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Economic Interdependence of Indonesia in Global Value Chain: An Analysis of Multiregional Input-Output

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Abstract

Indonesia's resilience to economic crises originating from the outside was due to the high domestic consumption as the main support for the economy. On the other hand, Indonesia does not have a significant role in the global value chain because of the low amount of export value and low product competitiveness. Using Multiregional Input-Output (MRIO) analysis, this study aims to map the interdependence and role of Indonesia in trade relations with major partner countries and see the magnitude of the economic influence of other countries on the domestic economy. The data used is the 35 economic sector MRIO tables issued by the Asian Development Bank in 2008 and 2018 consisting of 63 countries. The results indicate that Indonesia has low linkages in international trade with major partners. In addition, most of Indonesia's export commodities are intermediate goods that have low value-added. Furthermore, the simulation conducted in the study outlines that Indonesia is increasingly unaffected by the GDP changes of trading partner countries.

Key words : Multiregional Input-Output, forward lingages, backward linkages, value-added.

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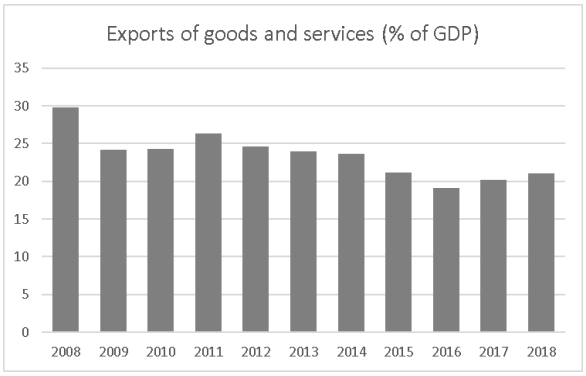
INTRODUCTION

The open economy tends to drive interdependencies among countries, as the use and flow of goods and services among countries increases. The dependence of a country on other countries is a condition where their domestic economy is influenced by the development of other countries' economies so that if a trading partner country experiences a crisis or economic downturn, it will have an impact on the countries that are under its influence and vice versa (Digdowiseiso, 2019). The economic downturn occurring in the other countries can have a direct or indirect effect on the domestic economy of their trade partners.

The impact of a country's economic slowdown on other countries occurred during the global financial crisis in mid-2007 and early 2009, starting from the United States, then spreading to almost all over the world. The impact experienced by Indonesia at the time was a downturn in the economic growth, only reaching 4.6%, compared to the previous economic growth which was more than 6%. In addition, the value of Indonesia's exports in 2009 decreased by 14.98% compared to the same period in 2008 (BPS, 2020). Nevertheless, Indonesia's success in recording positive economic growth has made Indonesia experience the relatively lightest impact compared to the neighboring countries in Asia. Sugema (2012), mentioned Indonesia's survival from the global financial crisis at the time was due to the low ratio of exports to GDP so the decline in the value of exports did not put too much pressure on the economy.

The same thing happened in 2018 when there was a global economic shock due to the trade war between the United States and China. The Indonesian economy was still able to grow by 5.02%, or only decreased by 0.15% from the previous year (BPS, 2020). This was again caused by the low ratio of Indonesia's exports to GDP and high domestic consumption as the main pillar of the economy (see Figure 1).



Source: Worldbank, 2021

Figure 1. The Export of Goods and Services of Indonesia (% of GDP)

The high ratio of domestic consumption to the economy can help Indonesia survive the crisis that comes from outside, but on the other hand, it will backfire when the global economy experiences growth. Indonesia will not be able to take full advantage of this opportunity because of the small portion of exports in the global market (Pradana, 2013). This situation also indicates that Indonesia does not have a significant role in the global value chain due to the low export value and weak product competitiveness (Ministry of Trade [*Kementerian Perdagangan*], 2015). Currently, Indonesia's exports are still dominated by natural resource-based products with low added value, which are vulnerable to the volatility of world commodity prices (Ministry of Trade [*Kementerian Keuangan*], 2019).

This research aims to evaluate the interrelationships and role of Indonesia in the global value chain with main partner countries in 2008 and 2018. The years 2008 and 2018 were chosen to compare and see the shift in Indonesia's economic structure with major trading partner countries in two conditions of global economic slowdown.

Applying the Multiregional Input-Output (MRIO) model, this study attempts to explain the forward and backward linkages between

Indonesia and major trading partner countries to identify the leading sectors of Indonesian products. This study also outlines the impact of final demand towards value-added to identify Indonesian products that have the highest value-added in the economy. Finally, this study also explains the impact of changes in the main trading partner's GDP on Indonesia's GDP.

