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The Electronic Industry Intra-Industry Trade Analysis in 10 Indonesian Trading Partners (Case Study: Refrigerator Products)

Intan Maria Lewiayu Vierke[1,2], Syaiful Ahmar[1], Achmad Sanusi[1]
[1]Politeknik APP Jakarta, Jakarta Selatan, Indonesia
[2]School of Business IPB University, Bogor, Indonesia

ABSTRACT

The importance of international trade in the context of refrigerator products makes intra-industry trade intensity (IIT) a very relevant tool. In international trade policymaking, particularly concerning refrigerator products, IIT is essential for understanding global economic dynamics, trade patterns, and trade relations between Indonesia and its trading partners. The use of IIT can provide deep insights into the extent to which there is an exchange of similar or similar but different goods among countries involved in the trade of refrigerator products. Therefore, the focus of the problem in this context is the extent to which the Indonesian refrigerator industry depends on ten trading partners in terms of exports and imports of refrigerator products and how this degree of dependence affects the stability of the sector in the face of changing global trade conditions. Regarding exports, India is the most important trading partner with a significant contribution, indicating a dependency that requires special attention. India has also emerged as an essential supplier, albeit with a lower level of dependence. Diversifying export and import markets should be considered to reduce the risk of dependence on certain trading partners. IIT analysis can also provide insights into the competitiveness of Indonesian products in the international market — improvement of export success also depends on understanding intra-industry trade dynamics.

Keywords: *electronics industry, Grubel-Lloyd Index, Intra-Industry Trade (IIT), refrigerator*

Corresponding author
Name: Intan Maria Lewiayu Vierke
Email: intan_vierke@apps.ipb.ac.id

INTRODUCTION

The growing trade integration between countries, especially in industrialized countries, has attracted researchers to focus their studies on developing countries, including Indonesia. Currently, some industrial development realities in Indonesia do not always fit the modern trade theory generally applied in developed countries.

Therefore, intra-industry trade (IIT) emerged as a concept considered relevant in facing the challenges of trade globalization (Bergstrand & Egger, 2006; Hendy et al., 2018). The application of IIT in Indonesia is crucial, given the significant role of the industrial sector

in contributing to Indonesia's Gross Domestic Product (GDP) and considerable employment (Bato, 2014).

Starting with the contributions of Krugman (1979) and Lancaster (1980), various general equilibrium models detailing intra-industry trade have been developed (Jošić & Žmuk, 2020). These models utilize diverse specifications of industries and international trade. Some of them generate what has come to be known as horizontal intra-industry trade, which relates to differentiated or homogeneous end products. Some models describe vertical intra-industry trade for products of different quality levels and other forms, such as fragmentation. Over time, new models have emerged, and the concept of intra-industry trade has expanded to include aspects such as marginal intra-industry trade, intra-firm trade, New Geography models, and intra-industry trade in services (Hellvin, 1996; Pawlak & Lukasiewicz, 2022).

In the second half of the 20th century, the world underwent significant transformations in information technology and transport, along with a round of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT). As a result, international trade multiplied, even outpacing income growth. In most developed and developing countries, most international trade volume involves intra-industry trade. Including trade in services and affiliated production, the proportion of intra-industry trade is even more striking. The high level of intra-industry trade makes this topic more important than ever (Hermanto, 2002; Putri et al., 2021).

The electronics industry is an industrial sector that continues to grow in Indonesia. Demand for products from the electronics industry continues to increase in line with the high public demand for electronic goods. Since November last year, overall exports have increased for four consecutive months. From January to February 2022, merchandise exports increased by an average of 10.4%, in line with improving global trade conditions and rising commodity prices. Meanwhile, merchandise imports increased 14.9% in February, marking the first increase in several months. The cyclical factors related to factory closures in the People's Republic of China make up the number in the same month of the previous year and increased demand for electronic devices. 2021, the trade surplus persists, while the current account deficit is growing to around 0.8% of Gross Domestic Product (GDP) in 2021 and 1.3% in 2022. The small surplus in the balance of payments increased portfolio inflows and foreign direct investment (Vierke et al., 2023). The Ministry of Industry noted that in 2020, the Electronics Industry (Computer Industry, Electronic Goods, Optics, and Electrical Equipment) experienced an increase in export value of 2.49%, from USD 11.38 billion in 2019 to USD 11.66 billion in 2020, while in 2019 the export value of this industry decreased by 0.04%. In 2020, the increase only occurred in the export value of the Computer, Electronic, and Optical Goods Industry, which increased moderately, namely by 7.09%, while the export value of the Electrical Equipment Industry decreased by 2.82% (Pusdatin Kemenperin, 2021).

