Global Economic Dynamics and Its Impact on Indonesian Trade: Multi-Regional Input-Output Analysis Approach

Annisa Muthi Zajidah[1], Dyah Widyastuti[2], Immanuel Nicholas Fransepta Samosir[3], Patrick Noel Simamora[4], Fitri Kartiasih[5]*

[1, 2, 3, 4, 5)] Politeknik Statistika STIS

*Corresponding author
Fitri Kartiasih
Email: fkartiasih@stis.ac.id

Abstrak

Penelitian ini menganalisis dampak dinamika ekonomi terhadap perdagangan internasional melalui analisis multiregional tabel Input-Output. Analisis yang digunakan yaitu analisis dampak pengganda untuk menganalisis dampak suatu sektor terhadap perekonomian domestik dan negara mitra, analisis keterkaitan melalui nilai forward linkage dan backward linkage untuk menentukan sektor-sektor yang unggul dalam aktivitas perdagangan internasional, serta simulasi dampak perekonomian negara mitra terhadap perekonomian Indonesia. Hasil menunjukkan bahwa Indonesia cenderung bergantung pada ekspor impor dari sektor manufaktur. Sektor kertas dan percetakan, sektor bahan kimia dan produk kimia, serta sektor manufaktur merupakan sektor unggulan dalam aktivitas perdagangan internasional. Selain itu, negara ASEAN cenderung memberikan dampak yang signifikan terhadap perekonomian Indonesia jika negara tersebut mengalami resesi ekonomi. Oleh karena itu, diperlukan diversifikasi ekonomi, stimulus konsumsi domestik, dan pembangunan ketahanan ekonomi.

Kata kunci: Ekonomi, multiregional, ekspor, impor, tabel input-output

Abstract

This study investigates the impact of economic dynamics on international trade using a multiregional analysis of Input-Output table. Multiplier effect analysis is used to study how a sector affects both the domestic economy and the economies of partner countries. Employing forward linkage and backward linkage values to analyze the linkages, determine which sectors are superior in international trade operations. The impact of partner countries' economies on Indonesia's economy is then simulated. The results show that Indonesia tends to rely on imports and exports connected to manufacturing. The manufacturing, chemical and chemical goods, and paper and printing industries are the main drivers of foreign trade. Furthermore, when Indonesia goes through a recession, the ASEAN nations typically have a big influence on the national economy. So economic diversification, domestic consumption stimulus, and building economic resilience are needed.

Keywords: Economy, multiregional, export, import, input-output table

INTRODUCTION

The year 2023 is one of the most challenging periods in global economic history. Many countries are experiencing economic recession as a result of the prolonged COVID-19 pandemic, political instability, and international trade tensions (Banerjee & Hofmann, 2022; Chen et al., 2020). This global health crisis has

affected supply chains, slowed down production activity, and reduced consumer demand significantly, causing global economic growth to decline drastically (Baldwin & Taglioni, 2021). The International Monetary Fund (IMF, 2023) said that global economic growth had contracted by 3.5% by 2023, one of the worst declines in decades.

Indonesia is among the developed and developing countries impacted by the current global recession. The decline of foreign trade to 8.5% by 2023 will have a direct impact on Indonesia's important industries, including mining, manufacturing, and agriculture (World Bank, 2023). Exports decreased as a result of a decrease in the market for Indonesian goods and services worldwide and risks for both domestic and foreign investors grew due to economic uncertainty (Suranovic, 2020). The worldwide recession caused a major decline in Indonesian export values, particularly in the coconut oil, coal, and textile products sectors, according to the Central Bureau of Statistics Indonesia (BPS, 2023). The stability of the national economy is being weakened by external shocks like a pandemic (Baldwin et al., 2021).

According to a study by Chinn (2021), several developing countries, including Indonesia, have seen a reduction in export quantities as a result of the drop in global demand. Furthermore, studies conducted by Digdowiseiso (2019); Freund and Pierola (2020) shows that the global economic crisis has had a more severe impact on sectors that are highly dependent on international trade. For instance, the mining and agricultural sectors in Indonesia experienced a sharp decline due to high dependence on global markets (Freund & Pierola, 2020). The World Trade Organization (2023) reported that significant volatility in global commodity prices occurred throughout the recessionary period, adversely affecting Indonesian commodity export earnings.

On the other hand, Indonesia's imports also experienced a decline due to decreasing domestic demand and increasing prices of imported goods due to exchange rate fluctuations (Bank Indonesia, 2023). A study by

Goldberg and Tille (2016) shows that sharp exchange rate fluctuations can reduce import volumes due to the increased costs of imported goods. In the Indonesian context, the depreciation of the rupiah exchange rate against the US dollar during the global recession caused an increase in the prices of imported goods, which in turn reduced domestic demand for these goods (Goldberg & Tille, 2016).

Research by Amiti et al. (2014) also shows that a decrease in imports can have a negative impact on the manufacturing sector, which is highly dependent on imported raw materials and capital goods. In Indonesia, many manufacturing industries experienced a decline in production due to difficulties in obtaining imported raw materials (Amiti et al., 2014). This causes a decrease in industrial output and a decrease in employment in related sectors (Ministry of Industry, 2023). Thus, the global recession not only affects the export sector but also has a significant impact on the import sector and the entire Indonesian economy.

Exports and imports play an important role in the Indonesian economy (Ginting & Kartiasih, 2019; Maulana & Kartiasih, 2017). Exports are not only a source of foreign exchange for the country but also create jobs and encourage the growth of the industrial sector (Suranovic, 2020). International trade contributes significantly to economic growth through increased production efficiency and better resource allocation. In Indonesia, sectors such as agriculture, manufacturing, and mining are highly dependent on export markets for growth and development (Belantika & Kartiasih, 2024).

Imports are very important to meet the need for raw materials and capital goods that cannot be produced domestically (Salvatore, 2019). A study by Grossman and Rossi-Hansberg (2008) shows that imports of capital goods and raw materials can increase domestic productivity by providing higher-quality inputs and more sophisticated technology. In Indonesia, imports of goods such as machinery and equipment are very important to support the industrial sector and increase production capacity (Grossman & Rossi-Hansberg, 2008). According to a report by the World Bank (2023), increased imports of

capital goods have contributed to increased productivity in key sectors such as manufacturing and agriculture.

Unstable international trade conditions can create economic uncertainty and influence investment decisions (Ningsih & Kartiasih, 2020). Melitz (2003) found that a drop in exports can limit investment in sectors that rely on overseas markets. Increased imports, on the other hand, might result in balance-sheet deficits, which are detrimental to the exchange rate and macroeconomic stability (Ervinda & Ariutama, 2022). Obstfeld and Rogoff (2009) found that a significant running balance deficit increases the probability of currency crises and worsens macroeconomic conditions.

