THE RELATIONSHIP BETWEEN INDONESIA'S FOREIGN DIRECT INVESTMENT AND BILATERAL INTRA-INDUSTRY TRADE WITH JAPAN, CHINA, AND ASEAN-9

(*Hubungan antara Penanaman Modal Asing di Indonesia dan Perdagangan Intraindustri dengan Jepang, R.R. Tiongkok, dan ASEAN-9*)

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Abstrak

Beberapa negara mencoba untuk lebih terlibat dalam perdagangan internasional untuk menjadi bagian dari jaringan global. Investasi asing dipercaya merupakan salah satu cara untuk meningkatkan skala ekonomi dari suatu negara. Oleh karena itu, negara berkembang seperti Indonesia mencoba untuk menarik lebih banyak penanaman modal asing (PMA). Tujuan utama PMA biasanya adalah berorientasi ekspor dan ingin bersaing di pasar global. Perdagangan intraindustri mengukur ekspor dan impor dalam satu kategori industri. Indeks perdagangan intraindustri yang mempunyai nilai tinggi berarti suatu negara memiliki integrasi yang kuat dengan negara mitra. Kajian ini mencoba menganalisis hubungan antara PMA sektor manufaktur di Indonesia dan bilateral perdagangan intraindustri antara Indonesia dengan masing-masing Jepang, China, dan ASEAN-9, khususnya pada level industri. Metode dari penelitian ini menggunakan Fixed Effect Model. Hasil penelitian menunjukkan bahwa keterkaitan antara PMA dan perdagangan intraindustri hanya signifikan pada industri tertentu. Dalam kasus Indonesia dan Jepang, PMA pada industri kendaraan bermotor dan alat transportasi lain memiliki korelasi tertinggi dengan perdagangan intraindustri. Sedangkan untuk kasus Indonesia dan China, PMA pada industri logam dasar, barang logam, bukan mesin dan peralatannya menunjukkan hubungan yang paling tinggi dengan perdagangan intraindustri. Dalam kasus Indonesia dan ASEAN-9, hubungan tertinggi antara PMA dan perdagangan intraindustri adalah pada industri tekstil. Hubungan PMA dan perdagangan intraindustri berbeda antarlokasi dan industri.
*Kata kunci: penanaman modal asing, manufaktur, perdagangan intraindustri*

Abstract

Many countries try to engage more in international trade to be part of global networks. Foreign investment is one of the ways to improve a country's economies of scale. Thus, developing countries, such as Indonesia, try to attract more FDI. FDI is mainly export-oriented and wants to compete globally. Intra-industry trade measures export and import in the same industry. A high degree of intra-industry trade means a country has strong integration with a partner's country. This study examines the relationship between FDI in Indonesia's manufacturing sector and bilateral intra-industry trade between Indonesia and Japan, China, and ASEAN-9, especially at the industry level. The method of this study is the Fixed Effect Model. The result shows that the linkage between FDI and intra-industry trade is only significant in specific industries. In the case of Indonesia and Japan, FDI in the vehicle and other transportation industry has the highest correlation with intra-industry trade. Meanwhile, in the case of Indonesia and China, FDI in the metal, except machinery, and equipment industry shows the highest association with intra-industry trade. In the case of Indonesia and ASEAN-9, the highest linkage between FDI and intra-industry trade is in the textile industry. The relationship between FDI and intra-industry trade differs across locations and industries.
Keywords: foreign direct investment, manufacture, intra-industry trade

INTRODUCTION

In the global economy, multinational enterprises (MNEs) try to enlarge their production to compete globally by investing abroad. Developed countries focus on expanding their business, meanwhile developing countries try to attract Foreign Direct Investment (FDI) and take part in the international trade. The host country, such as a developing country, can attain technology, knowledge, and financial capital from FDI (Halaszovich & Kinra, 2020). The trade among countries also happens when there is production fragmentation. MNEs separate the process into two or more stages in the production process of final products. Each of them may be in a different location due to an international fragmentation of production (Fung et al., 2013). As a developing country, Indonesia becomes one of the primary recipients of FDI. As can be seen in Figure 1, we know that the value of FDI every year is always higher than Domestic Direct Investment (DDI). Although in the fourth quarter of 2019, the difference in value between FDI and DDI was getting smaller.
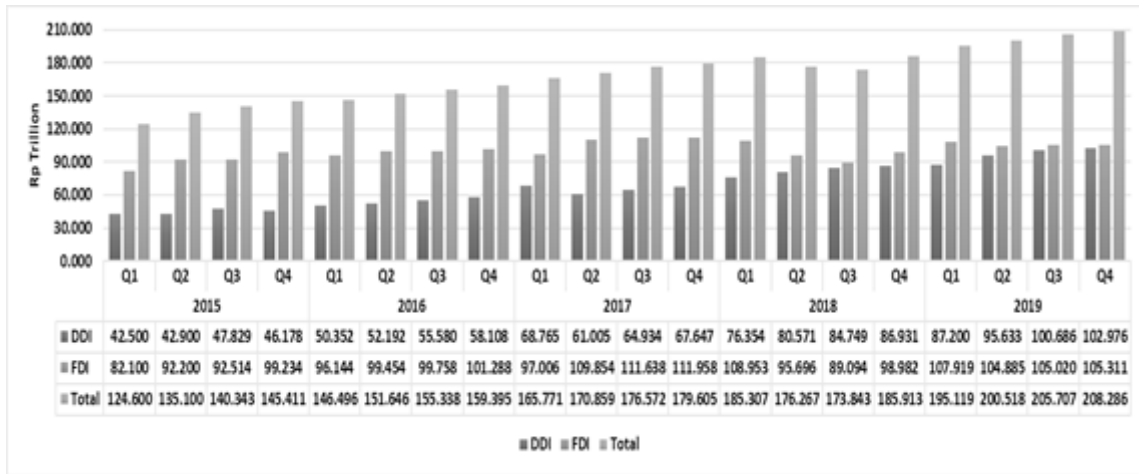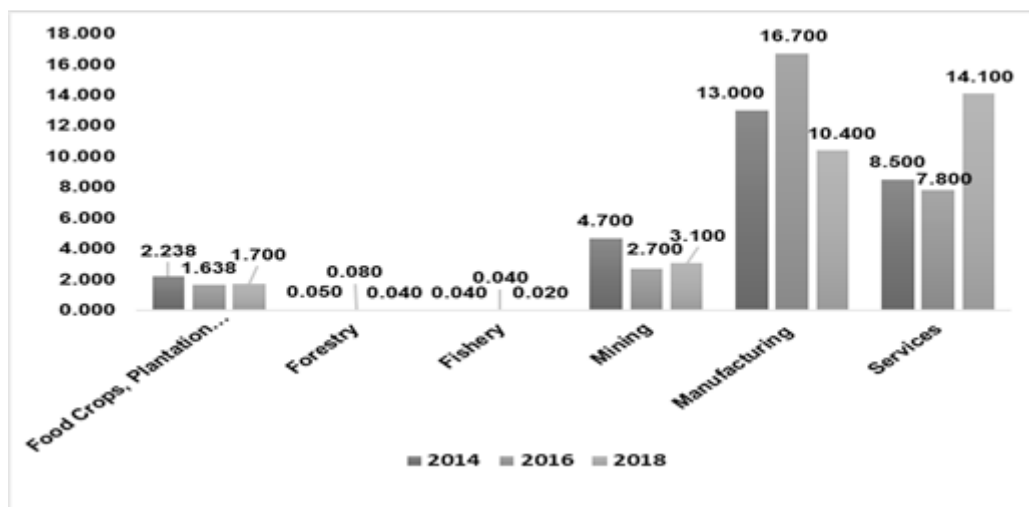
Source: Indonesia Investment Coordinating Board, 2019.