The multi-regional input-output analysis model is known as a comprehensive method in seeing the interrelationships between a country's economy and other countries (Masli & Rusmalia, 2015). This model has been widely used by previous researchers to analyze economic linkages between sector or regions.

Zuhdi (2015), analyzed the impacts of final demand changes on the total outputs of Japanese energy sectors using IO analysis. Using the same analytical model, Prasetyo & Ariutama (2021), calculated the impact of government expenditure during the Asian Games 2018 on the Indonesian economy. While Kecek et al. (2021), have analyzed the economic effects of transport sectors on the Croatian economy.

In multi-regional scope, Ibrahim et al. (2014), attempted to describe the trade structure of Asian countries in 2010. Muchdie (2019), has analyzed the spatial linkages on calculations of spill-over and feedback effects of world input-output tables, which were aggregated specifically into six-Asian countries. Whereas Mandras & Salotti (2020), analyzed the sectoral specialization and trade integration of the Western Balkans Economies.

In addition, Dietzenbacher & Temurshoev (2012), address the question of whether the results of IO impact analysis differ when a framework in current prices or constant prices is used. While Bess & Ambargis (2011), explained how to use multipliers correctly using Regional Input-Output Modeling System (RIMS).

The majority of previous studies only examined international trade in certain sectors and the countries used as research objects are limited to bilateral and regional scopes. Research that aims to evaluate Indonesia's linkages and role in trade value chains with major partner countries is still very limited. In addition, most of the MRIO data used in previous studies are not up to date in 2021. This study uses MRIO data released by the Asian Development Bank (ADB) in 2021. The use of the latest data will better describe the current condition and structure of the economy.

Classical international trade theory was presented by Adam Smith through the theory of absolute advantage. When a country has better efficiency (absolute advantage) than other countries in producing a certain commodity but has limitations in producing a second commodity, then the country can exchange results with other countries that have an absolute advantage in producing the second commodity. The situation generates mutual benefits, and the yield of both commodities will increase (Salvatore, 2014).

In addition, international trade also brings advantages to less efficient countries in producing commodities due to the concept of comparative advantage. According to Ricardo & Salvatore (2014), even though a country has absolute losses or is less efficient than other countries in producing a commodity, the country can still trade with its trading partners that benefit both parties. To be able to do this, the country should export products that have smaller absolute losses and import products that have larger absolute losses. This theory explains that international trade can occur because of differences in the productivity of labor. In this theory, there is no explanation about the causes of differences in factors of production between countries.

Porter (1990), argued that in international trade, there is no direct correlation

between the factors of production of abundant natural resources and the factors of production of cheap human resources. Many countries in the world have very limited natural resources yet have strong competitiveness in international trade, and vice versa. The success of a country in international trade is determined by the country's relative competitive advantage against competitors in the market. In other words, the industry's capacity to innovate in creating superior products and its ability to continuously make innovations are the keys. In addition, the synergy between government and a country's industry to improve product competitiveness plays an important role in encouraging success in the international world. (Fiscal Policy Agency [*Badan Kebijakan Fiskal*], 2014)

RESEARCH METHODS

The Input-Output (IO) table is a statistical description in the form of a matrix that presents information on transactions of goods and services as well as the interrelationships between units of economic activity (sectors) in a region, at a certain period (BPS, 2021a). This model was developed by Professor Wassily Leontief in the late 1930s, in recognition of which he received the Nobel Prize in Economic Science in 1973 (Miller & Blair, 2009).

The presentation of the IO table is a matrix, where each row shows how the output of a sector is allocated for intermediate and final demand, while each column shows the use of intermediate and primary inputs by a sector in its production process. The Multiregional Input-Output (MRIO) model is a developed version of the basic Input-Output model. The difference between MRIO and the basic Input-Output model is that MRIO describes the flow of goods and services from each sector from one region to other sectors, both within the region and in another region (multi-regional).