Caliendo et al. (2015) found that the economy's reliance on foreign trade makes it more sensitive to external shocks. In Indonesia, commodity price volatility and currency rate variations frequently cause economic instability, impacting industries that rely substantially on international trade (Caliendo et al. (2015). Furthermore, Cattaneo et al. (2013) underline the relevance of global value chain integration in improving national industry competitiveness. In the Indonesian context, expanding connectivity to foreign markets can help enhance the indigenous industrial base and boost export value (Cattaneo et al. 2013). It demonstrates the necessity of economic diversity and improved connectedness in meeting global challenges (Kotarski 2012).

Due to their substantial commercial connections with Indonesia, countries such as China, India, Japan, and the United States were selected (World Commercial Organization, 2023). According to studies (Napang, 2022), China is the country to which Indonesia exports the greatest number of goods, particularly raw materials like coal and palm oil. Furthermore, Indonesia's primary export customers for textile and manufacturing goods are the US and Japan (Napang, 2022).

South Korea, Malaysia, Singapore, and Thailand are significant commercial partners in Southeast and East Asia, contributing to regional trade (ASEAN, 2023). The Asian Development Bank (2015) found that intra-ASEAN trade is critical for regional economic integration and higher trade volumes. Trade connections with these countries have a substantial impact on Indonesia's exports and imports of capital goods and raw materials (Asian Development Bank, 2015).

Australia and the Netherlands were chosen for their strong agricultural and energy trade ties, respectively. According to Hall et al. (2022), Australia is Indonesia's main supplier of wheat and other agricultural products. Meanwhile, the Netherlands serves as the primary gateway for Indonesian products into the European market. The energy sector is also important in trade relations between the two countries, as Indonesia exports coal and oil.

By analyzing the impact of indicators, this study closes the gap left previous studies which only examined one aspect of how economic dynamics influence international trade. However, by studying it from other points of view, including multiplier effect, linkage analysis, and simulation, this research expands the scope of the analysis even further.

Literature Review
Input-Output analysis (IO) is used to describe the flow of goods and services in the economy as well as the interaction between economic sectors. The MRIO approach allows for a deeper analysis of inter-country trade relationships and how changes within one country can affect other countries (Joshi & Miller, 2021). The Multiregional Input-Output (MRIO) model is an extension of the traditional input-output table that accounts for cross-border economic interactions between countries and territories, describing the flow of goods and services between economic sectors across different geographical locations. This model is crucial for understanding the impact of globalization and international economic linkages on the economy of a specific country or region (Dietzenbacher & Lahr, 2006). The MRIO framework includes a trade matrix that covers the exports and imports of goods and services between the analyzed countries or territories. In this study, MRIO is applied to the period 2022, encompassing various global events such as the financial crisis, the COVID-19 pandemic,

and international trade tensions. However, traditional IO models have limitations in capturing the effects of external shocks, such as global demand contractions caused by recessions or protectionist policies. To address this issue, researchers developed an additional approach by simulating exogenous shocks in the MRIO model through reductions in final demand in key sectors of Indonesia's top 10 trading partners. This approach enables a more comprehensive analysis of the impacts of global trade contractions on the domestic economy.

MRIO allows for a more in-depth analysis of the global supply chain and economic impacts across various regions (Huo et al., 2022; Koberg & Longoni, 2019). MRIO also depicts the flow of goods and services from each sector within a region to other sectors, both within that region and in other regions on a multi-regional scale (Ervinda & Ariutama, 2022). Compared to the Computable General Equilibrium (CGE), which is more flexible in capturing market dynamics and interactions between economic agents, MRIO is more suitable for short-term mitigation analysis because it has fewer assumptions (World Bank, 2022). Although CGE excels in analyzing the impact of economic policies, this model has limitations in the form of more assumptions and a complex calibration process (Dixon & Jorgenson, 2013). Therefore, this research uses MRIO to analyze the impact of cross-sector and cross-country trade, while CGE is more suitable for evaluating the impact of economic policies (Hayati, 2013; Ervinda et al., 2022). Thus, since this research focuses on analyzing the impact of global trade dynamics on Indonesian trade, the use of MRIO is more relevant compared to CGE, which is more oriented towards economic policy evaluation (Hayati, 2013).

Intersectorial reliance is identified through the examination of backward and forward linkages in order to comprehend the impact of the global recession on Indonesian commerce. Ervinda and Ariutama (2022) assessed Indonesia's role and reliance on international commerce using MRIO analysis. They discovered that despite Indonesia's heavy reliance on imports, the country still makes up a small export portion of the global value chain (Ervinda & Ariutama, 2022; Sugema, 2012). Although Indonesia did not fully benefit from the expansion of the global economy, Pradana (2013) pointed out that the durability of domestic consumption was crucial to maintaining economic stability.

Using an input-output (IO) model to analyze economic linkages in Asia, Muchdie (2019) discovered that while Indonesia has low linkage in the global value chain, certain sectors have the potential to increase added value through increased linkage. This analysis emphasizes the importance of industrial linkage enhancement strategies to improve global competitiveness. (Ismanto & Pratikno, 2010) also emphasized the importance of regional cooperation in the face of global.

Vukić et al. (2021) examine the transport sector's impact on the Croatian economy, highlighting its potential to generate economic growth through strong linkages with other sectors. The findings are useful for identifying crucial sectors in the Indonesian economy that can help minimize the effects of the global recession. Amador and Cabral (2020) found that improved industrial connectivity can improve economic resilience to external shocks.

Therefore, the objectives of this research are as follows: using graphic visualization (Sankey diagram) to determine the amount of exports and imports from the reference country to each sector; multiplier effect to analyze the impact of changes in output between regions; linkage analysis (forward linkage and backward linkage) to analyze sector dependence on international trade; finally, simulating the impact of an economic decline of 1% to find out how changes in the partner country's economy affect the Indonesian economy. The use of a 1% economic downturn in the simulation is based on a common approach used in previous studies, such as those conducted by Ervinda & Ariutama (2022). This figure was chosen because it is considered representative for measuring relatively small yet significant impacts of external shocks on the economy. The simulation is applied to calculate changes in Indonesia's total output when

trading partner countries experience a 1% reduction in their final demand, relative to their Gross Domestic Product (GDP). This approach allows researchers to evaluate the multidimensional impacts of global demand contractions on Indonesia's domestic economy.