Figure 1. The Investment Trend in Indonesia in 2015-2019 (Quarterly)

Indonesia has gained many FDI inflows in various sectors, especially manufacturing, as several factors support production activities such as abundant natural resources and cheap labor. Besides that, several regulations are primarily related to import intermediate goods, making Indonesia an attractive country. One of them is the regulation about import facilities for export, which exempts import duty or taxes on the import goods and materials to produce export goods as mentioned in the Regulation of the Minister of Finance of The Republic Indonesia Number 176/PMK.04/2013. Figure 2 shows that the value of FDI in the manufacturing sector has a more significant proportion than the other sectors, especially in 2014 and 2016. In 2018, the share of FDI in services was higher than in the manufacturing sector.

One of the international trade forms is intra-industry trade. Intra-industry trade (IIT) measures to what extent both exports and imports on goods or services of a country in the same industry. Krugman et al. (2012) state that IIT's concept is mainly the two side exchanges in similar goods. A country usually will have a high degree of IIT when the trade partners have similar economies of scale. Economies of scale can characterize a country's demand so that if both countries have the same demand structure, it is more likely that the countries will engage more in IIT. Therefore, international trade usually happens in trading partners with similar characteristics, such as among developed countries. Xing (2007) describes a country with a similar trading partner tends to have an IIT, such as between industrialized countries. Furthermore, Sawyer et al. (2010) and Răzvan & Camelia (2015) explain that a country tends to have an IIT when a country has similar endowment factors with its trading partners. Meanwhile, if a country has a different endowment with its partners, it will involve more inter-industry trade. A preferential trade agreement between country-pair can decline

Source: Indonesia Investment Coordinating Board, 2019.

Figure 2. The Trend of Foreign Direct Investment in Indonesia by Sector in 2014, 2016, and 2018 (USD Billion)

IIT when there is a considerable difference in per capita income (Foster & Stehrer, 2011).

IIT is essential since it can bring a country to be part of the global economy. It can create a diversification product so that a country can compete in the global or international market. Furthermore, IIT also shows the connection and integration of international producers (global supply chain). For instance, the home countries can use the capital from their own country and employ abundant and relatively cheap labor from a host country. A high share of IIT has a positive relationship with expanding the business cycle synchronization (Li, 2017). Vertical IIT can serve as an engine of growth for the countries (Chin et al., 2020). Yazdani & Pirpour (2020) claim that when the share of IIT increases, it can advance market integration by improving competitive advantages. The more countries participate in the IIT, the more countries potentially have high economies of scale since countries will be part of the global value chain. The advancing of trade activities in export and import means that countries have improved in various products, technology, and economies of scales (Xing, 2007). Moreover, as the countries have participated more in the global value chain, the trade pattern will also change. Trade can increase market size such that a company can enlarge its production and benefit from the economies of scale. Furthermore, the average of production cost can be reduced from the presence of economies of scale. Thus, a company can be more competitive in the international market (Akram & Mahmood, 2012). Najafi et al. (2021) also mention that the government size represented by the ratio of government expenditure to GDP has a positive linkage with IIT.

There are two forms of IIT, based on the quality of products, namely horizontal and vertical IIT. If a product has a different quality, then we can say that the IIT is vertical. Conversely, a horizontal IIT is when there is nearly the same quality as a product. Sawyer et al. (2010) and Leitao (2012) state the vertical IIT has product differentiation, as it can be different in the price and quality. On the other hand, horizontal IIT usually happens between countries with similar income per capita, for example, between developed countries (Răzvan & Camelia, 2015). Thus, the products they exchange have similar quality. They also add the vertical IIT is usually between countries with different incomes. Türkcan (2011) confirms that when countries have different factor endowments, the vertical IIT tends to be high. As we know, vertical one has differentiated products, so the products have different quality. For instance, Indonesia exports a casual t-shirt to China and imports wool jackets from China. Since it is in the same industry category, the textile industry is included in IIT.