The research findings show that, on average, from 2000 to 2015, the food and beverage industry sector showed a high level of competitiveness, ranking third among other ASEAN countries. Meanwhile, the textile and apparel industry ranked fourth in terms of

competitiveness. On the other hand, the chemical, electronics, and automotive sectors show low competitiveness. The intense competitiveness of the electronics industry is due to the sector's dependence on imported raw materials (Prabowo & Putra, 2015). Companies or industries importing raw materials bear the cost impact of the high proportion of raw material imports. Electronics products depend on imported raw materials, accounting for around 80-90 percent, highlighting an unresolved problem and indicating the industry's lack of linkages with other supporting sectors.

Additionally, structural challenges, such as the low quality of human resources and limited mastery of technology, result in Indonesia's electronics industry functioning more as an assembler. The development of Indonesia's electronics industry is also shaped by the significant role of foreign companies establishing factories in the country, necessitating the importation of most components. The dependence on LCD screens and circuit panel imports from China and Europe reflects the absence of a local industry producing high-tech features.

Policymakers in each trading partner are likely to have low-security concerns regarding intra-industry trade, as there is a lack of strategic dependence or vulnerability to imports of goods that the trading partner country also produces. In contrast, inter-industry trade presents a dual nature, potentially carrying political significance for trading partners. For instance, a trading partner might leverage inter-industry trade as a political tool, particularly if it faces lower costs associated with terminating trade. Additionally, inter-industry trade tends to be more volatile due to smaller trade gains and a higher degree of asset specificity linked to exporting primary commodities than manufactured commodities. This dynamic could contribute to the dependence of countries primarily exporting final products on trading partners focused on manufacturing.

The growing trade volume of electronic products, encompassing both exports and imports, poses a challenge for Indonesia to maintain its competitiveness and determinative advantages. Furthermore, amidst the pandemic, there is a need for additional research to assess whether there has been an upsurge in the exchange of similar products within the electronics industry. It is crucial to investigate whether foreign trade continues to play a pivotal role in addressing the scarcity of products not domestically produced (Almamalik & Ganesha, 2020). Understanding these dynamics becomes essential for policymakers to formulate strategies that enhance the resilience of Indonesia's electronic industry amid evolving global trade scenarios.

IIT is an instrument to determine the level of trade intensity between various trading partners of a country. In international trade policymaking, especially related to refrigerator products, IIT is essential to understand global economic dynamics, trade patterns, and trade relations between Indonesia and its trading partners. The use of IIT can provide in-depth insight into the extent to which there is an exchange of similar or similar but different goods among countries involved in the trade of refrigerator products. Elaborating on this issue examines how much the Indonesian refrigerator industry depends on ten trading partners to export and import refrigerator products. Furthermore, it aims to explore how this level of dependence can impact the industry's stability in the face of evolving global trade conditions.

METHOD

Researchers use the Grubel-Lloyd Index method to measure intra-industry trade, encompassing trade between countries involving similar or complementary goods in the same industry. There are two types of commonly used Grubel-Lloyd Index, namely Grubel-Lloyd (GL) and Grubel-Lloyd (GL*), which considers two-way trade (Galistcheva & Nebolsina, 2021; Lovely & Nelson, 2000; Tampubolon & Nababan, 2022). The first step in calculating the Grubel-Lloyd Index is to identify the classification of goods using trade data between two or more countries that have been classified based on a specific goods classification system, such as the Harmonised System (HS) (Petersson, 2002).