METHODOLOGY

This research utilizes secondary data from the Asian Development Bank (ADB) available at https://kidb.adb.org/mrio, in the form of a 2022 Multiregional Input-Output (MRIO) table with constant prices for the 2010 period. This data includes the input and output of 35 industries in 62 countries, including Indonesia and its ten main trading partners: Australia, China, Japan, Singapore, the Netherlands, the United States, India, South Korea, Malaysia, and Thailand. Based on data from the Central Statistics Agency (BPS) in 2022, within this group, the countries with the largest contributions to national foreign exchange are China, the United States, Japan, Malaysia, and Singapore. Overall, these five countries contributed 50.93 percent of the total national exports. In 2022, the details of Indonesia's exports to those countries were as follows: China amounted to US\$65,839.3 million, the United States to US\$28,182.7 million, Japan to US\$24,853.1 million, Malaysia to US\$15,429.6 million, and Singapore to US\$14,349.5 million. These figures confirm that more than half of Indonesia's exports are directed to those countries, making sectoral linkage analysis through ADB MRIO relevant for understanding Indonesia's trade patterns and industrial interactions with its trading partners.

In this study, sector aggregation refers to the 35 industries in the ADB MRIO table selected to ensure consistency with the data used and to facilitate the analysis of economic interconnections. Thus, the use of ADB MRIO data and the sector aggregation approach in this study aims to provide a more systematic understanding of Indonesia's trade linkages with its trading partner countries and to identify strategic sectors in the national economy.

Method

The fundamental input-output (IO) model is developed into the Multiregional Input-Output (MRIO) model. MRIO and the IO model differ primarily in that MRIO depicts the flow of commodities and services between sectors, not just within a single region but also between multiple regions (multiregional). Table 1 displays the MRIO structure.

Table 1. MRIO Structure

		Demand Structure				A	B	Total Output
		Region (A)		Region (B)				
		Inter. Demand		Inter. Demand		Final Demand		
Sector		1	2	1	2	F^A	F^B	X
Region (A)	1	z_{11}^{aa}	z_{12}^{aa}	z_{11}^{ab}	z_{12}^{ab}	F_1^{aa}	F_1^{ab}	X_1^a
	2	z_{21}^{aa}	z_{22}^{aa}	z_{21}^{ab}	z_{22}^{ab}	F_2^{aa}	F_2^{ab}	X_2^a
Region (B)	1	z_{11}^{ba}	z_{12}^{ba}	z_{11}^{bb}	z_{12}^{bb}	F_1^{ba}	F_1^{bb}	X_1^b
	2	z_{21}^{ba}	z_{22}^{ba}	z_{21}^{bb}	z_{22}^{bb}	F_2^{ba}	F_2^{bb}	X_2^b
Primary Input		...	...	...	...			
Value Added		...	...	...	...			
Total Input		X_1^a	X_2^a	X_1^b	X_2^b			

The total output and total input are equal, as indicated by the MRIO matrix based on Table 1. Equation (1) can therefore be used to express the entire output:

$$X_i = \sum_{j=1} z_{ij} + Y_i \qquad (1)$$

Where z_{ij} is the intermediate demand and Y_i is final demand.

Furthermore, MRIO assumes that input is used proportionally to produce output values, so that the total output equation can be rewritten in equation (2):

$$X = (I - A)^{-1}Y \qquad (2)$$

Where is $(I - A)^{-1}$ is Leontief's inverse matrix. This matrix shows the total impact of changes in final demand in a region on output in all connected regions

Linkage analysis specifically, backward linkage (BL) and forward linkage (FL) is employed in the MRIO analysis approach to accomplish the goals of this study. Through its purchasing power, BL illustrates an economic sector's capacity to promote the expansion of other sectors (Asian Development Bank, 2020). Conversely, FL demonstrates how one economic sector can encourage the expansion of other sectors by producing a large amount of intermediate output (Asian Development Bank, 2020). Equations (3) and (4) can be used to derive the BL and FL

coefficients, respectively, as shown by Reis and Rua (2006):

$$BL = A^m(I - A^d)^{-1} \qquad (3)$$
$$FL = (I - A^d)^{-1}A^m \qquad (4)$$

A^m dan A^d are the imported input coefficient matrix and the domestic input coefficient matrix, respectively. Additionally, the BL and FL coefficients can be grouped into 4 quadrants shown in Table 2:

Table 2. Forward Linkage and Backward Linkage Quadrants

		Forward Linkage	
		Low (<1)	High (>1)
Backward Linkage	High (>1)	Dependent on Interindustry Demand	Generally Dependent
	Low (<1)	Generally Independent	Dependent on Interindustry Supply

The comparative analysis of Backward Linkage (BL) and Forward Linkage (FL) coefficients in an economy allows for the identification of key sectors that play a strategic role in driving overall economic growth. These sectors have strong linkages with other sectors, making them the main drivers in the economic system. Key sectors are located in quadrant four with BL and FL values greater than one, indicating significant contributions to the production and distribution chain (Ervinda & Ariutama, 2022). In addition, these sectors not only play a role in accelerating economic growth but also serve as the main engines of development that contribute to the achievement of sustainable development goals (Nisa & Ridho, 2024).

RESULTS AND DISCUSSION

This section presents a general analysis of import-export activity among the 11 countries as well as Indonesia against other countries. The analysis is presented in a Sankey diagram in which 35 sectors are grouped into 5 sectors. The purpose of this diagram is to get a common overview of transactions that occur between countries.
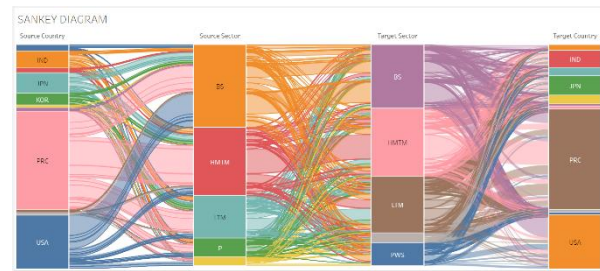
Figure 1. Input and Output between Origin and Destination Countries by Sector

Figure 1 illustrates that the highest production activity occurs in China, as evidenced by the large bars and connecting lines emanating from China. However, the majority of countries tend to engage in domestic economic activities rather than international economic activities. This indicates that domestic industrial activities require a greater input from domestic industries than from abroad.
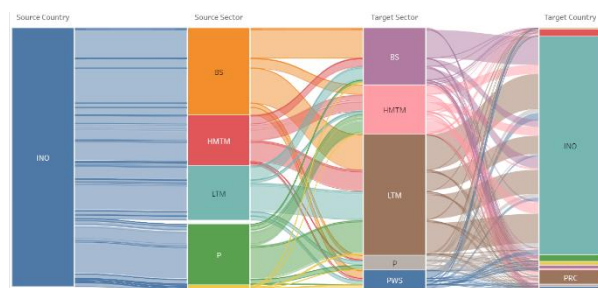
**Figure 2. Indonesia's Input and Output with Partner Countries according to 5 Sectors**

Indonesia (INO) is the most dominant in domestic industrial activity compared to international industrial activity. This is indicated by the size of the stem in the target country, which is INO. The largest sector of origin is BS (Business Service) and the largest target sector is LTM (Low Tech Manufacturing). Figure 2 illustrates the relationship between the sector of origin and the target sector in INO.

