

## The Different Role of Innovation on Indonesian Intra Industry Trade

Salman Alfarisi<sup>1</sup>, Telisa Aulia Falianty<sup>2</sup>

<sup>1,2</sup>Master in Economic Planning and Development Policy, Universitas Indonesia  
salman.alfarisi73@ui.ac.id, telisa97fe@yahoo.com

### Abstract

*This study aims to look at the role of differences in innovation between Indonesia and sixty selected partner countries in encouraging bilateral intra-industrial trade (IIT) in the 2009-2017 period with the fixed effect model estimation method (FEM). The innovations in other research generally use RnD spending, number of patents, and other cost-based variables. Whereas in this study using the Global Innovation Index score with the hope of capturing the level of innovation of each country more comprehensively. The results showed that the difference in innovation (DGII) was proven positively and significantly in encouraging IIT Indonesia and partner countries. Control variables, Economic openness (OPEN), GDP average (AGDP), differences in per capita income (DGDPC), and foreign direct investment (FDI) are known to have a positive and significant role in driving IIT. While another control variables, trade cost (TC) have a negative and significant effect in encouraging IIT.*

### Keywords

intra industry trade; innovation; Indonesia; manufactures JEL classification: F13, O24, O30



## I. Introduction

Globalization makes countries more integrated. International trade becomes more accessible, along with the existence of economic cooperation between countries that can reduce and even remove various trade barriers (Łapińska, 2016). As a result, both exporting and importing countries benefit from these activities. One type of international trade that is considered profitable is intra-industrial trade (IIT) because it is believed to be able to reflect large economies of scale, so that it impacts on efficiency, which causes lower production costs, as well as provides many choices for consumers (Krugman, Obstfeld, & Melitz, 2009).

Studies on international trade so far have shown great attention to the discussion of intra-industry trade, which is defined as the simultaneous export and import of products in a particular industry, in world trade. Research is generally divided into theory development and empirical investigations related to IIT, such as searching for patterns and determinants (Phan & Jeong, 2014). As for this research belongs to the second category, which is focused on finding the determinants of IIT.

Previously, since the 1980s, there have been studies that have tried to identify the determinants of intra-industry trade, ranging from those focusing on market size, income differences, foreign direct investment, geographical distance, to market structure, economies of scale, and product differentiation. Several factors influence IIT, among others, the average size of the economy, differences in income, differences in physical capital, and differences in human capital (Phan & Jeong, 2014). Another study stated that other variables affecting IIT were product share in total trade volume and trade imbalance (Łapińska, 2016).

In addition, some studies include the level of innovation in a country as an empirically tested variable, assuming that the nature of products produced in trading countries depends on the level of use of innovative technological processes (Zhang & Li, 2006). This is interesting, because, in the modern economy, knowledge is considered as important as inputs for production factors such as labor, capital, and raw materials. This knowledge can be obtained in various ways, from acquiring technology through own research and development efforts to learning from competitors by studying their products (Krugman, Obstfeld, & Melitz, 2009).

Unfortunately, research that aims to determine the determinants of intra-industry trade by including innovation as one of the variables is still minimal, including those specifically discussing Indonesia. Previous studies that included innovation as an independent variable, among others, research on the patterns and determinants of intra-industry trade in Asia (Sawyer, Sprinkle, & Tochkov, 2010), where the results show that spending on research and development (R&D) as a proxy for innovation appears as a major positive determinant of overall IIT in Asia.

In measuring the level of innovation of a country, various studies use different proxies, such as the amount of spending on research and development (R&D), the number of patents, the number of high-tech trade-in goods, the number of high-tech companies, and others. However, this proxy is still unable to describe the level of innovation of a country holistically. Therefore, in this study, the score will be used Global Innovation Index (GII) as a reference for a country's level of innovation.

Based on this background, this study seeks to see the effect of differences in innovation as a determinant in intra-industrial trade between Indonesia and partner countries around the world. This is based on the continuing trend of increasing the value of Indonesia's trade, both imports and exports, which also affects the number of intra-industry trade with partner countries, where this is considered important in improving the economy of a country because it can minimize technological differences (Xing, 2007).