Table 1. The Structure of MRIO

		Demand Structure								Total Output
		Region A(^{a})			Region B(^{b})			A	B	
		Intermediate Demand			Intermediate Demand			Final Demand (F)		
Sector		1	2	3	1	2	3	F^{a}	F^{b}	X
Region A (^{a})	1	z_{11}^{aa}	z_{12}^{aa}	z_{13}^{aa}	z_{11}^{ab}	z_{12}^{ab}	z_{13}^{ab}	F_1^{aa}	F_1^{ab}	X_1^a
	2	z_{21}^{aa}	z_{22}^{aa}	z_{23}^{aa}	z_{21}^{ab}	z_{22}^{ab}	z_{23}^{ab}	F_2^{aa}	F_2^{ab}	X_2^a
	3	z_{31}^{aa}	z_{32}^{aa}	z_{33}^{aa}	z_{31}^{ab}	z_{32}^{ab}	z_{33}^{ab}	F_3^{aa}	F_3^{ab}	X_3^a
Region B (^{b})	1	z_{11}^{ba}	z_{12}^{ba}	z_{13}^{ba}	z_{11}^{bb}	z_{12}^{bb}	z_{13}^{bb}	F_1^{ba}	F_1^{bb}	X_1^b
	2	z_{21}^{ba}	z_{22}^{ba}	z_{23}^{ba}	z_{21}^{bb}	z_{22}^{bb}	z_{23}^{bb}	F_2^{ba}	F_2^{bb}	X_2^b
	3	z_{31}^{ba}	z_{32}^{ba}	z_{33}^{ba}	z_{31}^{bb}	z_{32}^{bb}	z_{33}^{bb}	F_3^{ba}	F_3^{bb}	X_3^b
Primary Input		....	....	....	....	....	....			
Value Added		....	....	....	....	....	....			
Total Input		X_1^a	X_2^a	X_3^a	X_1^b	X_2^b	X_3^b			

Sources: Processed from Kuboniwa (2015)

Table 1 can be denoted into the form of a matrix as follows:

Intermediate input matrix =

$$z_{ij} = \begin{bmatrix} z_{11}^{aa} & z_{12}^{aa} & z_{13}^{aa} & z_{11}^{ab} & z_{12}^{ab} & z_{13}^{ab} \\ z_{21}^{aa} & z_{22}^{aa} & z_{23}^{aa} & z_{21}^{ab} & z_{22}^{ab} & z_{23}^{ab} \\ z_{31}^{aa} & z_{32}^{aa} & z_{33}^{aa} & z_{31}^{ab} & z_{32}^{ab} & z_{33}^{ab} \\ z_{11}^{ba} & z_{12}^{ba} & z_{13}^{ba} & z_{11}^{bb} & z_{12}^{bb} & z_{13}^{bb} \\ z_{21}^{ba} & z_{22}^{ba} & z_{23}^{ba} & z_{21}^{bb} & z_{22}^{bb} & z_{23}^{bb} \\ z_{31}^{ba} & z_{32}^{ba} & z_{33}^{ba} & z_{31}^{bb} & z_{32}^{bb} & z_{33}^{bb} \end{bmatrix} \quad (1)$$

Final Demand Matrix =

$$Fi = \begin{bmatrix} F_1^{aa} & F_1^{ab} \\ F_2^{aa} & F_2^{ab} \\ F_3^{aa} & F_3^{ab} \\ F_1^{ba} & F_1^{bb} \\ F_2^{ba} & F_2^{bb} \\ F_3^{ba} & F_3^{bb} \end{bmatrix} \quad (2)$$

Total Output = Total Input =

$$Xi = \sum_{j=1}^{i} z_{ij} + Fi \quad (3)$$

Assuming that all inputs are proportionally used (fixed) to generate output values, the stream of goods and services between economic sectors can be transformed into the following equation.

$$a_{ij} = Z_{ij} / X_i \quad (4)$$

Where a_{ij} is referred to as input coefficient. It is a basic equation that can be used to perform some analysis to answer the research purpose. Furthermore, by using mathematical manipulations, it will get a system of equations that can be written as:

$X = (I - A)^{-1}F$ (5)

Notation $(I - A)^{-1}$ is Leontief's inverse matrix which explains how the production increase of a sector will affect the economies of other sectors. I is the identity matrix and A is referred to as the technical coefficient matrix that explains the input requirements per unit of output for each commodity (Miller & Blair, 2009).

Backward linkage (BL) is an interconnectedness of an economic sector to other economic sectors from which its intermediate inputs for the production process are purchased (demand perspective). BL also shows the ability of an economic sector to increase the growth of other economic sectors through the amount of purchase (Asian Development Bank, 2020).

Forward linkage (FL) is the opposite of BL explaining the interconnectedness of an economic sector to the other economic sectors that purchase its output to use as inputs to their production (supply perspective). It shows the ability of an economic sector to encourage the growth of other economic sectors through the amount of intermediate output produced (Asian Development Bank, 2020).

Sahara (2017), explains that BL and FL coefficients can be calculated using this equation:

$$BL = \frac{n \sum_{i=1}^{n} \alpha_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_{ij}} \quad (6)$$

$$FL = \frac{n \sum_{j=1}^{n} \alpha_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_{ij}} \quad (7)$$

Where BL is referred to the Backward linkages coefficient for each economic sector, FL is referred to the Forward linkages coefficient for each economic sector, n is the sum of all economic sectors and aij is input coefficient. The interpretation of calculations numbers 6 and 7 can be classified into 4 quadrants which show the strength of the interconnectedness for each economic sector (see Table 2).

