisis could have been the reason why there is not this pattern in the distribution.

Table 11: Share of Value-added Firms Located in Industrial Areas by Broad Industries, Indonesian Manufacturing, 2005–2015 (%)

Sector	2005	2010	2015
Food products, beverages	13.66	3.18	5.75
Tobacco	49.37	4.65	19.10
Textiles	10.56	5.75	9.21
Wearing apparel	14.86	2.81	6.33
Leather and related products	6.17	1.03	1.66
Wood and products of wood and cork	2.92	3.21	7.10
Paper products and printing	6.94	1.55	3.47
Printing	10.03	1.21	2.25
Coke and refined petroleum products	8.92	2.21	1.90
Chemicals and pharmaceutical products	24.70	0.84	10.67
Rubber and plastic products	6.57	2.07	3.27
Other non-metallic mineral products	10.08	1.26	21.40
Basic metals	12.91	0.42	5.80
Fabricated metal products	13.20	0.91	3.48
Machinery and equipment, nec	15.20	0.39	11.32
Computer, electronic, and optical products	0.04	0.12	0.00
Electrical equipment	10.45	0.04	1.37
Electronic	11.72	1.12	0.32
Optical products	2.34	0.34	9.21
Motor vehicles, trailers, and semi-trailers	1.49	0.04	3.58
Other transport equipment	2.53	0.22	4.35
Other manufacturing; repair and installation of machinery and equipment	11.02	3.72	4.20
Average	11.17	1.69	6.17

Source: SI; author's computation.

Table 12 presents the results of the estimation of the four specifications on the importance of IPN and agglomeration on the extent of *FDI*. The most convincing finding

here is the positive impact of agglomeration and the dependency of IPN on agglomeration. This is the result of the estimation of the fourth specification in Table 12 (i.e. the last column of the table). That is, the estimated coefficient of *EGI* is positive and statistically very significant when it enters the equation individually, and it is also positive and statistically significant when it is interacted with *BL*, the proxy of IPN. In other words, the contribution of agglomeration in attracting FDI is suggested to be greater if there is already an established linkage between firms inside the agglomeration area. This supports the analytics that setting up value chains within an agglomeration is cheaper than outside the agglomeration. Looking at this from a different perspective, the finding supports the idea that the creation of agglomeration will support the growth of the IPN.

There is, however, an important caveat here in that one may argue that this finding may not be that robust. The estimated value of *EGI* is only positive and statistically significant in the fourth specification, whilst it is either negative or positive but statistically not significant in the other specification. Nevertheless, relying on the result of the fourth specification is justified because the model-fit of this specification is the highest amongst all estimated specifications (the R-squared value of the fourth specification is 0.393, which is the highest amongst all of the specifications).

Exporting is suggested to be another important determinant of FDI. Confirming the observation from the earlier descriptive analysis, the estimate of *EXP* is positive and statistically significant at a moderately high level across all four specifications. The magnitude of the impact is also suggested to be moderately high, considering the value of the estimate relative to that of the other variables.

Meanwhile, the experiment to interact exporting with agglomeration (i.e. the interactive variable (*EGI*)*(*EXP*)) yields the expected result, which is a positive relationship with FDI, but the estimated interacted variable is not statistically significant. In other words, the degree of certainty in the prediction coming from the result is not strong, and this may be the result of a limited number of observations that show such a relationship. If the number of observations is increased, there could be a chance that the estimated coefficient would become statistically significant. The other potential reason is that exporting is not the main objective of manufacturers in Indonesia (Putra and Narjoko,

2022), including those participating in the IPN. As suggested by Putra and Narjoko, this reflects the strong domestic orientation of many firms or MNEs conducting business in Indonesia, supported by strong domestic demand from the size and growth of the population – relative at least to other ASEAN countries. Exporting is merely selling the excess of production, especially when firms have excess supply in their production.

Table 12: Production Networks and Agglomeration Determinants of FDI, Indonesian Manufacturing, 2005–2015.

	(1)	(2)	(3)	(4)
$lnVA_{j(t-1)}$	0.0219***	0.0142	0.0215***	0.0139
	(0.00478)	(0.00911)	(0.00447)	(0.00906)
$EGI_{jk(t-1)}$	–0.631	–0.586*	1.165	1.108**
	(0.458)	(0.332)	(0.826)	(0.551)
$Tariff_{j(t-1)}$	–0.0008	–0.000328	0.000459	0.000798
	(0.00681)	(0.00687)	(0.00544)	(0.00547)
$EXP_{j(t-1)}$	0.756***	1.088**	0.764***	1.089**
	(0.120)	(0.461)	(0.114)	(0.462)
$BL_{j(t-1)}$	–0.00152	–0.00178	–0.00673	–0.00646
	(0.00366)	(0.00367)	(0.00477)	(0.00451)
$MW_{j(t-1)}$	0.0814**	0.0801**	0.0372	0.0385
	(0.0385)	(0.0375)	(0.0472)	(0.0445)
$ZONE_{j(t-1)}$	0.0721***	0.104**	0.0745***	0.106**
	(0.0224)	(0.0526)	(0.0209)	(0.0521)
$EGI_{jk(t-1)}$* $EXP_{j(t-1)}$			0.246	0.241
			(0.293)	(0.293)
$EGI_{jk(t-1)}$* $BL_{j(t-1)}$			–0.0613	0.0582**
			(0.0415)	(0.0266)
Observations	32,272	32,272	32,272	32,272
Adjusted R-squared	0.384	0.392	0.385	0.393

Standard errors are in parentheses
* p<0.10, ** p<0.05, *** p<0.010
Source: Author's calculation.