## II. Research Methods

### 2.1 Data and Data Sources

This study uses export-import data for the years 2009-2017 to see the amount of intra-industry trade as the dependent variable. The difference in innovation uses the difference in the Global Innovation Index (GII) scores of Indonesia and partner countries. Other data as independent variables, namely, the difference in GDP per capita of Indonesia with partner countries (USD), the level of trade openness, international trade costs (costs of international trade), the average GDP of Indonesia and partner countries (USD), and the value of foreign investment directly (USD) from partner countries. These data were obtained from various sources, such as, OECD, Stat, World Bank, and the Global Innovation Index (GII) Report.

### 2.2 Definition of Operational Variables

The dependent variable used in this study is the value of IIT using the intra-industry trading method per product from Nilsson (1997) with the formula:

$$IITp_{ij} = \frac{\text{Level } IIT_{ij}}{\sum \text{group of traded products}}$$

$$\text{Level } IIT_{ij} = \sum (X_{ij} + M_{ij}) - \sum |X_{ij} - M_{ij}|$$

Note: IIT<sub>p</sub> is Intra-Industrial Trade per Product; X is Export Value; M is Import Value; i is sector, and j is the partner country

Difference in Innovation Level using the difference in the Global Innovation Index (GII) score between Indonesia and partner countries. Expenditure on research and development is one of the factors that can encourage the occurrence of IIT (Sawyer, Sprinkle, & Tochkov, 2010). The difference in per capita income uses the difference in the value of the GDP per capita of Indonesia and partner countries. This variable captures the degree of variation in demand for different products among trading partners. IIT tends to be more intense among countries with similar levels of GDP per capita. Openness of trade uses the formula:

$$\text{Level of Openness} = \frac{X + M}{GDP}$$

Description: X is the value of exports; M is Import Value; i and GDP are Gross Domestic Product.

Trade openness signifies lower trade barriers and larger trade volumes that encourage higher IIT levels (Brühlhart, 2009). Trade costs are closely related to geographic proximity, which is an important determinant of IIT because it is associated with lower transportation and information costs (Balassa & Bauwens, 1987) as well as tariff and non-tariff barriers that limit access to foreign markets (Łapińska, 2016). The size of the economy includes the main factors involved in trade, measured by the size of GDP. The larger the market size of trading countries, the stronger their intra-industrial trade (Stone & Lee, 1995). The value of Foreign Direct Investment (FDI) uses the value in USD from the BKPM. FDI will increase foreign trade, especially IIT (Burange, Thakur, & Kelkar, 2017).

### 2.3 Analysis Tools

Estimates were calculated using the fixed-effect model (FEM) method with data from 2009-2017 on a panel consisting of sixty Indonesian trading partner countries around the world to determine the effect of innovation and other factors on intra-industry trade.

The relationship between the dependent variable and the factors (independent variables) that are thought to influence the intensity of IIT, in this case, six models refer to (Xing, 2007) (Łapińska, 2016) (Zhang & Li, 2006) formulated as follows:

$$\begin{aligned} IITp_{it} = & \beta_0 + \beta_1 DGII_{it} + \beta_2 OPEN_{it} + \beta_3 LogTC_{it} \\ & + \beta_4 AGDP_{it} + \beta_5 LogDGDP_{it} + \beta_6 FDI_{i(t-1)} + \epsilon_t \end{aligned}$$

Description: IIT is the value of intra-industry trade; DGII is the difference in scores of the Global Innovation Index; DGDPC is the difference between Indonesia's GDP per capita and partner countries; OPEN is the level of trade openness; TC is international trade fee; AGDP is the average GDP of Indonesia and partner countries; FDI is the value of the foreign direct investment; i is a partner country; and t is the year of trade credit company. Other influencing factors that cash flow volatility (the volatility of cash flows) was important determinants of the ability of the company to finance both working capital from cash flow.