Several factors can influence IIT. Many researchers (Sawyer et al. (2010), Răzvan & Camelia (2015), Aggarwal & Chakraborty (2017), Kim & Cho (2018), Aghlmand et al. (2018), and Brkić (2018)) have studied the factors which determine IIT. Sawyer et al. (2010) evaluate determinants of IIT in Asia. They claim that spending on research and development and export in manufacture products are primary factors of IIT in Asia. Trade openness and trade agreements also can advance trade among countries. Das et al. (2016) and Konno (2016) find that free trade agreements can promote IIT. Trade liberalization can affect IIT by increasing the number of varieties of differentiated products (Cieślik & Wincenciak, 2018). Chin et al. (2015) confirm trade openness shows a significant role on Vertical IIT in countries in their study. Another study by Răzvan & Camelia (2015) states that IIT's previous year and economic growth positively affect IIT. The difference of endowments and GDP per capita has a relationship to the low share of IIT too. It is also consistent with the studies by Cabral (2013), Phan & Jeong (2014), Łapińska (2016), Madeira (2016), Bagchi & Bhattacharyya (2019), and Brodzicki et al. (2020). IIT is initially a trade between countries that are similar in competitiveness (Madeira, 2016). Another study by Brkić (2018) claims that a lower IIT level is contributed by the existence of a significant bilateral trade imbalance. FDI is also one of the dominant factors that influence IIT. Fung et al. (2013) mention that the growing volume of foreign investment links with IIT's rising share. FDI is one of the approaches of MNEs to enhance their market scale abroad. The companies located in the developed country tend to enlarge their production to developing countries since developing countries usually have abundant natural resources and affordable labor. Thus, the production cost will be lower. It is also consistent with research by Jambor & Leitão (2016) and Brodzicki et al. (2020), who find that FDI and IIT are positively correlated. Sun (2001) asserts that the international division in labor and factor production mobility, such as technology and management, can happen when foreign investment is involved. FDI inflow can help to develop the productivity of labor, technology, and availability of capital. This condition also makes a host country has various products that they could not produce before (Xing, 2007). Aggarwal & Chakraborty (2019) also state the foreign investment can help a technology transfer, then it can further expand the manufacturing product basket and increase efficiency. FDI can facilitate production networks and make industrial products more fragmented (Intarakumnerd & Techakanont, 2016). In addition, a study by Michalski (2018) mentions that FDI projects,

as potential external factors, can help a host country gains access to modern knowledge and business solutions. Another study by Aziz et al. (2018) mention that intra-ASEAN FDI positively correlates with all types of ASEAN IIT, namely vertical, horizontal, and overall IIT.

In general, foreign investment is primarily export-oriented since companies intend to participate in the global market. Fung et al. (2013) mention that the growing volume of FDI would create various products and raise the number of products. Eventually, it will also improve IIT's volume or value since the volume or value of export raises. Additionally, they also point out that foreign investment, which has a production fragmentation, connects with IIT. Multinational firms make fragmentation of production in different places. For example, a host country as the destination of multinational firms' investment will rise its import in the parts and components. Then, a host country will manufacture finished or final products, after that exports its products to other countries. A host country may export back the finished products to the home or source country.

There are some studies related to FDI and IIT. Most of them are using panel data analysis. However, the studies mostly estimated foreign investment in the aggregate level and not at the industry level. Xing (2007) mentions foreign investment plays a vital role in raising IIT, especially between China and Japan, although in the case of China and the US, the result cannot confirm this statement. Sun (2001), Rahmaddi & Ichihashi (2013), and Fung et al. (2013) also state that FDI can promote export performance. Sun (2001) evaluates the FDI and export performance in China, especially at the province level, using panel data analysis. The result shows that FDI can create trade and is an essential factor for China's rapid export growth. Rahmaddi & Ichihashi (2013) study FDI based on factor intensity and the changing of export in Indonesia's manufacturing sector. They find that FDI from human capital intensive, physical capital intensive, and technology-intensive industries have a more vital linkage with export than FDI in natural resource-intensive or unskilled labor-intensive industries. Fung et al. (2013) analyze FDI from some countries and intra-east Asian trade using a fixed-effect model. Most of the FDI from those countries have a positive relationship with export and import, especially FDI from Japan. Additionally, Burange et al. (2017) try to assess a causality relationship between India's FDI and IIT in the manufacturing sector using granger causality. They try to evaluate the direction of the causal relationship. The result concludes that, in general the granger causality test supports the causality from FDI to IIT rather than the one from

IIT to FDI at the industry level. Thus, they add the FDI inflow will give benefit to the raising of IIT in the economy. Based on those studies, we may know that FDI from certain countries does not associate with trade. Probably this result followed when we use the aggregate data since not all FDI at the industry level will show a linkage with IIT. Thus, in this study, we believe it is essential to take into account the sector's disaggregation into each industry to depict the relationship between FDI and IIT of each industry. Moreover, suppose the result shows that FDI in a particular industry does not correlate with IIT. We can further evaluate and encourage more FDI contribution in a particular industry such that this FDI can increase its export contribution in the future.

This paper aims to examine the relationship between FDI and Indonesia's bilateral IIT in the manufacturing sector. This study pursues to give details elaborations of the relationship between FDI and IIT at the industry level. We will include 12 industries in the manufacturing sector. To match export and import and FDI data, we will categorize industry in the ISIC Rev. 3 for export and import, which has a similar industry category with ISIC Rev. 4 for FDI. The method used here is a panel data method, which has been applied in a similar topic, for instance, in the research by Xing (2007) and Fung et al. (2013).