It then categorizes the goods in the trade data into two main categories: intra-industry and inter-industry. Intra-industry goods are goods from the same sector traded between countries, while inter-industry goods are goods from different sectors. The next step is calculating the sum of intra-industry goods and total trade. Then, it is crucial to get a clear picture of the proportion of intra-industry trade to total trade. In detail, the steps to calculate the Grubel-Lloyd Index are as follows (Banik & Kim, 2022; Isemonger, 2000).

1. Determine Trade Data. Collect trade data between Indonesia and its ten trading partners for refrigerator and air conditioning products over the relevant period (2012-2021). This data should include the value or volume of trade, as well as the product's country of origin or destination. In this case, the data collected is Product: 8418 Refrigerators, freezers and other refrigerating or freezing equipment, electric or other, obtained from ITC calculations based on BPS-Statistics Indonesia statistics from January 2015 to 2022.
2. Classify Goods: Ensure the data has been correctly classified based on commonly used goods classification systems, such as the Harmonised System (HS) or other appropriate classifications.
3. Split the Data into Two Categories: Identify and split the trade data into two categories: intra-industry and inter-industry:
    - Intra-Industry: Countries trade goods from the same sector, such as refrigerators
    - Inter-industry: Countries trade goods from different sectors.
4. Determination of the total number of traded goods and the number of intra-industry goods for both products (refrigerators). The calculation of IIT for exports is calculated using the formula:

$$IIT_{Eksport} = \frac{Export\ Intra - Industry}{Export\ Total}\ x\ 100$$

Intra-industry exports are the value of exports that are part of intra-industry trade between Indonesia and trading partners, and Total Exports are the total value of exports from Indonesia to trading partners. Meanwhile, IIT for imports is calculated using the formula:

$$IIT_{Import} = \frac{Import\ Intra - Industry}{Import\ Total}\ x\ 100$$

Intra-industry imports are the value of imports that are part of intra-industry trade (between the trading partner and Indonesia), and Total Imports are the total value of imports from Indonesia from the trading partner. If the IIT for exports and imports is close to 100, it indicates intra-industry solid trade between Indonesia and the trading partner for this product. If the IIT is lower, then trade tends to be more inter-industry.

5. Calculate the IIT for Refrigerator:

$$IIT_{refrigerator} = \frac{Number\ of\ intra-industry\ refrigerator\ goods}{Total\ number\ of\ refrigerated\ traded\ goods}\ x\ 100$$

FINDING AND DISCUSSION

Based on ITC data, a list of partners for products commercialized by Indonesia and a list of supplier markets for products imported by Indonesia for products with HS Product code 8418 Refrigerators, freezers, and other refrigerating or freezing equipment, electric or other as follows.

Table 1: Top 10 list of partner markets for a product commercialized by Indonesia (USS Thousand)

Partners	Balance in value in 2013	Balance in value in 2014	Balance in value in 2015	Balance in value in 2016	Balance in value in 2017	Balance in value in 2018	Balance in value in 2019	Balance in value in 2020	Balance in value in 2021	Balance in value in 2022	Exported value in 2022
World	59403	58956	38715	-5959	22795	32264	28261	4273	64173	-11523	499866
India	3169	2809	9314	18901	17649	6283	20107	19567	36384	62839	64796
Japan	5192	16386	28377	24944	25183	32677	36713	32642	33940	46966	50665
Viet Nam	25201	25611	31273	32683	34263	28689	29073	17107	27944	37828	45146
Korea, Republic of	632	10910	23899	34296	40084	43826	47118	48648	48102	34625	45038
Singapore	23160	8398	4699	6990	7214	32668	36722	33675	33273	35770	37348
Thailand	-76026	-62765	-58959	-65000	-39951	-36414	-26544	-20272	-6464	-19878	32562
Philippines	33869	33414	28382	30980	27773	31821	33193	31830	34972	26813	27197
Australia	12602	16320	6834	7832	10272	13899	18304	19240	20698	19912	20393
United States of America	-11374	-8594	-9117	-6959	-5391	-6852	-9269	-10819	4189	13073	16363
Malaysia	17937	7958	4614	-4987	2086	3655	-345	-625	10879	7978	14504

Source: ITC calculation based on BPS – Indonesia statistics

Table 1. above is the Top 10 List of partner markets for a product Indonesia commercializes. The data is shown in export and import values (in thousands of US Dollars) for each year from 2013 to 2022. A positive "balance in value" indicates a trade surplus (exports greater than imports), while a negative value indicates a trade deficit (imports greater than exports).

