

Geographic scope of the global value chain for Indonesian coffee

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ABSTRACT

Through the global value chain (GVC), the coffee sector is expected to meet one of the UN's targets in the SDGs, which is to increase exports from developing countries to help them integrate into the multilateral trading system and benefit from it. Understanding the geographic scope of Indonesian coffee is essential, given that coffee is a pivotal global commodity for Indonesian coffee development. This study aims to analyze the geographic scope of Indonesia's green coffee beans trade and the key factors that determine the flow of this trade. The analytical approach employed is Gereffi's GVC analysis and Gravity Model. The panel data analysis uses bilateral coffee trade flows of 13 trading partners from 2002 to 2021. Analysis shows Indonesia exports most of its coffee to Global North countries, which also function as lead firms. Indonesia's coffee GVC is concentrated at the upstream stages, while complex processing activities occur in advanced countries. According to the gravity model, the significant variables that affect Indonesia's coffee trade flow are the importing country's real GDP per capita, the importing country's population, Indonesia's real exchange rate against the local currency, Indonesia's coffee competitiveness, and the non-tariff measurements for coffee. The potential countries to increase the Indonesian coffee trade are existing coffee markets.

Key words: Coffee export; gravity model; green coffee bean; trade flow; trade potential.

1 INTRODUCTION

The coffee industry is a significant commodity within the Global Value Chain (GVC) framework, and it generates economic benefits throughout the entire chain, connecting producing and consuming countries. From a geographic standpoint, the coffee trade displays a North-South trading pattern and governance structure (Samper; Giovannucci; Vieira, 2017). Most coffee-producing countries rate poorly in economic and social development, with 18 of the 44 International Coffee Organization (ICO) members that export coffee categorized as the least developed countries ICO (2019). In contrast, the primary coffee-importing countries are the Global North countries, the leading firms in the chain with significant influence over the exporting countries. The presence of lead firms is one of the distinguishing features of the global coffee value chain, setting it apart from other forms of international trade.

Coffee is a strategic plantation commodity due to its production in over 50 countries, providing livelihoods for 25 million farmers and their families and serving as a source of income in producing countries. The coffee sector has experienced substantial growth in the last two decades, primarily due to the development of the espresso industry and increased coffee consumption. Despite the Covid-19 pandemic, world coffee consumption in 2022 increased by 3.3 percent to 10.22 billion kg compared to 9.89 billion kg in 2021 (ICO, 2022), expanding coffee production and exports. As only about 30 percent of coffee production is consumed domestically, coffee remains an essential export commodity and a significant source of foreign exchange for many developing countries (Abafita; Tadesse, 2021; ICO, 2020).

Most coffee production occurs in developing countries, with Brazil, Vietnam, Colombia, Indonesia, and Ethiopia

responsible for approximately 73.66 percent of global coffee production. Indonesia is the fourth-largest coffee producer and the second-largest robusta coffee producer globally. Indonesian coffee plantations are dominated by smallholder plantations (95.71 %) with a land area of around 1.23 million ha. Indonesian coffee has the lowest productivity compared to the four other major coffee-producing countries. The estimates the national average coffee productivity to be only 540 kg/ha (ICO, 2019), which is still low compared to its potential. The average yield of coffee farmers has not changed much since 2005, and Indonesian coffee productivity remains low compared to Brazil, which achieves 1,800 kg/ha for Robusta and 1,200 kg/ha for Arabica. Indonesia is not competitive in terms of productivity compared to Vietnam, which can reach 2.85 tons/ha. Vietnam is a major competitor for Indonesia in the global market for high-volume and low-cost Robusta coffee.

In 2023, Indonesia was projected to produce 789.61 thousand tons of coffee beans, which will provide a source of income for 1.86 million farming households (Ministry of Agriculture, 2022). The development of coffee production in Indonesia between the years 1961 to 2020 has witnessed a consistent growth trend, with an average annual growth rate of 3.35% (Food and Agriculture Organization of The United Nations - FAOSTAT, 2019). The highest recorded production volume was in 2020, amounting to 773,409 metric tons of green beans. On the other hand, the volume of Indonesian coffee exports during the same period exhibited fluctuations, but with an overall increasing trend averaging 3.18% per annum. The highest export volume was observed in 2013, with 532,157 metric tons of green coffee beans. Within the last decade (2011-2020), coffee export volume has increased by an average of 4.52% per year, but the export value has experienced a decrease of 1.04% per year.