The difference between this study and the other studies is that we attempt to capture FDI in Indonesia's specific industries, especially in the manufacturing sector, which will associate with bilateral IIT. Furthermore, based on the result of FDI from a specific industry, we can also describe the industry's classification, which is more dominant in IIT between Indonesia and its trade partners. This study also tries to evaluate using panel data analysis. To capture the industry level, we try to adopt the model from Rahmaddi & Ichihashi (2013). This study especially intends to show the bilateral IIT
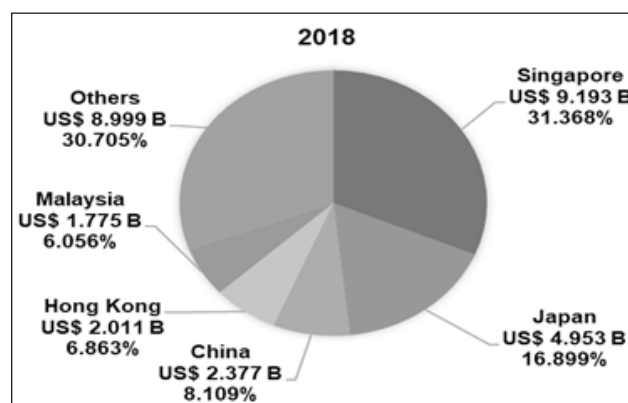
Source: Indonesia Investment Coordinating Board, 2019.

Figure 3. Foreign Direct Investment in Indonesia Based on Country of Origin in 2018

between Indonesia and Japan, China, and ASEAN-9, respectively. The main argument of why Japan, China, and ASEAN-9 are chosen are mainly from the fact that they contribute the most of FDI in Indonesia, as can be seen in Figure 3.

This study is organized into four parts. The first part is an introduction, which describes the background information, motivation, theory, and previous studies done by other researchers to give more information primarily for the method that researchers use as well as the economic theory and aims of doing this research. The second part will justify the method and data. The third part is the empirical results. The results include three parts, explaining and discussing more each relationship between Indonesia and its trading partners. The last part explains the conclusion and policy implication.

METHOD
Method Analysis

The study explains the manufacturing FDI in Indonesia which is based on country and industry. The trading partners are from the home countries of FDI in Indonesia. In this study, the home countries and trading partners are Japan, China, and ASEAN-9. After that, we compute Indonesia's IIT and each of Indonesia's trading partners. An index of IIT is calculated from Grubel & Lloyd (1975) index as follows:

$$IIT_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \times 100 \quad \text{............ (1)}$$

Where X_i exemplifies exports in the industry i, and M_i exemplifies import in the industry i. This index range is from 0 to 100, which shows no integration for 0 value and fully IIT or strong integration for 100 (Austria, 2004).

The primary purpose of this study is to analyze the relationship between FDI and bilateral IIT. Based on Burange et al. (2017), who evaluate the potential causality relationship between India's FDI and IIT in the manufacturing sector using granger causality, in general, the results support the causality from FDI to IIT rather than the one from IIT to FDI at the industry level. They also state that the FDI inflow will help a country increase its level of IIT. Furthermore, in the study by Sun (2001), based on the comparative advantage theory, FDI can make dynamic changes in the comparative advantage of a country and then can create trade. Primarily, FDI can facilitate an international division of labor and upsurge factor production mobility (capital, management skills, and technology). The study by Lee (2018) also mentions that comparative advantage can explain the existence and the level of IIT. In this study, we believe that the direction of the correlation between

FDI and IIT is from FDI to IIT at the industry level, as Burange et al. (2017) mentioned. This concept is also supported by some studies (as mentioned in the previous part) that evaluate IIT determinants and the theory of comparative advantage. Implementing the model by Xing (2007) and Rahmaddi & Ichihashi (2013), the model will be specified as follows:

$$\log(IIT_{ijt}) = \alpha_0 + \alpha_i D_i + \beta_1 \log FDI_{ij(t-1)} + \gamma_i(D_i \log FDI_{ij(t-1)}) + \beta_2 GDPG_{ht} + \beta_3 GDPG_{jt} + \beta_4 \log(TB)_{kt} + \beta_5 \log(TO)_{kt} + \beta_6 \log(REER)_t + \beta_7 Dcrisis_t + \beta_8 Dep_t + \varepsilon_{it} \text{......................................(2)}$$

Where IIT_{ijt} exemplifies Indonesia's IIT index with trading partner j in the industry i and time t. We will compare between bilateral IIT of Indonesia and Japan, Indonesia's IIT with China, as well as Indonesia's IIT with ASEAN-9, to know the pattern of IIT, which is dominant between Indonesia and those trading partners. $FDI_{ij(t-1)}$ exemplifies FDI from each country-of-origin j (home country) in the industry i, which are FDI from Japan, China, and ASEAN-9 in the previous period. $GDPG_{ht}$ represents Indonesia's GDP growth in time t, while $GDPG_{jt}$ represents the GDP growth of each Japan, China, and ASEAN-9 in time t. TB_{kt} denotes the relative trade balance between Indonesia and its trading partner in time t. The trade balance value is calculated by dividing the absolute value of the trade balance and total trade. TO_{kt} represents trade openness in Indonesia and trading partner in time t. Trade openness is calculated by the total value of export and import divided by nominal GDP. $REER_t$ represents the real effective exchange rate of Indonesia in time t. D_i represents the dummy variable for the industry. The subscript i shows the code of the dummy industry. For instance, we have D_1, which means value 1 is for the food industry, while value 0 is otherwise. γ_i represents a differential slope coefficient. If the β_1 and γ_1 are statistically significant, then we can calculate the coefficient of FDI for industry 1 (food industry), which is ($\beta_1 + \gamma_1$). There are two other dummy variables: the dummy of crisis and the dummy of economic partnership. The dummy of the crisis shows the financial crisis in 2007-2008. We code 1 for crisis 2007-2008, and 0 for other years. Dummy of economic partnership denotes trade agreement between Indonesia and each trading partner. For instance, Indonesia Japan Economic Partnership Agreement (IJEPA) for Indonesia and Japan in which the implementation was since 2008. Hence, we code dummy value 1 for IJEPA in 2008-2018, and 0 for other years. The other economic partnership is the ASEAN-China Free Trade Agreement (ACFTA) and the ASEAN Free Trade Area (AFTA).