### III. Discussion

Based on the data processing known value of  $R^2$  (goodness of fit) of 0.970146, which means relatively high in showing that the independent variables in the model jointly have explained 97% of the variation of the value of intra industry and the remaining 3% are influenced by variables other outside the model. Based on the probability value of t-statistics, it can be seen that the DGII, DGDPC, OPEN, TC, and AGDP variables during the 2009-2017 period were significant at =1%, =5%, and =10%.

Based on the estimation results, it can be concluded that the difference in innovation between Indonesia and partner countries has a significant effect in encouraging an increase in intra-industry trade at the level of =1%. Meanwhile, an increase in DGII of 1% will encourage an increase in IIT of 700.85.

As an illustration, Indonesia's top five trading partner countries with the highest average IIT values during the 2009-2017 period, respectively, are Japan, Singapore, China, the United States, and Malaysia. If we look at the innovation level of these five countries, it is much better than Indonesia's level of innovation. In fact, the differences in innovation between Indonesia and the United States, Singapore, Japan, Malaysia, and China are ranked 3rd, 5th, 17th, 26th, and 27th out of 60 partner countries in this study.

**Table 1.** Estimation Results of Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
C	115333.7 0.834388 0.4045			96233.08	
DGII	243.1671 2.882162 0.0041			700.8468	***
OPEN	4.04E + 09	4.06E + 08	9.943261	0.0000	***
LOG (TC)	-42812.30	20754.26	-2.062820	0.0397	**
AGDP	3.45E-08	8.56E-09	4.029438	0.0001	***
LOG(DGDPC)	16769.60	5998.698	2.795539	0.0054	***
FDI	0.011586	0.006525	1.775543	0.0764	*
R-squared		0.970146			
Prob(F-statistic)		0.000000			

Notes: \*\*\*, \*\*, \* significant at  $\alpha=1\%$ ,  $\alpha=5\%$ , =10%

This empirical result shows that the value of intra-industrial trade in Indonesia's manufacturing is more excellent if there is a significant difference in innovation, this means that intra-industrial trade occurs a lot with countries that are more technologically advanced and other factors supporting innovation from Indonesia. However, there is an anomalous condition, in which countries with a high level of innovation originating from the European Union, actually have a low level of intra-industry trade. This is because the export market share to Europe has been dominated by other ASEAN countries including China, so that

Indonesia's export access to the European Union market is increasingly limited (Puska KPI, BP2KP, Ministry of Trade, 2015).

If Indonesia wants to increase intra-industrial trade, the solution given is not to reduce innovation to create a bigger gap with these developed countries. However, the level of innovation must be increased in order to compete with other developing countries, especially with other ASEAN countries that are geographically and geographically and Its economic condition is similar to that of Indonesia.

The high level of intra-industrial trade between Indonesia and several other ASEAN countries, such as Singapore, Malaysia, Thailand, and Vietnam, cannot be separated from various international economic cooperation that creates regional integration. In the pattern of trade relations, there is a term called the upstream and downstream trade relations (Suprayitno, 2019). a seaport which was managed as a business by the government, built warehouses to be rented to trading companies, shipping companies, and other companies (Suprayitno, 2020). The increase in IIT among ASEAN countries is believed to reduce the asymmetric shock which is one of the conditions for the formation of a currency union. ASEAN countries need to coordinate economic policies to further increase their economies' convergence to create a more synchronous business cycle (Falianty, 2006).

The high intensity of Indonesia's intra-industrial trade with developed countries indicates that Indonesia's intra-industrial trade is vertical (VIIT), i.e. bilateral trade between two countries occurs on similar products but of different quality. VIIT is synonymous with differences in factors endowment such as technology, physical conditions, and the quality of human resources from one country to another. This condition causes an inequality in income distribution, affecting the preference for the quality of goods between high-income and low-income countries in the same industry.