Export and import values can give an idea of how much each trading partner contributes to trade in a product. The International Trade Centre (ITC) calculates the data based on statistics from Indonesia's Central Bureau of Statistics (BPS).

Table 2: Top 10 list of supplying markets for a product imported by Indonesia (USS Thousand)

Exporters	Imported value in 2013	Imported value in 2014	Imported value in 2015	Imported value in 2016	Imported value in 2017	Imported value in 2018	Imported value in 2019	Imported value in 2020	Imported value in 2021	Imported value in 2022
World	364978	338504	283768	334319	320696	354707	400419	397669	426540	511389
India	674	6709	1739	979	1622	1289	1969	1598	909	1957
Taipei, Chinese	3806	5869	1521	2054	1695	1990	1800	1027	1290	1596
Singapore	13358	10648	5410	2346	2413	2471	2961	1882	1819	1578
France	2020	1358	720	3111	2472	2845	1549	1927	1469	1549
Netherlands	558	1363	370	583	818	615	565	81	276	1375
Egypt	0	0	0	2	0	0	0	0	459	748
Türkiye	1402	2478	1507	1531	782	1810	2095	993	653	631
Sweden	672	220	635	72	72	114	139	1186	73	544
Hong Kong, China	717	1230	897	505	319	129	259	460	662	538
Australia	5836	1658	857	1541	1128	4518	597	219	411	481

Source: ITC calculation based on BPS – Indonesia statistics

Table 2 provides an overview of the top ten supplier markets of products imported by Indonesia. The data in this table includes the import value (in thousands of US Dollars) for each year from 2013 to 2022. Indonesia's import value for this product increased significantly from 2013 to 2022, reaching USD 511,389 thousand in 2022. Some major trading partners contributing considerably to these imports include India (US$1,957 thousand) and Chinese Taipei (US$1,596 thousand). Taipei, China's contribution varied with the highest value in 2018 and a decline afterward. Singapore (US$1,578 thousand): Despite fluctuations, Singapore remains one of Indonesia's main trading partners for this product. France, Netherlands, Egypt, Turkey, Sweden, Hong Kong, China, and Australia are also significant suppliers with varying contributions, reflecting the diversity of Indonesia's import sources.

Table 3 shows the top ten destination markets for products exported by Indonesia. The data in the table includes export values (in thousands of US Dollars) for each year from 2013 to 2022.

Table 3: Top 10 list of importing markets for a product exported by Indonesia (USS Thousand)

Importers	Exported value in 2013	Exported value in 2014	Exported value in 2015	Exported value in 2016	Exported value in 2017	Exported value in 2018	Exported value in 2019	Exported value in 2020	Exported value in 2021	Exported value in 2022
World	424381	397460	322483	328360	343491	386971	428680	401942	490713	499866
India	3843	9518	11053	19880	19271	7572	22076	21165	37293	64796
Japan	10935	20988	32182	28803	29233	37059	40577	37299	39849	50665
Viet Nam	26184	28257	32804	36869	42463	37099	38992	30102	38952	45146
Korea, Republic of	27253	32649	44353	43879	49803	53550	56566	57033	57294	45038
Singapore	36518	19046	10109	9336	9627	35139	39683	35557	35092	37348
Thailand	14677	11940	7097	13198	16801	21666	28608	32003	42010	32562
Philippines	33912	33960	28392	30983	27841	31867	33463	32006	35173	27197
Australia	18438	17978	7691	9373	11400	18417	18901	19459	21109	20393
United States of America	36	99	27	169	1173	25	651	518	6758	16363
Malaysia	29231	18048	14386	13843	14302	11537	8666	8920	16363	14504

Source: ITC calculation based on BPS – Indonesia statistics

The following are the results of the IIT calculation for 10 of Indonesia's trading partners in 2022 (using the latest data).