Table 2. Classification of Backward and Forward Linkage Results

		Forward Linkages	
		Low (<1)	High (>1)
Backward Linkages	***High*** (>1)	2. *Dependent on Interindustry Demand*	4. *Generally Dependent*
	Low (<1)	1. *Generally Independent*	3. *Dependent on Interindustry Supply*

Sources: Miller & Blair (2009)

Comparisons of the strengths of BL and FL coefficients for the sectors in a single economy provide one mechanism for identifying "key" or "leading" sectors in that economy. Those sectors are the most connected and therefore it is considered the most important sector that has the strong ability to encourage the growth of all other economic sectors. The key or leading sector is the economic sector located in quadrant 4 with BL and FL coefficients of more than 1.

The impact of final demand on value-added is used to determine the economic sector that contributes the most to the formation of value-added. This analysis aims to assess how significant the role of final demand is in increasing the value-added of Indonesian products both domestically and internationally.

Pula & Peltonen (2011), explains that the impact of final demand increase on value-added change can be calculated by the following equation:

$\Delta VA = \hat{y} (I - A)^{-1} \Delta F$ (8)

Where ΔVA is the value-added changes in the economy, $\hat{y}$ is the value-added coefficient diagonal matrix (quotient between value-added and total input for each sector), (I-A)-1 is the Leontief inverse matrix and ΔF represents the final-demand changes.

The calculation results by row show the effect of each component of final demand on the

value-added creation of a sector. The number of rows is the total value-added for each economic sector.

Miller & Blair (2009), also explained the use of the Leontief inverse matrix as a basis for simulating the impact of an economic variable change on other economic variables in the input-output table. To simulate the impact of the main partner countries' GDP changes on the Indonesian GDP, first, we need to calculate the GDP of each economic sector in each country, and then add together to calculate the total GDP of each country. Thus, the formula for calculating the impact of the main partner countries GDP changes on the Indonesian GDP can be written as:

$$\Delta GDPi = (I - A)^{-1} \Delta GDPc \quad (9)$$

Where ΔGDPi is the changes of Indonesian GDP, (I-A)-1 is the Leontief inverse matrix and ΔGDPc represents the main partner countries GDP changes (shock).

The data used in this study is secondary data, specifically 2008 and 2018 Multiregional Input-Output (MRIO) tables released by Asian Development Bank (ADB) which were accessed on 30 June 2021 based on current prices and 2010 constant prices. The ADB MRIO table presents input and output data for 63 countries and the Rest of the World with a total of 35 industrial sectors that can be aggregated into 5 categories. (Table 3)

Table 3. Detail Sector in ADB MRIO

Category	Code	Sector
Primary	c1	Agriculture, hunting, forestry, and fishing
	c2	Mining and quarrying
Low Tech Manufacturing	c3	Food, beverages, and tobacco
	c4	Textiles and textile products
	c5	Leather, leather products, and footwear
	c6	Wood and products of wood and cork
	c7	Pulp, paper, paper products, printing, and publishing
	c10	Rubber and plastics
	c16	Manufacturing, NEC; recycling
	c17	Electricity, gas, and water supply
	c18	Construction
High and Medium Tech Manufacturing	c8	Coke, refined petroleum, and nuclear fuel
	c9	Chemicals and chemical products
	c11	Other nonmetallic minerals
	c12	Basic metals and fabricated metal
	c13	Machinery, NEC
	c14	Electrical and optical equipment
	c15	Transport equipment
Business Services	c19	Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel
	c20	Wholesale trade and commission trade, except motor vehicles and motorcycles
	c21	Retail trade, except motor vehicles and motorcycles; repair of household goods
	c22	Hotels and restaurants
	c23	Inland transport
	c24	Water transport
	c25	Air transport
	c26	Other supporting and auxiliary transport activities; activities of travel agencies
	c27	Post and telecommunications
	c28	Financial intermediation
	c29	Real estate activities
	c30	Renting of M&Eq and other business activities
Public and Welfare Services	c31	Public administration and defense; compulsory social security
	c32	Education
	c33	Health and social work
	c34	Other community, social, and personal services
	c35	Private households with employed persons

Source: Asian Development Bank (2020)

The object of this research is 10 major Indonesia's trading partner countries which include: China, Japan, Singapore, the European Union, the United States of America, India, South Korea, Malaysia, Thailand, and Australia. The other countries are included in the "Rest of World" (RoW) in the calculation. The main

trading partner countries were selected based on the scope of Indonesia's international trade volume reaching 77.62% of the total international trade carried out by Indonesia in 2018 (BPS, 2020a). Indonesia's trade with major trading partners is expected to provide a comprehensive view of Indonesia's role in global value chains.