Through the global value chain, the coffee sector is expected to meet one of the UN's targets in the SDGs, which is to increase exports from developing countries to help them integrate into the multilateral trading system and benefit from it. Coffee exports are a source of foreign exchange and contribute to tax revenue and gross domestic product for many producer countries such as Indonesia. For developing countries, increasing exports is relevant to farmer income and poverty alleviation. Considering the importance of coffee in global value chain development, it would be beneficial to analyze the geographical coverage of Indonesia's coffee trade to understand how it is distributed globally and in which countries different global value chain activities are conducted. Furthermore, the coffee industry plays a significant role in the economy of many countries, including Indonesia. It would be beneficial to analyze the key factors determining the flow of the Indonesian coffee trade, which can affect how and how intensively Indonesian coffee can be integrated into the global value chain to reap the benefits of globalization.

This article aims to analyze the geographic scope of Indonesia's green coffee beans trade and identify the factors that determine the flow of the Indonesian coffee trade. In the following section, we present the material and methods which outlines the review of GVC previous research and the specific formulas employed in this study. Section 3 and 4 contains an in-depth analysis and discussion of the findings, while Section 5 provides the concluding remarks.

2 MATERIAL AND METHODS

2.1 Material

This research covers 20 years, from 2002 to 2021, and secondary data was obtained from various sources, as mentioned

in Table 1. The type of coffee under study is green beans, the most commonly exported coffee from Indonesia (97.17%). Export trade statistics for coffee were obtained from the United Nations Comtrade database at the Harmonized System (HS) 6-digit level, HS 090111 (Coffee; not roasted or decaffeinated). This study examines coffee as a whole since international trade data does not differentiate between Arabica and Robusta varieties. Thirteen destination countries for Indonesian coffee exports were selected, comprising the leading importers of Indonesian coffee and countries with high coffee consumption growth. These countries are the United States, Malaysia, Egypt, Italy, Japan, Germany, the United Kingdom, Russia, India, Belgium, Vietnam, Canada, and the Philippines. Together, these countries contribute up to 70% of the total volume of Indonesian coffee exports.

2.2 Methods

The geographic analysis of GVC in this study was conducted to explain how this industry was distributed globally and in which countries different GVC activities were performed. This geographic scope analysis was examined using the Gereffi approach (Gereffi; Fernandez-Stark, 2016) based on global supply and demand. The geographic study examined trade flows at each value chain stage utilizing production and import-export data.

To analyze trade flows, the empirical framework used in this study was the Gravity Model, which is commonly used to analyze macro-level trade flows between countries using several economic indicators and distance. Seminal studies about the gravity model stated that trade flows from the origin country to the destination country are directly impacted by the trading countries' GDP and physical distance from the economic center (Poyhonen, 1963; Tinbergen, 1962). Thus, the gravity model can generally be formulated as Equation 1:

Table 1: Type of data and data source.

Type of Data (Time series 2002-2021)	Data Source
Volume of green beans exports from Indonesia to importing countries	UN Comtrade (https://comtrade.un.org/data/)
GDP per capita of Indonesia and importing countries	World Bank (https://data.worldbank.org/)
Distance data from Indonesia to importing countries	Centre for Prospective Studies and International Information (http://www.cepii.fr/CEPII/en/)
Rupiah's real exchange rate relative to the currency of importing countries	World Bank (https://data.worldbank.org/)
Population of Indonesia and importing countries	World Bank (https://data.worldbank.org/)
Revealed comparative advantage	Author calculation, data on export value from UN Comtrade (https://comtrade.un.org/data/)
The ratio of TBT and SPS coverage in the destination countries for Indonesian coffee	World Trade Organization (https://www.wto.org/)