This is reinforced by the calculated data that differentiates IIT into VIIT and HIIT. This methodology is based on the assumption that differences in unit costs of exports and imports reflect differences in the quality of goods exported and imported between trading partners (Aturupane, Djankov, & Hoekman, 1999). This study uses the unit value (UV) ratio of exports and imports as a proxy for product differences. UV exports (imports) are obtained by dividing the total value of exports (imports) by the total number of exports (imports). IIT is considered horizontal if the value of exports and imports of different <math>\alpha</math> percent (15, 25, ex.) If you meet the following requirements:

$$\frac{UV_i^x}{UV_i^m} \leq 1 + \alpha$$

As *vertical* IIT formulated:

$$\frac{UV_i^x}{UV_i^m} \leq 1 - \alpha \text{ or } 1 + \alpha \leq \frac{UV_i^x}{UV_i^m}$$

Reason for the use  $\alpha$  in the calculation is that the transaction costs estimated at approximately  $\alpha$  percent of the price of the product, which in similar research value of  $\alpha = 25\%$  common use (Phan & Jeong, 2014) (Chin, Yong, & Yew, 2015). The use of threshold this is actually debated in some literature (Gabrisch, 2009). However, the choice of  $=25\%$  can be strengthened by several reasons, such as, the values recorded in trade statistics are often influenced by exchange rate fluctuations, and the existence of measurements unit value which tend to include more noise due to the selection of a wider industry classification (Fukao, Ishido, & Ito, 2003) so that the selection of a threshold is 25% considered to represent a more

suitable result. If the value of  $\alpha=25\%$ , then the IIT category of sixty partner countries is grouped into 20% (12 countries) HIIT and 80% (48 countries) VIIT.

By increasing innovation, it is hoped that the type of intra-industrial trade between Indonesia and partner countries, which has been dominated by vertical IIT, can begin to shift to horizontal IIT, that is, intra-industry trade which is differentiated by attributes. However, this is a long-term target. This is because the increase in innovation in the short term is aimed at making Indonesia more competitive in dealing with other manufacturing-producing countries in Southeast Asia. So that production activities become more efficient, and Indonesia's role in the global trade chain is strengthened.

The difference in gross domestic product per capita (DGDPC) between Indonesia and partner countries has been proven to encourage intra-industry trade significantly. Increase in DGDPC 1% will push IIT to 9.331263. This is contrary to the initial hypothesis, where the greater the difference in GDP per capita between Indonesia and partner countries, the higher the two countries' needs will be. thus making IIT low. However, the fact is that Indonesia's IITs are even bigger if they are carried out with partners with high per capita income countries.

This is due to Indonesia's intra-industrial trade, which is dominated by the vertical type. A negative correlation was found between differences in GDP per capita, which is usually seen as a proxy for differences in endowment factors, and trade. The vertical intra-industry trade model must assume that each household consumes only one type of good, which is differentiated according to quality. Therefore, the distribution of income in a country is important with respect to the combination of varieties consumed by that country. With increasing differences in income distribution, the model predicts the share of intra-industry verticals will increase (Gabrisch, 2009).

This makes sense, because statistics show that from 2000 to 2017, Indonesia's Gross Domestic Product (GDP) per capita increased by an average of 4 percent annually, after China and India, which grew by 9 percent and 5.5 percent per capita, respectively. year. However, Indonesia's economic growth has triggered high inequality between the population. This is reflected in Indonesia's Gini Index, which increased from 30.0 in the 1990s to 39.0 in 2017. This is what is thought to have led to increased demand for higher quality goods by high-income people, when some Indonesians only need low-quality goods to meet their needs.

Economic openness (OPEN) also has a significant role ( $\alpha=1\%$ ) in encouraging IIT. An increase in OPEN of USD 1 will increase IIT by 8.65E-06. The enactment of trade liberalization can mark openness. Trade liberalization itself is not always beneficial for some countries; it can be dangerous for local producers or small and medium enterprises. Especially in the case of the manufacturing industry, limited innovation causes high production costs. On the other hand, developed countries are able to produce them more efficiently with even better quality. This can cause Indonesia's manufacturing production to be unable to compete with trading partner countries.

Trade openness is considered to be one of the determinants that plays an important role in the ASEAN-5 vertical intra-industrial trade, especially with China. This implies that VIIT between ASEAN-5 countries and China could be stimulated if more liberalized trade in these two regions. However, Indonesia must be ready to compete with other ASEAN countries in maximizing intra-industrial trade with the largest partner countries such as China. ASEAN's role in this regard is important so that the competition takes place without harming either party (Chin, Yong, & Yew, 2015).