It is important to make some observations here on factors other than production networks and agglomeration.

The first is the wage level. The results find that a higher minimum wage applied for an industry tends to attract FDI. The estimate of the minimum wage (*MW*) is positive and relatively large in value in all specifications, although it is only statistically significant in two specifications (the first two specifications). Whilst the finding seems to be counterintuitive, it can be explained by the stylised fact that MNEs typically pay higher wages than domestic firms in the same industry (Bernard et al., 1995).

The second is infrastructure. The estimation indicates a positive impact of infrastructure on the decision to invest by foreign investors, confirming it as one of the typically most-often cited factors to attract FDI. The estimate of the proxy for infrastructure intensity (*ZONE*) is positive and statistically significant for all specifications. The impact is relatively strong, indicated by high statistical significance (either at the 1% or 5% level) and the relatively large value of the estimate. Thus, firms located inside industrial parks tend to have higher shares of foreign ownership than those located outside industrial parks. It is typical that agglomeration areas, such as that of Greater Jakarta, have been chosen as the location of many industrial parks compared to the non-agglomerated areas.

6. Policy Relevance

Investment is important for economic growth and development in any country in the world, especially for developing ones. This study is expected to provide some policy insights into encouraging FDI inflows to a country, using the case study of Indonesian manufacturing. Especially with respect to globalisation and developing countries, it is expected to provide some idea of the importance of GVCs, international trade policy regimes, institutions, and infrastructure in determining the extent of FDI inflows.

This study shows that agglomeration and participation in the IPN are two important industry activities that determine the extent of foreign investment in a country. Production networks or agglomeration are found to play an important role in driving FDI in Indonesia's manufacturing sector, at least for the period 2000–2015. The contribution of

agglomeration is clear when there is an already established linkage between firms inside the agglomeration area. This supports the theoretical argument that setting up value chains within an agglomeration is cheaper than outside the agglomeration and hence facilitates the growth of networks of production between firms.

This study provides the insight that agglomeration could be utilised to increase the extent of FDI inflows to Indonesia. This not only improves the productivity of the sector targeted by the investment but also promotes productivity growth, as FDI provides a source of advanced knowledge and technology. The long-run productivity impact is not only limited to the targeted sector but also to other sectors by the technology-spillover mechanism coming from FDI.

In the context of Indonesia, this approach is even more important, given the vast available area for new agglomeration. The policy taken by the government on this, unfortunately, has not been strong, especially since the economic crisis of 1997/98. Unlike during the 1990s, policy to create or facilitate agglomeration tends to have been sporadic and not linked with infrastructure development, as there was also only minimal infrastructure development after the crisis. At this moment, many of the agglomerated areas are largely the remaining ones from the development that occurred in the 1990s. Creating more agglomerated areas could then be a policy direction taken by the country to help increase the growth of FDI inflows to the country.

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Appendix

A. Summary of Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI_{jt}	67,360	0.033	0.813	0.000	98.168
$lnVA_{jt}$	67,360	14.782	2.120	7.467	24.569
EGI_{jkt}	67,360	0.028	0.037	–1.612	0.269
EXP_{jt}	58,263	0.024	0.590	0.000	98.119
$Tariff_{jt}$	67,360	5.508	3.059	0.210	13.130
BL_{jt}	67,360	17.328	8.507	6.100	50.110
MW_{jt}	67,360	6.884	0.608	4.590	8.892
$ZONE_{jt}$	67,360	0.009	0.280	0.000	47.934

Source: Author's calculation.

B. Correlation of the Dependent and Independent Variables

	FDI_{jt}	$lnVA_{jt}$	EGI_{jkt}	EXP_{jt}	$Tariff_{jt}$	BL_{jt}	MW_{jt}	$ZONE_{jt}$
FDI_{jt}	1.000							
$lnVA_{jt}$	0.116	1.000						
EGI_{jkt}	–0.073	0.033	1.000					
EXP_{jt}	0.718	0.103	–0.129	1.000				
$Tariff_{jt}$	–0.024	–0.103	0.191	–0.019	1.000			
BL_{jt}	0.045	0.138	0.049	0.029	0.086	1.000		
MW_{jt}	0.021	0.395	0.086	0.014	–0.195	0.238	1.000	
$ZONE_{jt}$	0.099	0.085	0.004	0.107	–0.009	0.018	0.012	1.000

Source: Author's calculation.

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