$$trade_{ij} = A \frac{(GDP_i GDP_j)^{b_1}}{(distance_{ij})^{b_2}} \quad (1)$$

where $trade_{ij}$ represents the value of commodity trade flow between country i (country of origin) and country j (country of destination), GDP_i and GDP_j represent the size of the economies or national incomes of nations i and j . $Distance_{ij}$ indicates the distance between the capitals of two countries. A is a constant, while b_1 and b_2 are approximated values. According to current study findings, this fundamental model can be expanded by adding market potential as indicated by population, trade obstacles, and exchange rates (Assoua et al., 2022; Gorlich et al., 2020). In some research studies, the traditional *gravity model* was augmented to include a revealed comparative advantage (RCA) index, Malau et al. (2022) found that RCA index has a positive effect on Indonesian plywood exports, while Hosein et al. (2023) indicate that comparative advantage influence export in the agricultural sector. In the case of importing countries, tariff was found to reduce coffee trade as expected significantly (Abafita; Tadesse, 2021), while Nga et al. (2023) found that while agricultural product is affected mainly by tariff measures but for coffee export in Vietnam are particularly sensitive to non-tariff measures. In the case of trade distance between countries, various studies have come up with quite mixed results.

Consequently, following economic theory and the findings of prior research, this study employs the gravity model of international trade with the following Equation 2:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln EDISM_{ijt} + \beta_2 \ln EXR_{ijt} + \beta_3 \ln GDP_{jt} + \beta_4 \ln POP_{jt} + \beta_5 \ln RCA_{ijt} + \beta_6 \ln NTM_{ijt} \quad (2)$$

where i represents the exporting country, Indonesia, j represents the importing country, and t represents the trading year. In the year t , X_{ijt} represents the volume of trade flows of green beans from Indonesia i to the importing country j . The unit of measurement for X_{ijt} is the kilogram. $EDISM_{ijt}$ represents the economic distance between the capital of Indonesia i and the importing country j , which is computed by multiplying the geographical distance (in kilometers) by the world oil price in year t . In the year t , EXR_{ijt} represents the real exchange rate between Indonesia i and the importing nation j . GDP is the gross domestic product per capita of the importing country j in the year t , measured in US dollars. POP_{jt} is the population of the country importing goods in the year t , measured in souls. RCA_{ijt} is the value of Indonesian coffee's competitiveness in importing country j in year t . NTM_{ijt} comprises SPS and TBT. Based on the availability and limits of data, NTM is a dummy variable with a value of 1 if the importing country applies trade barriers to Indonesian coffee in the form of SPS and/or TBT and a value of 0 otherwise. The parameter β is the estimated

explanatory variable's coefficient, while ϵ_{ijt} is the error term. In the model, economic distance and trade obstacles are anticipated to have negative coefficient values, while other factors are expected to have positive coefficient values.

3 RESULTS

3.1 Geographic Scope of The Coffee Global Value Chain

According to the The World Bank (2019), GVCs account for up to half of global trade, whether in value chains that resemble spider webs (parts are produced in different countries and then assembled in a factory in one country) or snakes (value is added in each process or link along the supply chain). The closest GVC type for coffee is a snake-like chain with value added from the country of production to the country of consumption. The world coffee trade can be divided into three primary categories: green beans, roasted, and soluble. In 2021, green bean exports were valued at USD 21 billion, four times higher than in the preceding two decades. Although green bean exports are the most valued, roasted coffee exports have grown faster over the previous two decades (12.86%) (UN Comtrade, 2023).

Most coffee is produced in South America, Central America, Africa, and Asia, where most are developing countries with dense populations, making coffee production labor-intensive. Figure 1 depicts Brazil, Viet Nam, Colombia, Indonesia, and India as the leading coffee-producing countries. Historically, the export trade flow of green beans has been predominantly from the Global South to the Global North. Early stages of the coffee supply chain, including production, harvesting, and post-harvesting, are labor-intensive, whereas later stages, manufacturing processes, are capital-intensive. Producers primarily export coffee as green beans, which account for 90 percent of all coffee exported (ICO, 2020). Then, industrialized countries in the north process these green beans for domestic consumption or re-export as more complex coffee products such as roasted coffee, decaffeinated coffee, and instant coffee.

World coffee export volume increased significantly after the International Coffee Agreement ended the export quota system. Figure 1 shows the development of export volume from the world's leading coffee exporters. The export of green beans is highly concentrated, with these five countries dominating 75 percent of the world's coffee bean exports. It is unsurprising since Brazil, Vietnam, Colombia, and Indonesia are the leading four coffee-producing nations, accounting for over 70% of global coffee production. Although coffee export value has increased, it is more volatile than trade volume due to global coffee prices and the global coffee trade expansion.