The method of this study is panel data analysis. We conduct the Hausman test to define the most fitted

model, whether it is a fixed-effect model or a random-effect model. This test also defines a null hypothesis, namely a fixed-effect model, and the alternative one is a random effect model. If we can reject a null hypothesis, we can tell that a fixed effect model gives a better result than a random effect model.

Data Type and Source

The full sample period of this study is from 2000 to 2018. We use this FDI data based on the newest of the

ISIC classification, which is ISIC Rev. 4, from the Indonesia Investment Coordinating Board (BKPM) database. The IIT and trade openness is from export and import data. The export, import, and trade balance data is from the World Integrated Trade Solution (WITS). The WITS trade statistic is a database created using aggregate data from UN COMTRADE and UNCTAD TRAINS database. It provides data about bilateral trade export and import. We use ISIC Rev. 3 for the export and import data. Since the classification of FDI data and trade data is different,

Table 1. Summary Statistics of Variables

Variable	Mean	Std. Dev	Min.	Max.
Indonesia and Japan				
Log IIT	1.405	0.588	-0.297	1.999
Log FDI	7.482	0.968	3.491	9.477
Indonesia's GDP growth	5.268	0.681	3.600	6.300
Japan's GDP growth	0.9368	1.877	-5.400	4.200
Log Trade Balance	-0.596	0.309	-1.397	-0.225
Log Trade Openness	-1.235	0.159	-1.514	-0.957
Log Real Effective Exchange Rate	1.981	0.031	1.939	2.053
Dcrisis	0.105	0.308	0.000	1.000
Dep	0.579	0.495	0.000	1.000
Indonesia and China				
Log IIT	1.511	0.227	1.093	1.889
Log FDI	7.209	0.911	5.005	9.248
Indonesia's GDP growth	5.257	0.375	4.900	6.000
China's GDP growth	7.143	0.500	6.600	7.900
Log Trade Balance	-0.653	0.135	-.8595	-0.491
Log Trade Openness	-1.253	0.038	-1.292	-1.171
Log Real Effective Exchange Rate	1.960	0.016	1.939	1.985
Indonesia and ASEAN-9				
Log IIT	1.762	0.184	1.137	1.993
Log FDI	7.784	0.836	5.371	9.390
Indonesia's GDP growth	5.443	0.549	4.600	6.300
Average ASEAN's GDP growth	5.741	1.443	2.315	7.805
Log Trade Balance	-0.329	0.062	-0.496	-0.241
Log Trade Openness	-1.988	0.063	-2.095	-1.867
Log Real Effective Exchange Rate	1.982	0.031	1.939	2.053
Dcrisis	0.125	0.332	0.000	1.000
Indonesia and Singapore				
Log IIT	1.620	0.313	0.653	1.996
Log FDI	7.250	1.023	3.204	9.389
Indonesia's GDP growth	5.268	0.681	3.600	6.300
Singapore's GDP growth	5.277	3.674	-1.069	14.526
Log Trade Balance	-0.882	0.378	-2.159	-0.572
Log Trade Openness	-1.362	0.093	-1.558	-1.207
Log Real Effective Exchange Rate	1.981	0.031	1.939	2.053
Dcrisis	0.105	0.308	0.000	1.000
DAFTA	0.842	0.365	0.000	1.000

we justify each industry so that the classification from ISIC Rev. 3 will be the same as ISIC Rev. 4. This study also needs data about GDP and the real effective exchange rate. The data source of GDP and the real effective exchange rate is from the World Bank.

summary and the description of the data of Indonesia and Japan, Indonesia and China, and Indonesia and ASEAN-9. Moreover, there are also statistics about Indonesia and Singapore data (separate from ASEAN-9).

RESULTS AND DISCUSSION
Statistical Summary

Table 1 below presents the summary statistics of each variable. The summary statistics show the

Bilateral between Indonesia and Japan

Table 2 below describes the estimation result of the relationship between FDI and IIT in Indonesia and Japan's bilateral pattern. This estimation includes 12

Table 2. FDI and Bilateral IIT between Indonesia and Japan

Variable	Coefficient	t-statistic
Constant (α_1)	1.123	0.850
Log FDI lag 1 (β_1)	**-0.104***	-1.940
γ_1	0.092	1.220
γ_2	**0.160***	1.710
γ_3	0.086	0.680
γ_4	**0.142****	2.080
γ_5	**0.149****	2.170
γ_6	0.081	1.100
γ_7	0.149	1.430
γ_8	0.086	1.150
γ_9	-0.178	-1.570
γ_{10}	0.104	1.530
γ_{11}	**0.214****	2.350
Food Industry ($\beta_1+\gamma_1$)	-0.012	
Textile Industry ($\beta_1+\gamma_2$)	0.056	
Leather Goods and Footwear Industry ($\beta_1+\gamma_3$)	-0.018	
Wood Industry ($\beta_1+\gamma_4$)	0.038	
Paper, Paper Based Goods and Printing Industry ($\beta_1+\gamma_5$)	0.045	
Chemical and Pharmaceutical Industry ($\beta_1+\gamma_6$)	-0.023	
Rubber, Rubber and Plastic Based Goods Industry ($\beta_1+\gamma_7$)	0.045	
Non-Metallic Mineral Industry ($\beta_1+\gamma_8$)	-0.018	
Metal, Except Machinery, and Equipment Industry ($\beta_1+\gamma_9$)	-0.282	
Metal, Machinery, Electronic Medical instrument, Precision, Optical, and Watch Industry ($\beta_1+\gamma_{10}$)	0.000	
Vehicle and Other Transportation Industry ($\beta_1+\gamma_{11}$)	0.111	
Other industry (β_1)	-0.104	
Indonesia's GDP growth	-0.016	-0.510
Japan's GDP growth	0.002	0.230
Log Trade Balance	0.017	0.210
Log Trade Openness	0.207	1.500
Log Real Effective Exchange Rate	0.348	0.480
Dcrisis	-0.002	-0.050
Dep	**0.170*****	3.070
Estimation properties		
R2	0.065	
Rho	0.986	
N	185.000	