Table 4. IIT Export (From Indonesia to Partner Country) Product HS 8418 Refrigerators, freezers, and other refrigerating or freezing equipment, electric or other

No.	Country	Eksport Value (US Dollar)	Total Trade (US Dollar)	IIT Eksport (%)
1	India	64,796	564,662	11.49
2	Japan	50,665	550,531	9.19
3	Viet Nam	45,146	544,012	8.26
4	Korea, Republic of	45,038	544,904	7.85
5	Singapore	37,348	536,294	6.93
6	Thailand	32,562	531,508	5.98
7	Philippines	27,197	526,143	4.83
8	Australia	20,393	518,943	3.80
9	United States of America	16,363	503,913	3.08
10	Malaysia	14,504	501,052	2.66

From the IIT data for exports (from Indonesia to trading partners), several things can be seen that reflect the dynamics of Indonesia's international trade in specific product industries. India, Japan, and Vietnam are the main trading partners showing high IIT levels. This indicates significant intra-industry trade between Indonesia and these trading partners in these product categories. The trend suggests continued reliance on these key trading partners to trade certain industrial products.

Table 5. IIT for Imports (From Trading Partners to Indonesia) IIT for Imports (From Trading Partners to Indonesia) Product HS 8418 Refrigerators, freezers and other refrigerating or freezing appliances, electric or other

No.	Country	Import Value (US Dollar)	Total Trade (US Dollar)	IIT Import (%)
1	India	1,957	513,346	0.38
2	Taipei, Chinese	1,596	512,295	0.31
3	Singapore	1,578	512,367	0.31
4	France	1,549	512,396	0.30
5	Netherlands	1,375	512,570	0.27
6	Egypt	748	513,197	0.15
7	Türkiye	631	513,314	0.12
8	Sweden	544	513,401	0.11
9	Hong Kong, China	538	513,407	0.11
10	Australia	481	513,464	0.09

There are variations in IIT levels between trading partners. Diversifying trade with different trading partners can help reduce the risk of dependence on one or a few specific markets. Countries such as Korea, Republic of Korea, and Singapore show high levels of IIT. This may indicate market potential or successful integration in the production chain with these countries. India, Japan, and Vietnam are trading partners that show high levels of IIT in these product categories. This may indicate dependence on these key trading partners for the supply of these products. High reliance on one or two major trading partners may increase supply risk. Therefore, diversification of supply to different trading partners may be necessary to reduce the risk of supply instability.

The level of imported IIT can provide insights into the quality and price of imported products. Reliance on a particular trading partner may also reflect confidence in product quality or competitive pricing. Based on HS 8418 Product data ("Refrigerators, freezers and other refrigerating or freezing equipment, electric or other"), it can be seen that Indonesia has significant international trade in this product category. Below are some analyses of export and import conditions and their implications:

Export Conditions:

1. Export Market Share: India is the largest trading partner for Indonesia in terms of exports of this product, with a contribution of 11.49%. The significant involvement in the Indian market indicates that Indonesian companies depend highly on demand from this country. Furthermore, there are a variety of other trading partners such as Japan, Vietnam, and South Korea, demonstrating the diversity of the export market.
2. Dependence on Major Trading Partners: India and Japan are major trading partners with significant levels of dependency. This can be a strength or weakness depending on each trading partner's market conditions and stability. This dependency can be a strength if both trading partners have good economic stability, but it can also be a weakness if there are drastic changes in the Indian or Japanese markets.

The implication is that dependence on a few major trading partners can make Indonesia vulnerable to changes in trade policies or economic conditions in these countries. Dependence on India is particularly noteworthy, considering that if there is a change in trade policy or economic turmoil in India, this could significantly impact Indonesia's exports, highlighting the risk of dependence that needs to be considered.
Market Diversification: To mitigate the risk, diversification of export markets is crucial. Efforts must be made to expand into new markets and reduce dependence on one or two major trading partners. Diversification of export markets can be a strategy to reduce risk.