The world's coffee production has increased by 43.51 percent over the past 30 years. Because only around 30% of domestic coffee consumption occurs, coffee remains an export good (ICO, 2020). Between 2001 and 2021, Indonesia produced an average of 568 thousand tons of green coffee beans, most of which were Robusta (79.84 percent) and the remainder Arabica. During this period, Robusta and Arabica coffee experienced an average production growth rate of 0.48 percent and 13.11 percent per year, respectively (Ministry of Agriculture, 2021). Although more Robusta coffee is produced in Indonesia, the production share of Arabica coffee increased from 10% in 2000 to 21% in 2020 due to a higher growth rate.

3.2 Geographic scope of Indonesian trade of the coffee global value chain

Indonesia produces coffee almost everywhere in the country (Figure 2). The provinces of South Sumatra, Lampung, and Bengkulu are the most important producers of Robusta coffee. These three provinces account for 69.53 percent of Indonesia's total Robusta coffee output. Aceh, North Sumatra, and South Sulawesi are the production centers for Arabica coffee in Indonesia, accounting for 79.18 percent of total Arabica coffee production in Indonesia. As an archipelagic nation with varying climates between regions, Indonesia produces a variety of coffees with distinct regional origins and flavors.

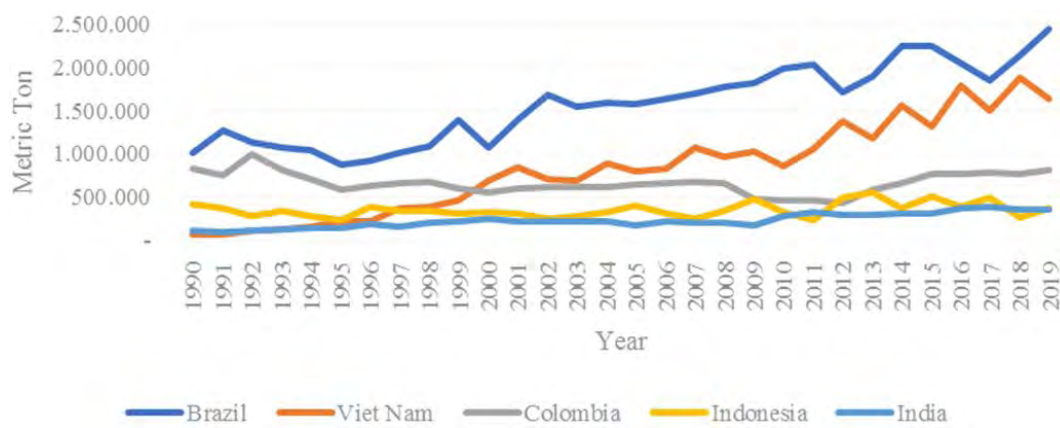


Figure 1: Leading Coffee Exporting Countries Worldwide between 1990 and 2019.

Source: Author's analysis based on ICO (2023).