Note: the estimation uses a fixed-effect model.
Dependent variable is IIT. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Source: WITS, BKPM, and World Bank, calculation by STATA App

industries and 19 years period from 2000 until 2018. Since our main purpose is to understand the result of each industry level, in this estimation, we develop the interaction of dummy industry and FDI. In this case, we utilize 11 dummies which represent industries. The coefficient result of FDI in a specific industry is from the addition between the coefficient of β_1 and γ_i. For instance, if we want to calculate the value of the textile industry, then we take the summation of the γ_2's coefficient and β_2's coefficient. The requirement here is that both coefficients should be significant to justify that the summation result is considered as significant as well. For the main interest of variable, FDI, we utilize lag period *t-1* after considering the previous study and comparing results using current FDI, FDI lag 1, and FDI lag 2. We believe that as FDI needs time to justify its contribution, we decide to use the lag in the estimation.

We know that β_1, γ_2, γ_3, γ_4, and γ_{11} are significant. Thus, we can take the summation of the value β1 and each γ_2, γ_3, γ_4, or γ_{11}. Based on the estimation result, we know that FDI in four industries positively and significantly correlates with IIT between Indonesia and Japan. It means that, for instance, in the leather goods and footwear industry, we can affirm that when FDI from Japan in the leather goods and footwear industry rises, then the IIT between Indonesia and Japan will also rise. In Indonesia and Japan, we can declare the positive correlations between FDI and IIT, mostly from FDI on the labor-intensive and

resource-intensive industry. It means Indonesia has an integration of trade with Japan in the four industries. Those industries are the textile industry, wood industry, and paper, paper-based goods, and printing industry. Furthermore, Indonesia also starts to have bilateral IIT with Japan in the technology-intensive industry, namely vehicle and other transportation industry. This outcome also matches with Rahmaddi & Ichihashi (2013) study. Their study finds that Indonesia's FDI in-vehicle and other transportation industry has a positive correlation with Indonesia's export in this industry. We have a negative coefficient in the case of other industry. It means FDI from other Industry cannot explain its positive linkage with the IIT between Indonesia and Japan. Xing (2007) mentioned that the FDI that gives a positive relationship with IIT is the export-oriented FDI. If the FDI does not target the global market, then the FDI cannot create trade. The other explanatory variable, which also has a positive and significant result, is a dummy of economic partnership. This economic partnership represents the existence of IJEPA. Based on the result, we may affirm that the implementation of IJEPA has a positive linkage with IIT between Indonesia and Japan. This result also corresponds with the research's result by Sawyer et al. (2010), in which trade agreement can advance trade among countries.

Table 3. FDI and Bilateral IIT between Indonesia and China

Variable	Coefficient	t-statistic
Constant (α_0)	-72.295	-1.540
Log FDI lag 1 (β_1)	**0.419*****	6.260
γ_1	**-0.271****	-2.610
γ_2	-0.053	-0.330
γ_3	**-0.380*****	-4.250
γ_4	**-0.320*****	-4.210
Food Industry ($\beta_1+\gamma_1$)	0.148	
Wood Industry ($\beta_1+\gamma_2$)	0.366	
Paper, Paper Based Goods and Printing Industry ($\beta_1+\gamma_3$)	0.039	
Chemical and Pharmaceutical Industry ($\beta_1+\gamma_4$)	0.099	
Metal, Except Machinery, and Equipment Industry (β_1)	0.419	
Indonesia's GDP growth	-1.416	-1.070
China's GDP growth	1.673	1.540
Log Trade Balance	5.550	1.690
Log Trade Openness	13.930	1.400
Log Real Effective Exchange Rate	45.360	1.470
Estimation properties		
R^2	0.058	
Rho	0.997	
N	29.000	

Note: the estimation uses a fixed-effect model.
Dependent variable is IIT. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Source: WITS, BKPM, and World Bank, calculation by STATA App

Bilateral between Indonesia and China

The second estimation is the relationship between FDI and IIT in the case of Indonesia and China. Nevertheless, due to many of the missing data, we drop some industries and periods to better estimate results. We only employ five industries and seven years period from 2012 until 2018. Our limitation here is that we only have a small sample size in this estimation. In the case of Indonesia and China, FDI in four industries, namely food industry, paper, paper-based goods and printing industry, chemical and pharmaceutical industry, and metal, except machinery, and equipment industry, have a positive linkage and statistically significant on the IIT (see Table 3). Here we know that FDI in the labour-intensive, resource-intensive industry and technology-intensive industry correlates with the bilateral IIT between Indonesia and China. We can interpret, for instance, when FDI from China in the metal, except machinery, and equipment industry increases, then bilateral IIT between Indonesia and China will increase too. This result also corresponds with Rahmaddi & Ichihashi (2013) study. Indonesia's FDI in metal, except machinery, and equipment industry positively link with Indonesia's export in this industry. The bilateral IIT between Indonesia and each Japan and China shares the similarity of the trade pattern, which is in the paper, paper-based goods, and printing industry. The FDI from those two home countries in the paper, paper-based goods, and printing industry positively and significantly correlates with bilateral IIT.

Indonesia and ASEAN-9

We incorporate ASEAN-9 as one region, including Brunei Darussalam, Cambodia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. There are some missing data in the case of Indonesia and ASEAN-9; consequently, we decide to drop several industries and period. We utilize six industries and 16 years period from 2003 to 2018.