***Intraregional and Interregional Multiplier Effect Analysis***

The industries with the greatest impact on the economies of Indonesia and its partner countries will be examined in the following analysis. The multiplier effect values, which are separated into two categories—intraregional multiplier effect and interregional multiplier effect—show the impact of each sector. Sectors with the highest values in both

intraregional and interregional multiplier effects on the global economy are represented in darker colors (dark blue or dark purple)

compared to others. Figure 3 displays the multiplier impact results.
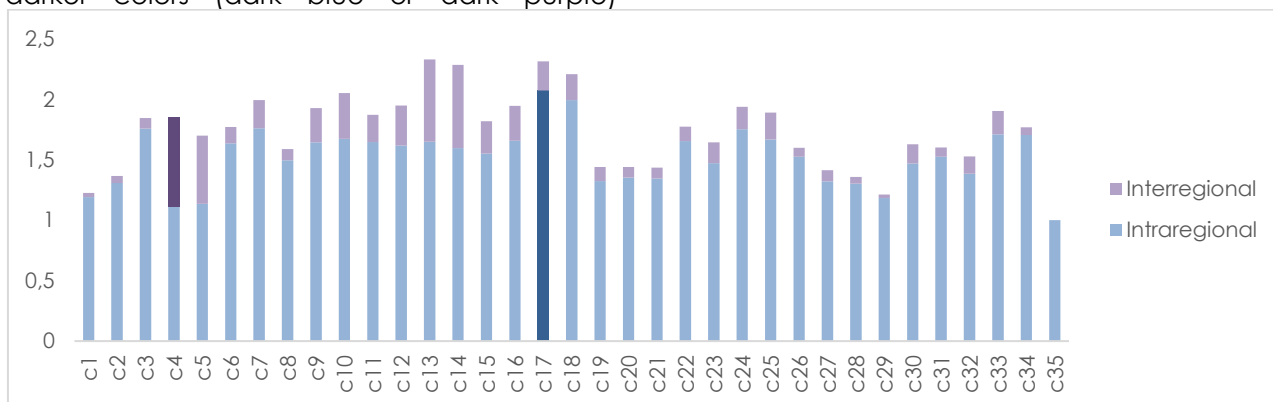
Figure 3. Interregional and Intraregional Effect in Indonesia 2022
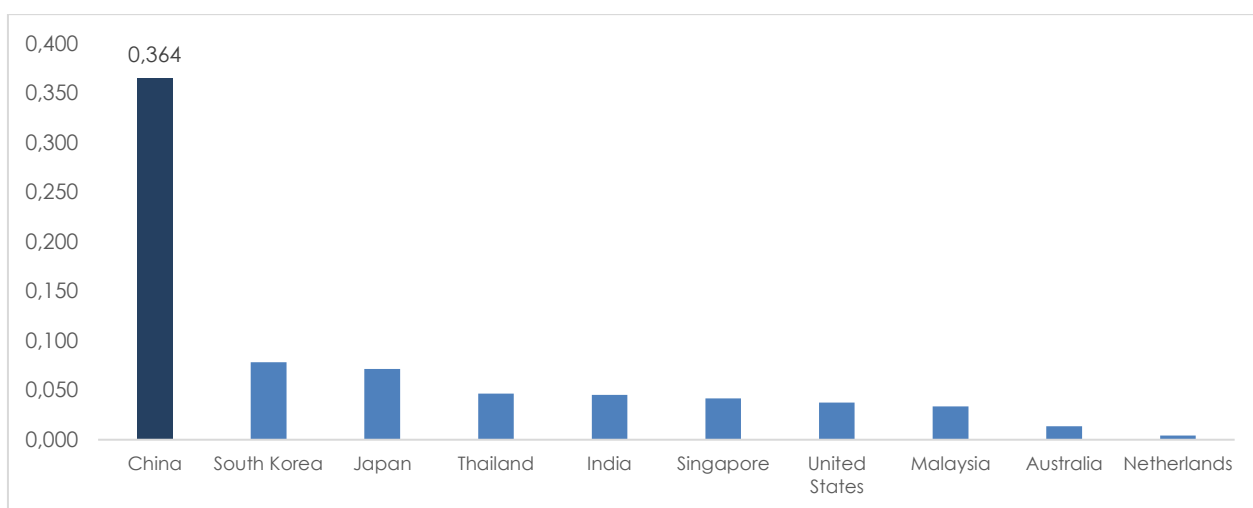
Figure 4. Indonesia's Interregional Effect according to Partner Countries in Textiles and Textile Products Sector 2022

Changes in demand for a sector in Indonesia are shown in Figure 3 along with how these changes affect the value of output in all sectors both locally and internationally (to major trading partners). At 2.31, the sector with the biggest multiplier effect is the Electricity, gas, and water supply sector. Global economic production increased by about $2.31 million when final demand in the Electricity, gas, and water supply sectors increased by $1 million from Indonesia. In addition, this sector's intraregional effect, at 2.07, is the largest of all the sectors. There is a $2.07 million gain in the Indonesian economy for every $1 million rise in final demand in this industry. The sector with the highest interregional multiplier impact is the textile and textile products sector, namely 0.74.

This figure shows that every $1 million increase in final demand in the textile and textile products sector in Indonesia will increase the economy of the main trading partner countries by $0.74 million in total.

Indonesia's textile industry and its products have an interregional effect on partner countries' economies, as illustrated in Figure 4. Between Indonesia and its other main trading partners, China's economy has been affected the most. Approximately $0.364 million will be added to China's economy when the final demand for Indonesian textiles and textile products rises by $1 million.