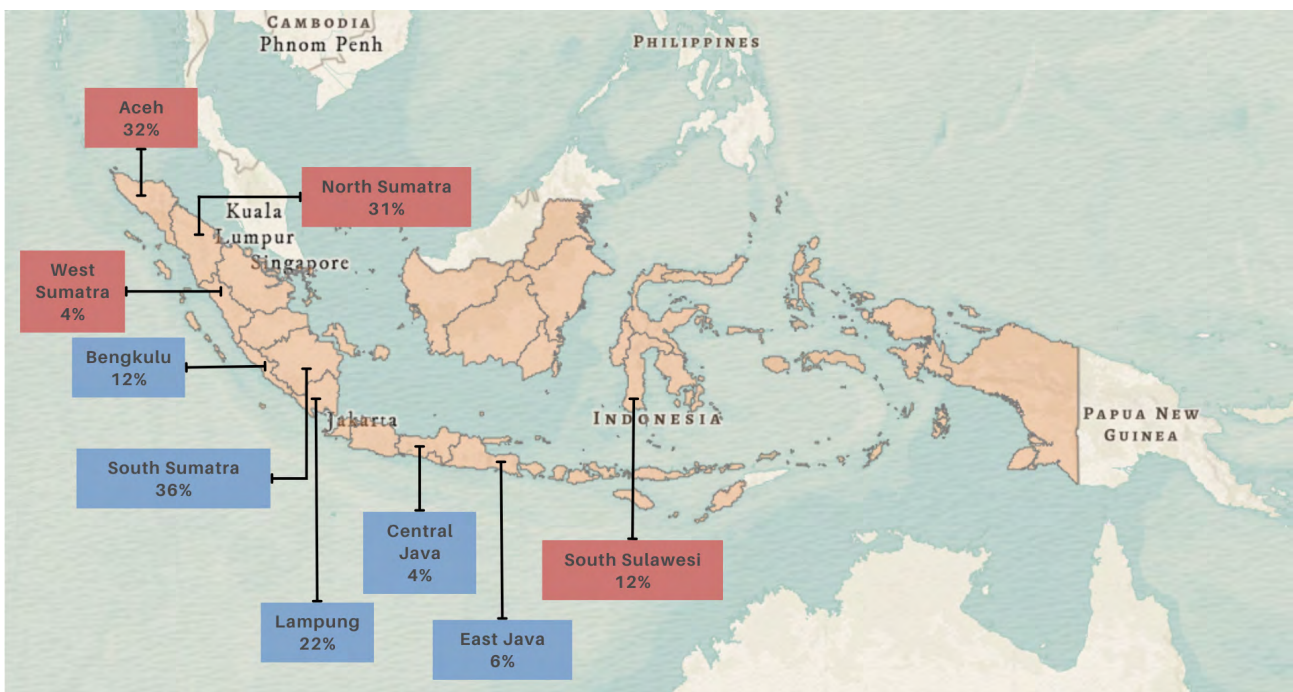


Figure 2: Geographic Scope of National Level for Indonesian Robusta and Arabica Coffee.

Source: Author's analysis based on Statistics Indonesia (2022) data.

Around 65 percent of Indonesia's production of green beans was destined for export to consumer countries in 2017. In 2021, Indonesia exported green beans, roasted coffee, and instant coffee with export volume shares of 91.27 percent, 0.47 percent, and 8.25 percent, respectively. From a geographical perspective, most of Indonesia's coffee is exported in the form of green beans to countries such as the United States, Malaysia, Egypt, Italy, Japan, Germany, United Kingdom, Russia, India, and Canada, as part of the global coffee value chain (Figure 3). Regarding volume, the United States, Malaysia, and Egypt are the most prominent destinations for Indonesia's green beans export. In terms of value, the United States is the largest market for Indonesia's green beans export, followed by Japan, Egypt, and Malaysia (UN Comtrade, 2023). The most significant export flows of coffee from Indonesia are to the United States and Europe, with export shares of 25.75 percent and 23.48 percent, respectively. Both regions are countries in the Global North with high per capita consumption and advanced coffee processing industries. Malaysia, Thailand, Timor-Leste, Hong Kong, and Brunei Darussalam are the leading destinations for Indonesia's roasted coffee exports, while the Philippines, Malaysia, the United Arab Emirates, China, and Iran are the largest export markets for Indonesia's instant coffee. The export flows for roasted coffee to these top five countries reached 95.34 percent, while for instant coffee, it reached 86.37 percent of the total coffee exports.

According to the data, green beans are the most exported form of coffee from Indonesia to the rest of the world. Based on the group indicator criteria, the exported Indonesian coffee belongs to the Robusta group in grade 4. Comparatively, the

same group contains Vietnamese coffee of grade 2, Ivory Coast coffee of grade 2, and Ugandan coffee of its own standard. It indicates that Indonesian green beans are of inferior quality. The government has eliminated the export tax on coffee to support the export performance of Indonesian green beans and enhance price competitiveness (Sahat; Nuryartono; Hutagaol, 2016).