Based on Table 4, we can see that FDI in two industries positively and significantly correlates with IIT between Indonesia and ASEAN-9, namely the textile industry and metal, except machinery and equipment industry. Especially in metal, except machinery, and equipment industry, this result is also consistent with Rahmaddi & Ichihashi (2013) result. Indonesia's FDI in metal, except machinery, and equipment industry positively associate with Indonesia's export in this industry. The similarity between IIT of Indonesia and each Japan and

Table 4. FDI and IIT between Indonesia and ASEAN-9

Variable	Coefficient	t-statistic
Constant (α_0)	**5.725***	3.810
Log FDI lag 1 (β_1)	**-0.110****	-2.090
γ_1	-0.101	-1.260
γ_2	**0.239****	3.740
γ_3	**0.098***	1.740
γ_4	0.016	0.260
γ_5	**0.159****	2.310
Food Industry ($\beta_1+\gamma_1$)	-0.211	
Textile Industry ($\beta_1+\gamma_2$)	0.129	
Paper, Paper Based Goods and Printing Industry ($\beta_1+\gamma_3$)	-0.012	
Chemical and Pharmaceutical Industry ($\beta_1+\gamma_4$)	-0.094	
Metal, Except Machinery, and Equipment Industry ($\beta_1+\gamma_5$)	0.050	
Vehicle and Other Transportation Industry (β_1)	-0.110	
Indonesia's GDP growth	**0.153***	3.510
Average Asean's GDP growth	**-0.024***	-1.750
Log Average Trade Balance	-0.384	-1.250
Log Average Trade Openness	-0.495	-1.130
Log Real Effective Exchange Rate	**-2.728***	-3.810
Dcrisis	**-0.088****	-2.040
Estimation properties		
R^2	0.005	
Rho	0.988	
N	89.000	

Note: the estimation uses a fixed-effect model.
Dependent variable is IIT. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Source: WITS, BKPM, and World Bank, calculation by STATA App

ASEAN-9 are in the textile Industry. The FDI in the textile Industry from home countries, namely Japan and ASEAN-9, has a positive linkage with the IIT between Indonesia and those trade partners. Additionally, there is also a similarity of Indonesia's IIT pattern and each trading partner, namely China and ASEAN-9, in the metal, except machinery, and equipment industry. The FDI from this Industry has a positive and significant correlation with IIT between Indonesia and its trading partner, China and ASEAN-9.

In contrast, the FDI in a paper, paper-based goods and printing industry, vehicle, and other transportation industry fails to correlate with IIT positively. It means, when there is FDI in those two industries, it will reduce IIT or cannot trigger IIT. We believe in the case of the vehicle and other transportation industry, although the trade in this industry is high between Indonesia and ASEAN-9, the FDI inflow of this Industry from ASEAN-9 is not considered high. Usually, the FDI in technology-intensive industries, such as vehicles and other transportation industries, comes from developed countries. As ASEAN-9 countries are mostly developing countries, we believe that the FDI inflow from ASEAN-9 in the vehicle and other transportation industry is not much so that it cannot positively associate with IIT. The FDI in the paper, paper-based goods and printing industry also has a negative

Table 5. FDI and Bilateral IIT between Indonesia and Singapore

Variable	Coefficient	t-statistic
Constant (α_1)	**3.769****	2.550
Log FDI lag 1 (β_1)	**-0.155****	-2.20
γ_1	0.118	1.240
γ_2	**0.437*****	4.220
γ_3	**0.197****	2.110
γ_4	**0.236****	2.220
γ_5	**0.151***	1.860
γ_6	0.079	0.880
γ_7	0.108	1.030
γ_8	**0.215*****	2.730
γ_9	**0.252*****	2.840
γ_{10}	0.058	0.310
γ_{11}	0.180*	1.790
Food Industry ($\beta_1+\gamma_1$)	-0.037	
Textile Industry ($\beta_1+\gamma_2$)	0.282	
Leather Goods and Footwear Industry ($\beta_1+\gamma_3$)	0.042	
Wood Industry ($\beta_1+\gamma_4$)	0.081	
Paper, Paper Based Goods and Printing Industry ($\beta_1+\gamma_5$)	-0.005	
Chemical and Pharmaceutical Industry ($\beta_1+\gamma_6$)	-0.077	
Rubber, Rubber and Plastic Based Goods Industry ($\beta_1+\gamma_7$)	-0.047	
Non-Metallic Mineral Industry ($\beta_1+\gamma_8$)	0.060	
Metal, Except Machinery, and Equipment Industry ($\beta_1+\gamma_9$)	0.097	
Metal, Machinery, Electronic Medical instrument, Precision, Optical, and Watch Industry ($\beta_1+\gamma_{10}$)	-0.097	
Vehicle and Other Transportation Industry ($\beta_1+\gamma_{11}$)	0.025	
Other industry (β_1)	-0.155	
Indonesia's GDP growth	0.031	0.560
Singapore's GDP growth	0.008	0.980
Log Trade Balance	**0.126***	1.960
Log Trade Openness	0.298	1.590
Log Real Effective Exchange Rate	-1.033	-1.380
Dcrisis	0.007	0.100
Dep	0.076	0.910
Estimation properties		
R^2	0.019	
Rho	0.949	
N	179.000	

Note: the estimation uses a fixed-effect model.
Dependent variable is IIT. * p < 0.1; ** p < 0.05; *** p < 0.01.
Source: WITS, BKPM, and World Bank, calculation by STATA App

association and statistically significant to the IIT. If we consider the trade pattern between Indonesia and ASEAN-9, we may identify that this industry is not in the top or leading industries with high export and import value. The FDI from ASEAN-9 in this Industry is also not included in the top five industries. Accordingly, we think that the low value of FDI inflow in the paper industry will offset IIT's value. The other explanatory variables which have a significant linkage with IIT are the real effective exchange rate, average ASEAN's GDP growth, and dummy economic crisis. Those variables display a negative coefficient. The higher value of real effective exchange rate, average ASEAN's GDP growth, and the existence of a crisis in 2007-2008 may diminish the IIT between Indonesia and ASEAN-9. This results links with the research's result by Yong et al. (2015), in which the global financial crisis impacts IIT (in the case of Malaysia and China) (began in 2008). On the other hand, Indonesia's GDP growth shows a positive and significant association with IIT, which means that the IIT will grow when Indonesia's GDP growth increases.