Trading fees (TC) have an important role in supporting intra-industry trade. Not only about geographical distance, but also various other obstacles including tariffs. The trade cost data used in this study is calculated using the ESCAP WB Trade Cost method. This method is

considered to be able to capture all the additional costs involved in trading goods relative to those involved in trading goods domestically, including, international shipping and logistics costs, tariffs and non-tariff costs, including indirect and direct costs associated with trade procedures and regulations, as well as fees for differences in language, culture, currency. Based on the estimation results, it is known that every 1% increase in TC will significantly reduce IIT by 5.064674 ( $\alpha=5\%$ ).

Trade barriers are another possible determinant of intra-industry trade. In highly protected industries, there may be very little intra-industry trade. The different levels of trade barriers provided by different industries only explain the differences in the existing levels of IIT. If, on the other hand, trade barriers were lowered uniformly across industries, the overall level of intra-industry trade could increase, but then the increasing differences across industries would be explained by other industry characteristics (Manrique, 1987).

Meanwhile, the average GDP of Indonesia and partner countries (AGDP) also has a significant effect in increasing IIT ( $\alpha=1\%$ ). Every increase in AGDP by 1 will increase IIT by 9.25E+11. The average GDP value of Indonesia and partner countries is closely related to the achievement of economies of scale in production. The larger the GDP of Indonesia and partner countries, the bigger the market potential will be.

The average level of GDP of the two trading partners provides a proxy for market size. A larger average market size is expected to increase two-way bilateral trade, due to greater demand for products and more varieties produced under the concept of economies of scale (Helpman & Krugman, 1985). This is what causes a lot of trade between Indonesia and partner countries that have higher GDP.

Next, the variable of foreign direct investment (FDI). The estimation results show that this variable has a statistically significant ( $\alpha=10\%$ ) effect on IIT in this study. However, the significance value is lowest compared to other variables. This could be due to the small number of countries that invest directly in Indonesia's manufacturing sector. Of the 60 partner countries in this study, only 34 countries have had FDI values above one million USD. Meanwhile, there were only six countries whose investment was above one billion USD in a year, namely, China, Hong Kong, Japan, South Korea, Singapore, and the UK.

#### IV. Conclusion

The difference in innovation has a significant effect in encouraging intra-industrial trade between Indonesia and partner countries. This is due to IIT Indonesia and partner countries which are dominated by vertical intra-industry trade (VIIT). The economic openness of partner countries has a significant positive effect in encouraging IIT. While on the variable cost of trading, the results are significantly negative in encouraging IIT. The average GDP between Indonesia and partner countries also has a significant positive effect on IIT. The difference in per capita income which was hypothesized to have a negative effect, turned out to have a positive effect, because Indonesian IITs often occur with high-income countries. Meanwhile, FDI in this study has a significant effect on IIT.

It is known that intra-industrial trade in Indonesia's manufacturing industry is still dominated by trade with developed countries that have a higher level of innovation. This can benefit Indonesia's innovation climate, leading to a faster and more intense transfer of technology and knowledge.

On the other hand, the potential of the domestic manufacturing industry has not been able to compete with developed countries, and its presence has not been accepted by countries with an equivalent or lower level of innovation. If improvements are not made, developed countries such as China, Japan, and the United States will prefer to trade with

other ASEAN countries that have geographical proximity and similar characteristics to Indonesia. This is because Indonesia's position as part of the global supply chain where trade is strongly influenced by the demand and supply of developed countries.

Policies are needed that can encourage the creation of innovation for the national manufacturing industry, so that production becomes more efficient. Apart from developing your own research and research, the other most accessible way is to trade in high-tech goods that can assist production activities. This is more efficient, because there is no need to spend on research and research yourself, but can take advantage of the results developed by developed countries.

In relation to the low quality of domestic institutions and regulations in supporting innovation. So the government needs to pay serious attention to political stability and national security. This includes improving the quality of regulations, law enforcement, and facilitating business licensing and tax payments.