Multiregional Linkage Analysis

International trade links have been identified based on the results of the previous multiregional multiplier impact investigation. L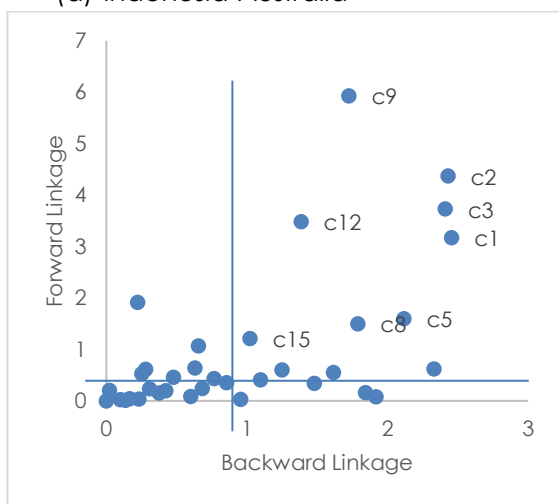inkage analysis is a useful tool for examining the connections between global trade. Figure 5 displays the FL and BL values, which represent the two parts of the linkage analysis.
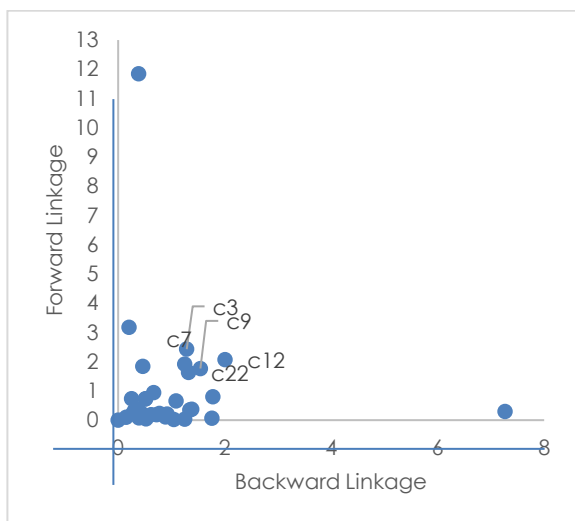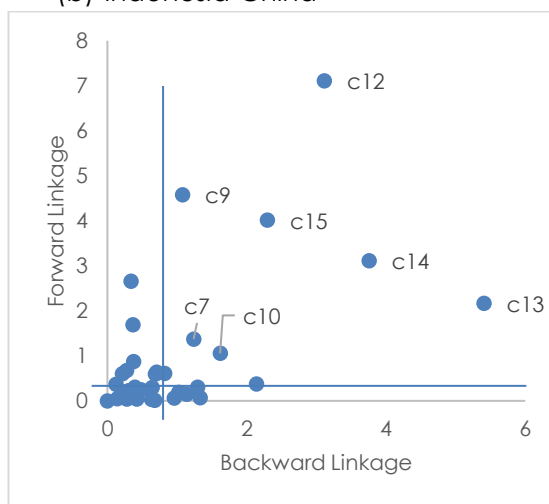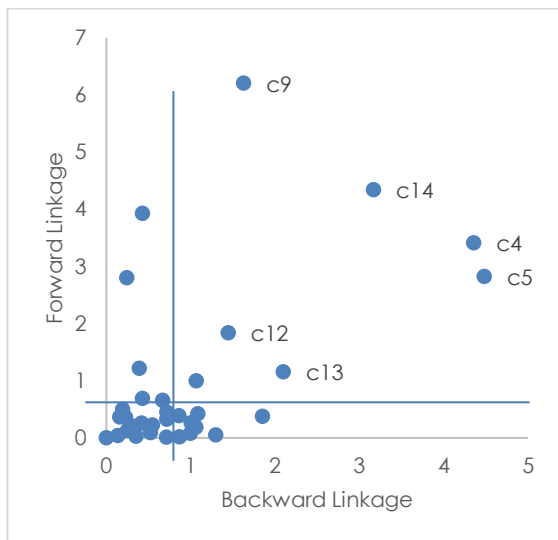
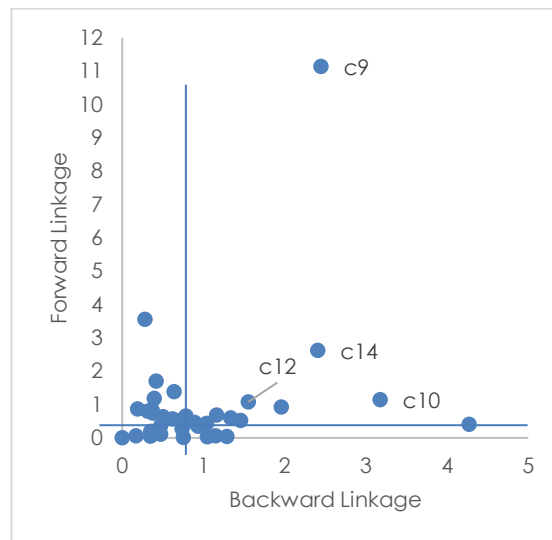(a) Indonesia-Australia
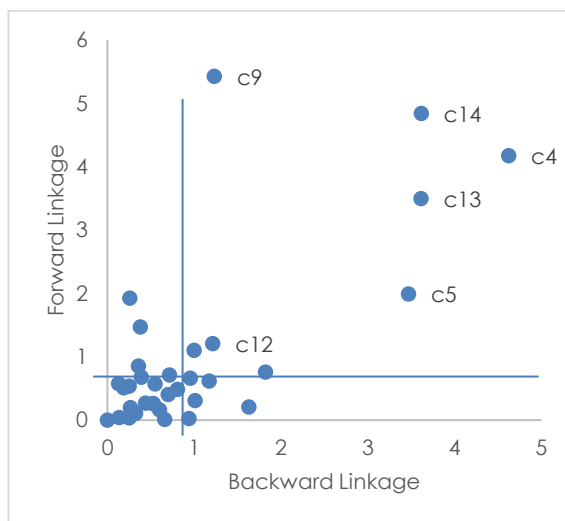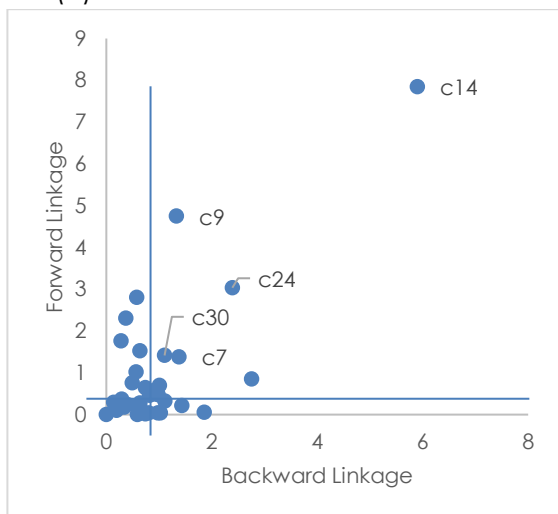
(b) Indonesia-China