RESULTS AND DISCUSSION

The magnitude of backward and forward linkages coefficients is an important indicator in analyzing intra-industry relationships. When the amount of output sector increases, it will provide more output to other sectors so that the other sectors also experience an additional number of outputs. Through forward linkage analysis, the coefficient displays the ability of a sector to encourage the growth of other sectors. Meanwhile, through backward linkage analysis, the coefficient indicates the ability of a sector to improve the growth of other sectors through the number of demands (inputs).

These coefficients are relevant in explaining a country's participation in global value chains (Ministry of Trade [*Kementerian Perdagangan*], 2015). In the context of MRIO analysis, where the analyzed trade relations cover sectors both domestically and between countries, the distribution coefficient of each sector can be accumulated in aggregate for each analyzed country.

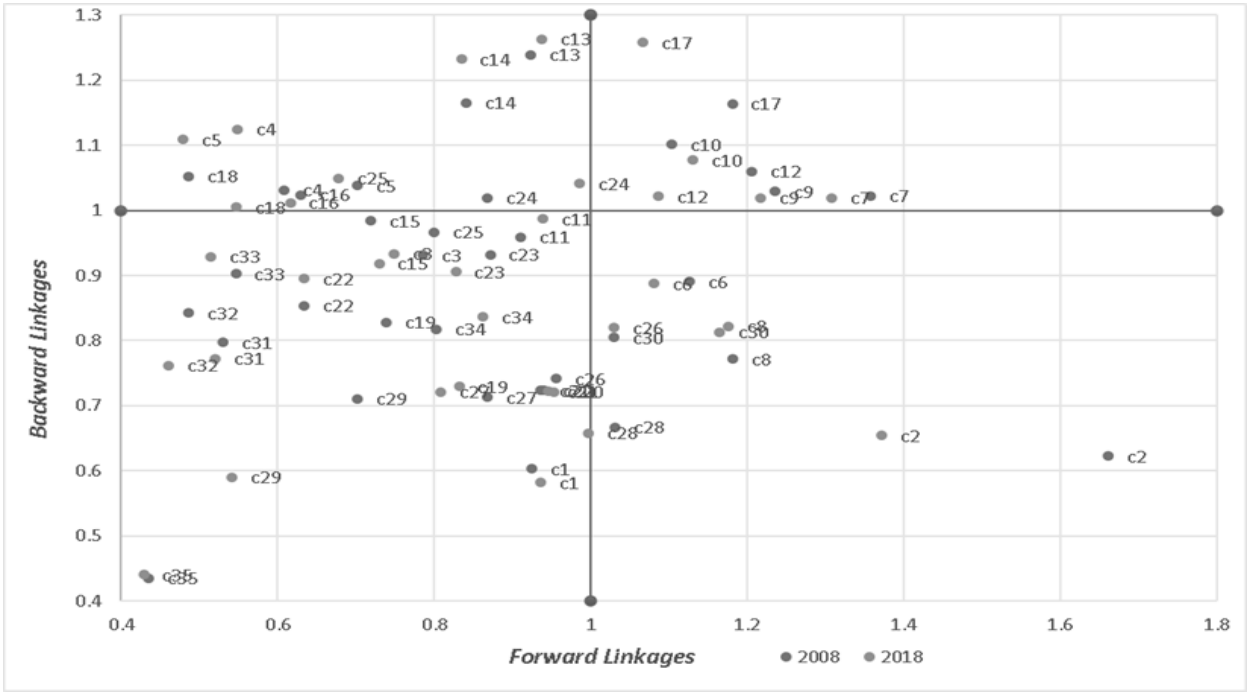
Table 4. Aggregate Forward Linkages (Current Prices)

Country	2008	2018	Intermediate Output Distribution	2008 (%)	2018 (%)
China	1.18	1.26	Domestic	80.41	84.03
Malaysia	1.06	1.13	China	2.86	3.43
S. Korea	1.08	1.07	EU	2.22	1.64
Singapore	0.97	1.04	Japan	3.53	1.11
Thailand	1.10	1.03	USA	1.32	0.95
Australia	1.03	1.01	India	0.43	0.88
Japan	1.03	1.00	S. Korea	1.36	0.72
EU	0.93	0.95	Malaysia	0.44	0.54
USA	0.88	0.86	Singapore	0.67	0.52
Indonesia	0.88	0.86	Thailand	0.53	0.34
India	0.89	0.83	Australia	0.66	0.28
RoW	0.97	0.96	RoW	5.57	5.56