In order to meet domestic demand, Indonesia has resorted to coffee imports. Notably, more than half of the imported coffee is instant, primarily from Brazil, Malaysia, and India. In addition, Vietnam, Brazil, and East Timor supply 45 percent of the imported green beans. The remaining two percent of imported coffee comprises roasted beans from Malaysia and the United States. Several factors have contributed to the rise in coffee consumption in Indonesia, including the expansion of the downstream coffee industry, the proliferation of international coffee chains and local franchises, changes in lifestyle, and increased consumer awareness and education regarding coffee (Purnomo et al., 2021; Utama et al., 2021). The average growth rate of coffee consumption in Indonesia over the past decade has been approximately 0.37 percent per year, but in the last three years, the annual growth rate has increased to 2 percent (Statistics Indonesia, 2022).

Indonesia's coffee industry is still at the beginning of the value chain, from the production process to the early stages of processing into green beans (Figure 4). The largest value-added of coffee lies in downstream activities, namely advanced processing and distribution. The fact that most of Indonesia's exports are green beans indicates a technology gap, resulting in coffee being traded as a bulk commodity rather than a product with added value.

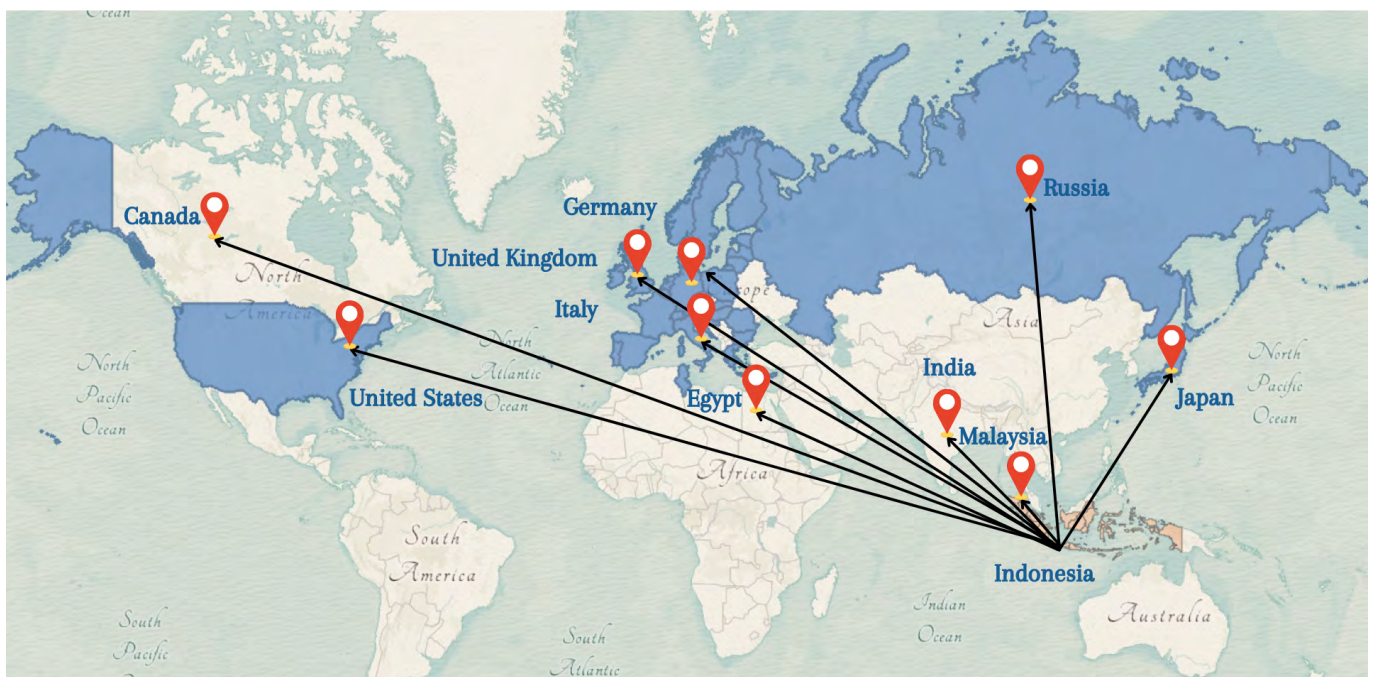


Figure 3: Geographic Scope of Indonesian Green Beans in the Coffee Global Value Chain.