After estimating ASEAN-9 as one region, we also attempt to estimate Singapore separately. We intend to recognize the relationship between FDI and IIT between Indonesia and Singapore outside ASEAN-9 because FDI from Singapore has the highest share in Indonesia, especially in 2018 (Figure 3). Moreover, Singapore also has different characteristics compared to other ASEAN countries; thus, we think it is essential to estimate the Singapore case as well. In this case, we incorporate all 12 industries and 19-year period.

Table 5 shows that FDI in the textile industry, leather goods and footwear industry, wood industry, non-metallic mineral industry, metal, except machinery, and equipment industry, and vehicle and other transportation industry positively and significantly associate with IIT between Indonesia and Singapore. It means, for instance, when FDI from Singapore in the textile industries rises, then the bilateral IIT between Indonesia and Singapore will also rise. This result is in line with Rahmaddi & Ichihashi (2013) research. The FDI in four industries, namely leather goods and footwear industry, non-metallic mineral industry, metal, except machinery, and equipment industry, and vehicle and other transportation industry have a positive correlation with Indonesia's export in those industries. In contrast, the FDI of the manufacturing sector, specifically in the paper, paper-based goods and printing industry and other industry, has a negative linkage with IIT. It means, when FDI in those two industries increases, the IIT will be lower. Based on data, the FDI in the paper, paper-based goods and printing industry from Singapore in Indonesia

are considerably high. However, the trade in this Industry between Indonesia and Singapore is low. Thus, the FDI in the paper, paper-based goods and printing industry has a negative linkage with IIT between Indonesia and Singapore. Comparing this result with the ASEAN-9 result has a similar result in the textile industry and metal, except machinery, and equipment industry. FDI in both industries has a positive relationship with IIT in the case of bilateral between Indonesia and ASEAN-9 and Indonesia and Singapore. The FDI in the paper, paper-based goods and printing industry also shows a similar result which has a negative correlation. On the other hand, FDI in the vehicle and other transportation industry displays a different result. In the case of Indonesia and ASEAN-9, FDI in the vehicle and other transportation industry has a negative association with IIT. In contrast, in the case of Indonesia and Singapore, this industry displays a positive relationship with IIT. The potential reason is that the trade between Indonesia and Singapore in the vehicle and other transportation industry is high. Also, the FDI from Singapore in this industry, although it is not the top five FDI from Singapore, the value is not low. Probably this FDI or MNEs is not originated from Singapore. However, it is still counted as FDI from Singapore since those MNEs also invest in Indonesia in Singapore companies' name. Accordingly, the FDI from this industry has a positive correlation with IIT with Singapore. The other explanatory variable which has a positive and significant association with IIT is the trade balance. Accordingly, when the value of the trade balance rises, the bilateral IIT between Indonesia and Singapore will also increase.

CONCLUSION

This study finds that some FDI in specific industries has a positive linkage with IIT between Indonesia and its trade partners. First, in the case of bilateral between Indonesia and Japan, there are four FDI in specific industries that have a positive correlation with IIT. The FDI is mostly in the labor-intensive and resource-intensive industry, namely FDI in the textile industry, wood industry, and paper, paper-based goods, and printing industry. Moreover, FDI in the vehicle and other transportation industry, which is in the technology-intensive industry, also has a positive linkage with IIT. Second, in the case of bilateral between Indonesia and China, FDI both in the labor-intensive and resource-intensive industry, as well as technology-intensive industry associates with IIT. Those industries are the food industry, paper, paper-based goods, and printing industry, chemical and pharmaceutical industry, and metal, except machinery, and equipment industry. Third, in the case

of Indonesia and ASEAN-9, FDI in the textile industry and metal, except machinery, and equipment has a positive linkage with IIT. Moreover, in the case of Indonesia and Singapore (separate from ASEAN), the result of Singapore and ASEAN-9 is similar, especially in the FDI in the textile industry and metal, except machinery, and equipment industry, which shows positive and significant association with IIT. The FDI in other specific industries that positively correlate with IIT is leather goods and footwear industry, wood industry, and non-metallic mineral industry. Unlike the outcome of FDI in the vehicle and other transportation industry, which negatively associates with IIT between Indonesia and ASEAN-9, FDI from Singapore in the vehicle and other transportation industry gives positive and significant linkage with IIT between Indonesia and Singapore.

Overall, foreign investment in Indonesia shows an increasing trend over the year. This share of FDI is expected can encourage IIT in Indonesia. Foreign companies, which are mainly export-oriented, are believed can expand economies of scale and varieties of products such that Indonesia can engage more in the global networks. IIT can show trade integration between countries. We believe that FDI in Indonesia from other countries can improve IIT. This study concludes that not all FDI in the specific industry has a positive relationship with IIT. We have mixed evidence that some FDI from labor-intensive, resource-intensive industry, and technology-intensive industry can positively associate with Indonesia bilateral IIT with each trading partner, and some FDI also does not correlate with IIT. Therefore, it is necessary to attract and encourage more multinational companies in Indonesia to maximize their potential in transferring their technology and management in Indonesia, especially FDI in industries which have not shown a positive correlation with IIT. Then, we hope that FDI can improve the scale of its production and export capacity.

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