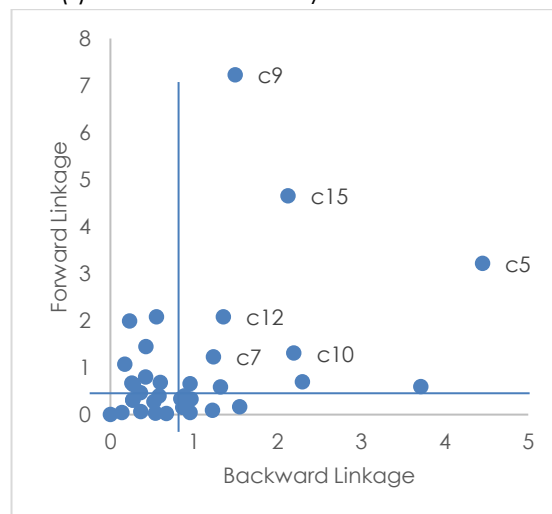(c) Indonesia-India

(d) Indonesia-Japan
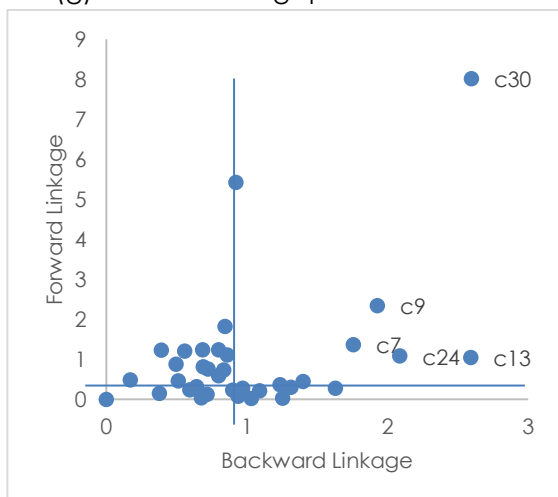
(e) Indonesia-South Korea
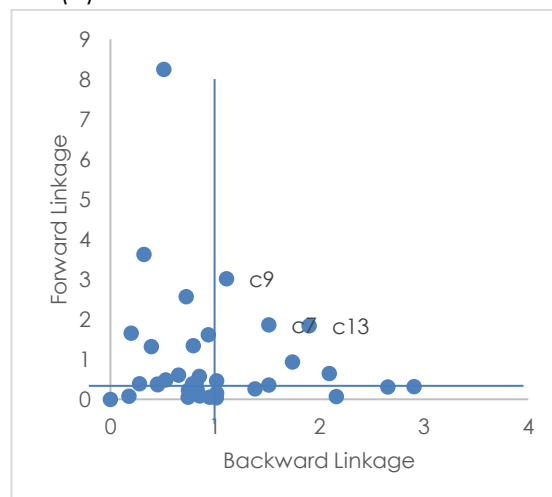
(f) Indonesia-Malaysia

(g) Indonesia-Singapore

(h) Indonesia-Thailand

(i) Indonesia-Netherlands

(j) Indonesia-United States

Figure 5. Indonesia's FL and BL Values with Main Trading Partner Countries in 2022

The connections between Indonesia and its main trading partners in global trade are depicted in Figure 5. To maintain its domestic supply chain, Indonesia often relies on imports from the manufacturing sector. In addition, the manufacturing industry has a considerable positive impact on the economies of partner countries. This is indicated by FL and BL values of greater than one, which show that this sector is a leading sector for both countries in international trade. A high FL value suggests that the Indonesian manufacturing sector contributes significantly to the input used to support production activities in the sectors of partner countries. When the BL value is high, it means that shifts in the demand for Indonesian manufacturing have a tendency to have a major impact on boosting production in partner country industries.

Partner countries typically have strong ties to Indonesia in the paper industry when it comes to low-tech manufacturing. Indonesia depends on imports from Australia, Japan, Singapore, the Netherlands, and the United States to supply raw materials for the paper and printing industries. Furthermore, Indonesia frequently positions the paper industry as a top export market to its allies. As for the high-tech manufacturing sector, the chemicals and chemical products sector is a leading sector for Indonesia and all partner countries. The demand from Indonesia for chemicals from partner countries will spur economic growth and manufacturing in these countries. Furthermore, Indonesia plays a role in supplying chemical inputs to assist partner countries' production activities.

In international trade relations, Indonesia and partner countries tend to have more than three leading sectors. In trade between India and Indonesia there are eight leading sectors including the primary sector and the manufacturing sector. Japan and Indonesia also have several leading sectors and most of them are high-tech manufacturing sectors. This shows that international trade activities between Indonesia and partner countries can influence the national economy and the economy of the partner countries themselves.

Impact of Decreasing GDP of Main Trading Partners on Indonesia's GDP

Indonesia's dependence on international trade shows that the economies of partner countries have an impact on the national economy. An unstable economy in a partner country causes a decrease in demand for Indonesia's exports and imports. The decline in exports and imports due to the world economic recession can cause an economic slowdown in Indonesia.

Table 3. Simulation of the Impact of Every Partner Country's GDP Dropping by 1% on Indonesia's GDP

Number	Country	GDP Indonesia (%)
1	Australia	-0,0025
2	China	-0,0069
3	India	-0,019
4	Japan	-0,0059
5	South Korea	-0,009
6	Netherlands	-0,0036
7	United States	-0,0013
8	Malaysia	-0,03
9	Thailand	-0,02
10	Singapore	-0,02

Table 3 shows a simulation of the impact of a decrease in partner countries' GDP on changes in GDP in Indonesia. A decline in the economy of a major trading partner tends to reduce the Indonesian economy by less than one percent. This was caused by high domestic consumption which helped Indonesia to survive despite a decline in exports. ASEAN countries, which are Indonesia's main trading partner countries, tend to have the most significant impact on the economic decline in Indonesia. Apart from ASEAN countries, a decline in GDP in India could cause a decline in GDP in Indonesia of 0.01%. The high impact of India's economic dynamics on Indonesia's economy is due to previous linkage analysis, which indicates that India has strong trade relations with Indonesia across various sectors, including agriculture, hunting,