Import Conditions:

1. Level of Import Dependence: Regarding imports, India also stands out as a significant trading partner, albeit with a lower contribution than exports. There is a low level of import dependency from other major trading partners. Although the level of import dependence from India is low, it is still worth keeping an eye on, especially if there is a change in trade policy or supply from India.
2. Variation in Dependency Level: There is variation in the level of import dependence from some trading partners such as Taiwan, Singapore, and France. This reflects the diversity of Indonesia's import sources. Diversity in import sources provides flexibility and resilience to changes in market conditions or international trade policies.

The implication based on the IIT value of imports is that some trading partners' low level of import dependence provides flexibility in responding to changes in markets or international trade policies. Focusing on key trading partners, especially India, requires vigilance against changing conditions in that country. Low import dependency of some trading partners provides flexibility in responding to market dynamics or changes in international trade policies. Awareness of this can be the foundation for an adaptive trade policy. The following implications can be identified:

1. Risk of Dependence on Major Trading Partners:
   - Exports: Significant dependence on India and Japan may increase the risk of economic and trade policy fluctuations in both countries. Sudden changes could have a severe impact on Indonesia's exports.
   - Imports: Although import dependence from India is low, it is still a risk, especially in the event of changes in policy or supply from India.
2. Need for Product Diversification:
   - Exports: The diversity of trading partners in exports suggests that export market diversification policies need to be strengthened. This will help mitigate the potential negative impact of changes in one or two major trading partners.
   - Imports: Diverse sources of imports provide flexibility, reducing the risk of depending on a single source. However, efforts to maintain and improve diversification need to continue.

3. Awareness and Adaptation in Trade Policy:
    - Exports and Imports: Awareness of risks and flexibility in responding to market changes or international trade policies are essential. Adaptive and responsive policy measures are crucial to maintaining Indonesia's trade stability amid global dynamics.

CONCLUSION

Based on ITC data regarding trade in HS 8418 ("Refrigerators, freezers and other refrigerating or freezing equipment, electric or other") products by Indonesia, several essential aspects can be identified. India is the main export trading partner, with a significant contribution (11.49%), indicating a dependency that needs special attention. India also stands out as a significant supplier, albeit with a lower level of dependence. Nevertheless, the diversity of import sources is an important aspect.

In exports, dependence on India and Japan indicates a significant risk to fluctuations in these two countries' economies and trade policies. In imports, insights into the quality and price of imported products can be gained from varying degrees of dependence.

A market and product diversification strategy is essential to mitigate risks that may arise from high dependence on one or two major trading partners. Continuous efforts are required to increase the diversity of import sources and export destinations.

Awareness of risks and the ability to respond to changes in markets or trade policies are essential. Adaptive and responsive trade policies are needed to maintain Indonesia's trade stability in a dynamic global environment. By understanding the IIT data and its implications, Indonesia can take wise steps to improve sustainability and competitiveness in the trade of refrigerator products. Thus, it is necessary to note the overall consequences, namely:

- Importance of Market Diversification: To reduce the risk of dependence on a particular trading partner, diversification of export and import markets should be considered.
- Increased Competitiveness: IIT analysis can provide insights into the competitiveness of Indonesian products in the international market. Export success can be improved by understanding the dynamics of intra-industry trade.

This information can help policymakers formulate strategies to develop the industry, maintain a balanced trade balance, and respond to global market changes. Then, Indonesia can take appropriate measures to improve the industry's competitiveness and deal with international trade dynamics.

While the analysis has provided significant insights into Indonesia's trade dynamics for HS 8418 products, some limitations must be noted. Firstly, the data processing is limited to 2022, and market conditions may change over time. Secondly, reliance on export and

import data alone may not cover the entire picture of supply chains and other economic aspects that affect trade. Furthermore, environmental and sustainability factors, which are increasingly coming into focus, are not covered in detail in this analysis.

Future research could expand the period or investigate long-term trends to provide a more comprehensive perspective. In addition, a deeper dive into the factors that influence dependence on specific trading partners and their potential impact on trade stability could enhance understanding. Research can be expanded to include complete supply chain analyses, including environmental and sustainability aspects, providing a holistic picture of the impact of such products on society and the environment. In addition, comparative research with similar countries could provide valuable additional perspectives for Indonesia's trade policy.

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