Source: Processed data

Indonesia's backward linkages coefficient occupies the second-lowest position with a value of 0.89 in 2008 and rose to 0.90 in 2018. This figure shows that Indonesia has a low linkage to output produced by other countries, because more than 80% of inputs used in the production process come from within the country itself, while the rest comes from imports. China is one of the major trading partner countries that have strong links as a supplier of intermediate goods inputs for production activities in Indonesia with a share of 3.81% in 2018, followed by the European Union and the United States. Japan became a country with a significant decrease in both the forward linkages and backward linkages coefficients in 2018 compared to 2008.

Figure 2 shows the plotting of 35 sectors based on the coefficients of forward linkages and backward linkages. Most of the industrial sectors in Indonesia still have forward and backward linkages coefficients of less than 1, consisting of 18 sectors (51%) in 2008 and 17 sectors (49%) in 2018. Many of those are included in the business service and public services category as well as several categories of medium and high-tech manufacturing sectors such as other non-metallic minerals (c11) and transportation equipment (c15) sectors.



Source: Processed data

Figure 2. Indonesian Economic Sector Plotting Based on FL and BL

The mining and quarrying sector's (c2) forward linkages coefficient was 1.67 in 2008 and 1.37 in 2018. However, the backward linkages coefficient was quite low, only 0.62 in 2008 and 0.65 in 2018. This figure shows that the mining and quarrying sector can encourage the growth of other sectors through their outputs, but they are weak in absorbing inputs from other sectors. In Indonesia, the outputs produced by this sector mostly are still in the form of raw materials, which need to be reprocessed by the downstream industry (which has low value-added). Nevertheless, it contributes as the second-largest sector (10.8%) producing intermediate goods output in Indonesia.

At the opposite position, the machinery (c13) and the electrical & optical equipment sectors (c14) are at a low position on forward linkages but high on backward linkages. The strong ability to absorb output from other sectors and produce final demand with high value-added is expected from these two sectors, considering they are included in the category of medium and high-tech manufacturing.

The plotting results also indicate that there are 5 sectors in the manufacturing category that become the leading sectors of Indonesian products in 2008 and 2018 with forward and backward linkages coefficients of more than 1. The leading sectors include pulp, paper, paper products, printing and publishing sectors (c7); chemicals and chemical products sector (c9); rubber and plastic sector (c10); base metal and fabricated metal sector (c12); and the electricity, gas and water supply sector (c17).

Most of the leading sectors experienced a decrease in the coefficient of both forward linkages and backward linkages in 2018 compared to 2008. Although the decline was not too significant, it indicates that Indonesia's economic structure did not strengthen in 2018. The leading sector is a sector that is expected to encourage growth and strengthen the economic structure in both the upstream and downstream industries. Therefore, the policymakers must pay more attention to encourage and maintain the growth of these sectors, especially in the sectors that are included in the category of medium and high

technology manufacturing as a better contributor to the formation of value-added.

The previous analysis and discussion about forward and backward linkages only illustrate the flow of intermediate goods. In the next discussion, an analysis will be carried out on how big the role of final demand is in increasing the added value (value-added) of Indonesian products both domestically and internationally. The purpose of this analysis is to evaluate Indonesia's export performance and contribution in the global value-added formation, especially those produced by final demand products, then map out the market reach for final demand products produced by Indonesia.

Table 7. Impact of Final Demand on Value-Added (2010 Constant Price)

Country	2008 (Bil US$)	2018 (Bil US$)	VA Contribution	2008 (%)	2018 (%)
EU	15,469	17,497	Dom	77.47	81.54
USA	15,218	17,068	EU	3.16	2.12
China	4,997	11,018	USA	2.83	2.10
Japan	5,608	6,406	China	2.09	2.00
India	1,411	2,885	Japan	3.93	1.69
Aus	1,194	1,415	India	0.62	1.26
S. Kor	931	1,194	S. Kor	1.06	0.70
Indo	691	1,123	Aus	0.64	0.46
Mal	241	405	Tha	0.52	0.32
Tha	301	379	Mal	0.25	0.29
Sin	196	297	Sin	0.30	0.25
RoW	14,704	18,569	RoW	7.14	7.25

Sources: Processed data

All countries experienced an increase in value-added resulting from final demand in 2018 compared to 2008. The European Union still ranks first with a significant increase in value in 2018, followed by the USA. The largest increase was made by China, which in 2018 increased almost 3 times compared to 2008. It shows that the industrial sectors in China are increasingly able to compete with European Union countries and the United States in producing high value-added products.