forestry, and fishing; mining and quarrying; food, beverages, and tobacco; leather, leather products, and footwear; coke, refined petroleum, and nuclear fuel; chemicals and chemical products; basic metals and fabricated metal; and transport equipment (sectors with FL > 1 and BL > 1) (in many sectors). Following this, the study conducts a cross-country demand shock simulation on Indonesia's output using the MRIO framework. The simulation focuses on Malaysia, the country with the greatest impact on Indonesia's economy based on GDP simulation. The goal is to identify the sectors in Indonesia most affected by the decline in demand for the chemical and optical sectors in Malaysia (decrease in demand in Malaysia). The selection of these two sectors was based on previous linkage analysis. These two sectors have high FL and BL values in Indonesia-Malaysia.
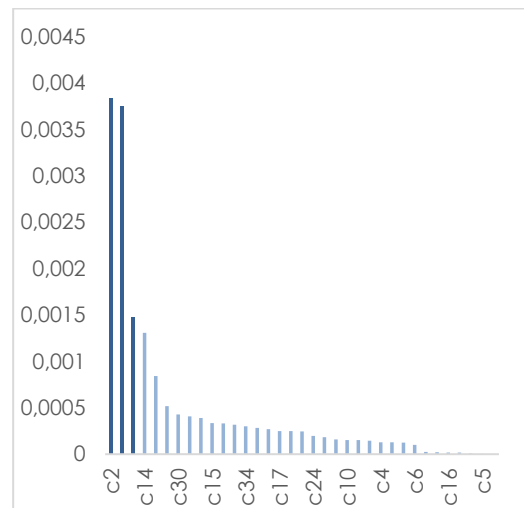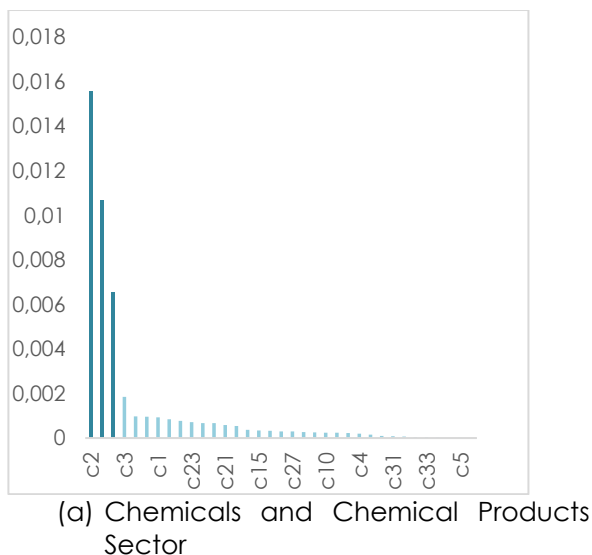
(b) Electrical and Optical Equipment Sector

Figure 6. Impact of Malaysia's Decline in Demand for the Chemical and Technology Sector on Indonesia's Output in 2022

Figure 6 shows a simulation of the impact when demand for the chemicals and chemical products sector, as well as the electrical and optical equipment sector from Malaysia experiences a decline on output in Indonesia. Based on Figure 6(a), when demand in the chemicals and chemical products sector in Malaysia experiences a decline, the mining and minerals sector, the chemicals and chemical products sector, and the fuel sector are the sectors that will experience the highest decline in output in Indonesia. Figure 6(b) shows that the chemicals, mining and metals sectors will experience the highest output declines in Indonesia when Malaysian demand in the electrical and optical equipment sectors declines. The chemical and chemical products sector affects the mining and minerals sector because chemicals are used in both surface and underground mining for various purposes, including mineral processing, explosives and drilling, water treatment, tailings management, and mining haul roads (ILO,2024). Meanwhile, optical equipment is increasingly used in communication, surveying, remote sensing, and measurement in underground mining (Stoicuta et al., 2023).

(a) Chemicals and Chemical Products Sector

CONCLUSION

Indonesia is dependent on import-export in the manufacturing sector, both low- and high-tech. In the high-tech sector, dependence is seen in chemicals and chemical products, while in the low-tech sector, dependence is on the paper and printing sector. Multiregional trade links with partner countries, such as India and ASEAN countries, are also significant. Simulations show that the decline in India's GDP has a large impact on the Indonesian economy. Despite a decline in import-export demand, Indonesia's economy is largely supported by domestic consumption.

Based on the research findings, Indonesia relies on the manufacturing sector in international trade, with strong trade relations between Indonesia, India, and ASEAN countries. To reduce dependence on import-exports, Indonesia may consider diversifying export products to partner countries and expanding export markets, and stimulating domestic consumption through fiscal and monetary policies, such as tax incentives and social assistance programs. Additionally, strengthening economic resilience is also important by reducing dependence on certain commodities and increasing the economy's flexibility in responding to market changes.

REFERENCE

Amiti, M., Itskhoki, O., & Konings, J. (2014). Importers, exporters, and exchange rate disconnect. *American Economic Review, 104*(7), 1942–1978. https://doi.org/10.1257/aer.104.7.1942

ASEAN. (2023). *ASEAN Economic Integration*.

Asian Develoment Bank. (2015). *Asian Economic Integration Report 2015* (Issue fEBrUarY).

Baldwin, R. E., & Taglioni, D. (2021). Gravity Chains: Estimating Bilateral Trade Flows When Parts and Components Trade is Important. *SSRN Electronic Journal*, *November 2011*. https://doi.org/10.2139/ssrn.1956466

Banerjee, R., & Hofmann, B. (2022). Corporate zombies: anatomy and life cycle. *SSRN Electronic Journal*, *2020*(882). https://doi.org/10.2139/ssrn.4051592

Belantika, B. T., & Kartiasih, F. (2024). International Trade, Information and Communication Technology, and the Covid-19 Pandemic: Indonesian Empirical Evidence. *Indonesian Journal of Economics and Management, 5*(1), 1–18. https://doi.org/10.35313/ijem.v5i1.5759

BPS. (2023). *Statistik Ekspor Impor Indonesia*.

Caliendo, L., Feenstra, R. C., Romalis, J., & Taylor, A. M. (2015). Tariff Reductions, Entry, and Welfare: Theory and Evidence For The Last Two Decades. *Angewandte Chemie International Edition, 6(11), 951–952., 1*(April).

Cattaneo, O., Gereffi, G., Miroudot, S., & Taglioni, D. (2013). Joining, Upgrading and Being Competitive in Global Value Chains: A Strategic Framework. *Policy Research Working Papers*, *April*. https://doi.org/10.1596/1813-9450-6406

Chen, S., Igan, D., Pierri, N., & Presbitero, A. (2020). Tracking the Economic Impact of COVID-19 and Mitigation Policies in Europe and the United States. *IMF Working Papers*, *20*(125). https://doi.org/10.5089/9781513549644.001

Chinn, M. D. (2021). Global Trade and the Dollar. *Journal of International Economics*, *129*, 103423. https://doi.org/10.1016/j.jinteco.2020.103423

Dietzenbacher, E., & Lahr, M. L. (2006). *Expanding Extractions Erik Dietzenbacher 1,2 and Michael L. Lahr 3,1 A*. 1–22.

Digdowiseiso, K. (2019). Teori Pembangunan Daerah. In *Universitas Terbuka*. http://repository.unas.ac.id/652/1/Buku Teori Pembangunan.pdf%0Ahttp://repository.ut.ac.id/4601/

Dwi Ervinda, M. Y., & Ariutama, I. G. A. (2022). Economic Interdependence of Indonesia in Global Value Chain: An Analysis of Multiregional Input-Output. *Jejak*, *15*(1), 151–164. https://doi.org/10.15294/jejak.v15i1.34747

Dixon, Peter and Jorgenson, Dale, (2012), Handbook of Computable General Equilibrium Modeling, vol. 1, 1 ed., Elsevier, https://EconPapers.repec.org/RePEc:eee:hacgem:1.