In order to maximize this, this also needs to be supported by reducing tariffs and trade barriers. However, we still pay attention to the appropriate protection for several commodities so that the domestic industry is not less competitive. In addition, for the sake of mutual prosperity, ASEAN's role is important in regulating the trade of its member countries with developed countries. So that the emerging competition does not weaken the trade of other member countries.

## References

- Aturupane, C., Djankov, S., & Hoekman, B. (1999). Horizontal and vertical intra-industry trade between Eastern Europe and the European Union. *Weltwirtschaftliches Archiv* Vol.34 No.3, 404-422.
- Balassa, B., & Bauwens, L. (1987). Intra-Industry Specialization in a Multi-Country and Multi-Industry Framework. *Economic Journal* 97, 923-939.
- Brühlhart, M. (2009). An Account of Global Intra-industry Trade, 1962-2006. *The World Economy*, 401-459.
- Chin, M.-Y., Yong, C.-C., & Yew, S.-Y. (2015). The Determinants of Vertical Intra Industry Trade in SITC 8: The Case of ASEAN-5 and China. *The Journal of Developing Areas* Vol 49 No 4, 257-270.
- Falianty, T. A. (2006). Endogenitas dari Indikator Optimum Currency Area: Studi Empiris di Negara ASEAN. *Jurnal Ekonomi dan Pembangunan Indonesia* Vol.VI No.2, 1-28.
- Fukao, K., Ishido, H., & Ito, K. (2003). Vertical Intra Industry Trade and Foreign Direct Investment in East Asia. *Journal of the Japanese and Internatinal Economies*, 468-506.
- Gabrisch, H. (2009). Vertical Intra-Industry Trade, Technology and Income Distribution: A Panel Data Analysis of EU Trade with Central-East European Countries. *Acta Oeconomica*, Vol. 59, 1-22.
- Helpman, E., & Krugman, P. (1985). *Market Structure and Foreign Trade*. Harvester Wheatsheaf: Brighton.
- Krugman, P., Obstfeld, M., & Melitz, M. (2009). *International Economics: Theory Policy*. Wesley: Pearson Eddison.
- Łapińska, J. (2016). Determinant Factors of Intra-Industry Trade: the Case of Poland and Its European Union Trading Partners. *Quarterly Journal of Economics and Economic Policy* Volume 11 Issue 2, 251-264.
- Manrique, G. G. (1987). Intra-Industry Trade between Developed and Developing Countries: The United States and the NICs. *The Journal of Developing Areas*, Vol. 21, No. 4, 481-494.



- Phan, H. T., & Jeong, Y. J. (2014). An Empirical Analysis of Intra Industry Trade in Manufactures Between Korea and ASEAN. *Journal of Economic Studies* Vol. 41 No. 6., 833-848.
- Puska KPI, BP2KP, Kementerian Perdagangan. (2015). Laporan Akhir Analisis Pengembangan Pasar Uni Eropa. Jakarta: Kementerian Perdagangan.
- Sawyer, W. C., Sprinkle, R. L., & Tochkov, K. (2010). Patterns and Determinants of Intra-industry Trade in Asia. *Journal of Asian Economics* 21, 485–493.
- Stone, J. A., & Lee, H. H. (1995). Determinants of Intra-Industry Trade: A Longitudinal, Cross-Country Analysis. *Weltwirtschaftliches Archiv* 131 (1), 67-85.
- Suprayitno, et.al. (2020). From Labuhan Deli to Belawan: The Removal of Harbor in Medan during the Dutch Colonial Period of 1863-1942. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)* Vol 3 (2): 1392-1402.
- Suprayitno, Ratna, and Handoko. (2019). Salt Trading in Deli: Relationship between Karo and Coastal Area in 19th Century. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)* Vol 2 (4): 298-305.
- Xing, Y. (2007). Foreign Direct Investment and China's Bilateral Intra-industry Trade with Japan and the US. *Journal of Asian Economics*, 685-700.
- Zhang, Z., & Li, C. (2006). Country-Specific Factors and the Pattern of Intra Industry Trade in China's Manufacturing. *Journal of International Development*, 325-356.