Indonesia occupies the first position in ASEAN as the country that produces the highest value-added final products with an almost 2-fold increase in 2018 from 2008. In 2008, Japan became the partner country that contributed to the formation of the most value-added product, with a portion of 3.93% of the total value-added produced by Indonesia. However, in 2018 there was a very significant decrease to only 1.69%. The shift in the portion was due to changes in the volume of trade between the two countries. Indonesia experienced a decline in the value of exports to Japan, originally 27.7 billion USD in 2008 to only 19.5 billion USD in 2018 (Badan Pusat Statistik, 2021). The decline in export value to Japan is estimated because of the factories' delocalization belonging to their multinational companies to areas where the sales targets are determined. This has resulted in the final demand of goods or services from Japanese companies being produced and consumed within Indonesia, without going through international trade (Ibrahim, 2014).

The calculation results also outline that Indonesia has an increasing dependence on domestic demand. In 2008 Indonesia's dependence on domestic demand was recorded at 77.47% and increased to 81.54% in 2018. It means that in 2018, every 100 Dollars of value-added formed from the output of final demand produced by Indonesia, as much as 81.54 Dollars came from domestic demand, while the remaining portion was the demand from trading partner countries (global value chain).

These results suggest that although the volume has increased, the portion of value-added from exports to the total value-added of final demand products produced by Indonesia is getting smaller. It also reveals that Indonesia's contribution to the global value chain decreases. As a comparison, in the same table, the portion of value-added formation of Thailand products due to final demand from abroad increased, from 30% in 2008 to 36% in 2018. Likewise, Singapore increased from 60% in 2008 to 62% in 2018. Meanwhile, Malaysia experienced a decrease in its share, as did Indonesia, from 56% in 2008 to 43% in 2018.

The next analysis is related to the impact of final demand on value-added formation at the sector level. This analysis aims to determine the main sectors that make the largest contribution to the formation of value-added.

Table 8. Value-Added Contribution (Sector Level) at Constant Price 2010 (Million US$)

Category	Sector Code	2008		2018	
		Domestic	Export	Domestic	Export
Medium and High-Tech Manufacturing	c8; c9; c11; c12; c13; c14; c15	91,235	17,162	128,246	23,377
Low-Tech Manufacturing	c3; c4; c5; c6; c7; c10; c16; c17; c18	157,723	63,485	257,120	72,163
Primary	c1; c2	169,665	28,489	240,371	41,622
Business Services	c19; c20; c21; c22; c23; c24; c25; c26; c27; c28; c29; c30	208,034	29,355	386,879	38,051
Public Services	c31; c32; c33; c34; c35	64,749	17,304	110,581	32,115

Source: Processed data

The output of final demand products with high value-added increased in 2018 compared to 2008. The largest value-added was contributed by sectors classified as business services for both domestic and exports demand. Meanwhile, in international trade, sectors contributing the highest value-added were sectors classified as low-tech manufacturing. The medium and high-tech manufacturing sectors did not contribute significantly to the formation of value-added through international trade.

In general, the contributor of value-added as presented in table 8 was dominated by the manufacturing category, both low-tech or medium and high-tech manufacturing. However, among these sectors, only the chemical and chemical products sector (c9) has strong backward and forward linkages and contributes the largest value-added from export products.

Table 9. Simulation of the Impact of a 1% Decrease in Partner Country's GDP on Indonesia's GDP.

No	Country	2008	2018
1.	China	-0.0383%	-0.0351%
2.	EU	-0.0371%	-0.0239%
3.	India	-0.0078%	-0.0186%
4.	Japan	-0.0659%	-0.0168%
5.	USA	-0.0242%	-0.0162%
6.	S. Korea	-0.0208%	-0.0085%
7.	Malaysia	-0.0052%	-0.0052%
8.	Singapore	-0.0057%	-0.0047%
9.	Australia	-0.0108%	-0.0038%
10.	Thailand	-0.0070%	-0.0036%
11.	RoW	-0.0964%	-0.0815%

Source: Processed data

The simulation presented in table 9 reveals that Indonesia is increasingly unaffected by the economic downturn in major trading partner countries. Japan, the country with the biggest impact on the Indonesian economy, experienced decreasing influence almost 5 times lower in 2018, at 0.0168%. This means that every 1 percent decrease in Japan's GDP will have a direct or indirect impact on Indonesia's GDP, which will also decrease by 0.0168%. This finding also strengthens the previous finding that Indonesia's industrial sectors have lower linkages with Japan in 2018.