Freund, C., & Pierola, M. D. (2020). The Origins and Dynamics of Export Superstars. *World Bank Economic Review*, *34*(1), 28–47. https://doi.org/10.1093/wber/lhy011

Ginting, C. P., & Kartiasih, F. (2019). Analisis Ekspor Kopi Indonesia ke Negara-Negara ASEAN. *Jurnal Ilmiah Ekonomi Dan Bisnis*, *16*(2), 143–157. https://doi.org/10.31849/jieb.v16i2.2922

Goldberg, L. S., & Tille, C. (2016). Micro, macro, and strategic forces in international trade invoicing: Synthesis and novel patterns. *Journal of International Economics*, *102*, 173–187. https://doi.org/10.1016/j.jinteco.2016.07.004

Grossman, G. M., & Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. *American Economic Review*, *98*(5), 1978–1997. https://doi.org/10.1257/aer.98.5.1978

Hall, P., McCulloch, N., & Sinclair, P. (2022). Trade and Economic Growth in Developing Countries: The Case of Australia and Indonesia. *Journal of*

Development Economics, *156*, 102737. https://doi.org/10.1016/j.jdeveco.2022.102737

Hayati, M. (2013). Pemahaman Dasar Analisis Model Computable General Equilibrium (Cge). Agriekonomika, *2*(1), 66-75. doi:https://doi.org/10.21107/agriekonomika.v2i1.667

Huo, J., Chen, P., Hubacek, K., Zheng, H., Meng, J., & Guan, D. (2022). Full-scale, near real-time multi-regional input–output table for the global emerging economies (EMERGING). Journal of Industrial Ecology, *26*(4), 1218–1232. https://doi.org/10.1111/jiec.13264

IMF. (2023). *World Economic Outlook*.

International Labour Organization. (2024). *Chemical Exposures in Mining*. International Labour Organization. https://www.ilo.org/publications/chemical-exposures-mining

Ismanto, I., & Pratikno, R. V. (2010). Perubahan Ekonomi Global dan Tantangan bagi Indonesia. *Tantagan Ekonomi Untuk Indonesia*. https://scholar.archive.org/work/onqa6tmw3zezhfpopotugastfu/access/wayback/https://ojs.uph.edu/index.php/JHIV/article/download/726/242

Joshi, A., & Miller, C. (2021). Review of machine learning techniques for mosquito control in urban environments. *Ecological Informatics*, *61*, 101241. https://doi.org/10.1016/j.ecoinf.2021.101241

Kementerian Perdagangan. (2023). *Laporan Perdagangan Indonesia*.

Kementerian Perindustrian. (2023). *Laporan Industri Manufaktur*.

Koberg, E., & Longoni, A. (2019). A systematic review of sustainable supply chain management in global supply chains. Journal of Cleaner Production, *207*, 1084–1098. https://doi.org/10.1016/j.jclepro.2018.10.033

Kotarski, K. (2012). Dani Rodrik: The Globalization Paradox: Democracy and the Future of the World. *Političke Analize*, *3*(10), 46–48.

Maulana, A., & Kartiasih, F. (2017). Analisis Ekspor Kakao Olahan Indonesia ke Sembilan Negara Tujuan Tahun 2000–2014. *Jurnal Ekonomi Dan Pembangunan Indonesia*, *17*(2), 103–117. https://doi.org/10.21002/jepi.v17i2.664

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695–1725. https://doi.org/10.1111/1468-0262.00467

Mi, Z., Meng, J., Zheng, H. et al. A multi-regional input-output table mapping China's economic outputs and interdependencies in 2012. Sci Data 5, 180155 (2018). https://doi.org/10.1038/sdata.2018.155

Muchdie, M. (2019). Spatial Linkages in Asian Trade: An Input-Output Analysis. *Asian Economic Journal*, *33*(1), 23–45.

Napang, M. (2022). The Trade War of China and The Us In 2021, and It's Impact on The Indonesian Economy. *Journal of Strategic and Global Studies*, *5*(2). https://doi.org/10.7454/jsgs.v5i2.1102

Ningsih, Y. P., & Kartiasih, F. (2020). Dampak Guncangan Pertumbuhan Ekonomi Mitra Dagang Utama Terhadap Indikator Makroekonomi Indonesia. *Jurnal Ilmiah Ekonomi Dan Bisnis Triangle Editorial Team*, *1*(1), 182–195.

Nisa, A. F., & Ridho, A. F. (2024). Economic Linkage Between Rubber Plantation and Other Sectors In Indonesia. SEAS (Sustainable Environment Agricultural Science), 08(01), 69–78.

Obstfeld, M., & Rogoff, K. (2009). Global Imbalances and the Financial Crisis: Products of Common Causes. *Federal Reserve Bank of San Francisco Asia Economic Policy Conference*, *November*, 1–70.

Pradana, A. M. (2013). Indonesia dan Putaran Bali. *Global: Jurnal Politik Internasional*, *15*(1). https://doi.org/10.7454/global.v15i1.19

Reis, H., & Rua, A. (2006). *An Input-Output Analysis: Linkages Vs Leakages An input-output analysis: linkages vs leakages*. 71.

Salvatore, D. (2019). *International Economics*. John Wiley & Sons.

Stoicuta, O., Riurean, S., Burian, S., Leba, M., & Ionica, A. (2023). Application of optical communication for an enhanced health and safety system in underground mine. *Sensors*, *23*(2), 692.

Sugema, I. (2012). Krisis Keuangan Global 2008-2009 dan Implikasinya pada Perekonomian Indonesia. *Jurnal Ilmu Pertanian Indonesia (JIPI)*, *Desember*, *17*(3), 145–152.

Suranovic, S. M. (2020). *International Trade: Theory and Policy*. OpenStax. https://doi.org/10.3390/s23020692

Vukić, L., Mikulić, D., & Keček, D. (2021). The impact of transportation on the croatian economy: The input-output approach. *Economies*, *9*(1). https://doi.org/10.3390/economies9010007

World Bank. (2023). *Global Economic Prospects*.

World Bank Group Macroeconomic Models for Climate Policy Analysis (English). Equitable Growth, Finance and Institutions Insight Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/490571642086593026

ATTACHMENT

Output Sector Code and Name at Constant Prices (2010 = 100)

Category	Code	Sector
Primer (P)	c1	Agriculture, hunting, forestry, and fishing
	c2	Mining and quarrying
Low tech manufacturing (LTM)	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 (HMTM)	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 (BS)	c19	Sale, maintenance, and repair of motor vehicles

Category	Code	Sector
		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 (PWS)	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