In 2018, the country with the biggest influence or impact was China. For every 1% decrease in China's GDP, Indonesia's GDP will go down by 0.0351%. In comparison, in 2018 Malaysia experienced the largest impact (0.1405%) among partner countries due to a 1% decline in China's GDP. This means that Malaysia receives almost 5 times more impact than Indonesia. At that time, Malaysia's export portion of GDP was quite large, amounting to 69% (Worldbank, 2021). Meanwhile, in the same period, Indonesia's export portion was only 21%.

The next biggest influence comes from the European Union, India, and the United States. The thing that needs to be considered from the simulation is the magnitude of India's influence, where the impact is given had increased significantly. In 2008 for every 1% reduction in India's GDP, the impact felt by Indonesia was only 0.0078%. This figure increased rapidly in 2018 by 0.0186%, or an increase of more than 2 times. This is in line with previous findings, that India experienced the expansion of both forward and backward linkages with Indonesia and has increased its contribution to the formation of value-added for Indonesia.

From the findings in the study, it can be concluded that Indonesia is increasingly unaffected by economic changes that occur from the outside. This resilience has been proven at least in the crisis that occurred during 2007-2009 and also in the global economy weakening due to the trade war in 2018-2019. On the other hand, in 2018-2019 Indonesia could not maximize the potential for diversion of the trade carried out by the United States and China. Tariffs barrier on each other's products make both countries look for resources of supply for their domestic needs from other countries.

The research conducted by UNCTAD in 2019 showed that there were four countries that benefited the most from the trade diversion. The European Union, Mexico, Japan, and Canada experienced a total increase in export profits of more than US$ 130 billion. These countries have competitive products, strong trade relations and have the economic capacity to replace US and Chinese companies (UNCTAD, 2019).

Lack of trade relations and influence with the United States and China have made Indonesia fail to maximize these opportunities. This condition is one of the disadvantages of Indonesia's weak economic structure in relation to international trade. Indonesia should expand its trade portfolio and economic cooperation with many countries to increase its role in the global economy. The policies implemented need to be focused on encouraging industries that are the key sectors for increasing exports of value-added products.

One of the sectors that must be maintained and encouraged for its growth is the chemical and chemical products sector. This sector plays an important role in encouraging the growth of other sectors both at domestic and abroad, through the demand and supply of intermediate goods as well as its large contribution to the formation of value-added for exports of final demand goods. The other sectors that are included in manufacturing categories should continue to

be given attention because of their large contribution in the formation of value-added, so that those sectors are able to become the leading sectors and have strong competitiveness in the international world.

CONCLUSION

This research revealed that during the period from 2008 to 2018, there was no significant change in the relationship between Indonesia's economic sectors and major trading partner countries. In aggregate, Indonesia's forward linkages and backward linkages coefficients are still below the average for the entire economy. The output produced by Indonesia has low linkages in the trade value chain with major trading partner countries. Vice versa, Indonesia has a low linkage to the output (intermediate goods) produced by other countries, since more than 80% of the inputs exploited in the domestic production process come from within the country itself, while the rest comes from imports.

The plotting results indicate that there are only 5 sectors becoming the leading sectors of Indonesian products in 2008 and 2018. All of them are in the manufacturing/processing industry including the chemical and chemical products sector; rubber and plastic sector; base metal and fabricated metal sector; electricity, gas, and water supply sector; and the pulp, paper, paper products, printing and publishing sectors. These sectors play a crucial role in encouraging economic growth. In aggregate, final demand forms Indonesia's largest value-added in a sector dominated by the manufacturing industry. However, the largest value-added comes from within the country, and has an increasing share in 2018.

The simulation of the trading partners' influence demonstrates that during the period 2008 to 2018 Indonesia tended to be less affected by the economic downturn experienced by major trading partner countries. It is in line with Indonesia's low export share of GDP and the type of exports consisting of commodities with low value-added.

This research has several important implications for policymakers in Indonesia. The policies implemented need to be focused on encouraging the key sectors for increasing exports of value-added products, especially sectors that are included in the category of medium and high-tech manufacturing. In addition, other sectors must continue to be given attention so that they are able to develop and become the leading sectors and have international competitiveness. Furthermore, periodic reviews or evaluations must be carried out on the implementation of previous policies, so that improvements and adjustments can be made immediately to ensure the achievement of the targets previously announced.

The use of Multiregional Input-Output (MRIO) as an analytical model has some limitations. This analytical model is only carried out at a certain point in time, meaning that this study uses a static model. In addition, the input-output table does not include limited resources in production, meaning that inputs can be continuously increased without any constraints in the provision of resources, even though resources in this world are limited. Those limitations should be considered in order to conduct similar research in the future.

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