Source: Author's analysis based on UN Comtrade (2023).

3.3 Factors that determine the flow of Indonesian coffee trade

The best model was obtained through a panel data estimation approach with the Fixed Effect Model (FEM), using the Panel Estimated Generalized Least Square (Panel EGLS) method with Cross-section SUR weighting. The estimation results of the model can be seen in Table 2. Based on the analysis, the panel regression provided satisfactory results, as indicated by the goodness of fit indicator. The estimated model results have a significant F-statistic probability value and a high R-square value. Based on the analysis results, it can be seen that out of the six independent variables in the model, five variables are significant, except for the economic distance between Indonesia and the export destination country.

The estimation results in Table 2 show that the coefficient of the economic distance variable between Indonesia and the

importing country does not match the hypothesis and does not have a significant effect at the 10% level. On the contrary, the importing country's GDP coefficient is positive and statistically significant. The coefficient of 2.57 for importers' GDP indicates that a one percent increase will result in a 2.57 percent increase in Indonesian coffee exports, *ceteris paribus*.

According to the analysis findings, the coefficient of the rupiah exchange rate against the local currency unit (LCU) and the population of Indonesia's trading partners is positive and significantly impacts the flow of the Indonesian coffee trade. Concerning the implementation of non-tariff measurement of green beans in importing countries, the estimation results demonstrate a significant and negative impact on the flow of the Indonesian coffee trade. The results of the analysis show that the coefficient of Indonesia's coffee competitiveness in importing countries is positive and statistically significant. It is in line with the research hypothesis.

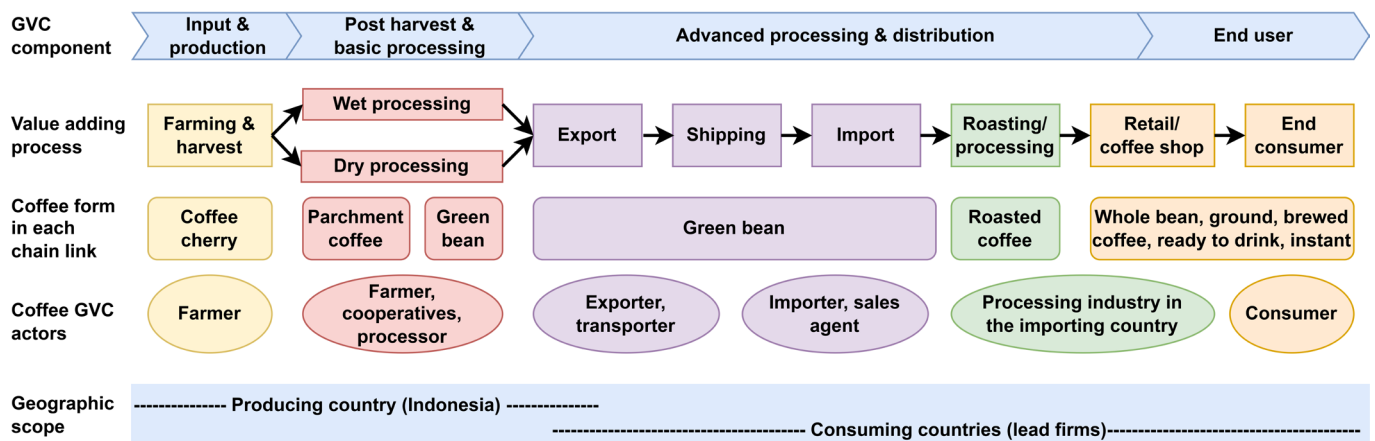


Figure 4: Trade flow perspective on Indonesian Coffee Global Value Chain.

Source: Author's analysis.

Table 2: Estimation of Indonesian Coffee Export Flow Model to Major Export Destination Countries.

Variable	Coefficient	t-Stat	Prob.
Economic distance between Indonesia and importers	0.095397	1.519225	0.1300
Real GDP per capita of the importing country	2.566529	21.23278	0.0000
The population of the importing country	1.957964	9.126403	0.0000
Real exchange rate of the Rupiah against the LCU	0.244823	2.709987	0.0072
Revealed Comparative Advantage (RCA)	0.958128	53.24386	0.0000
Non-tariff measures (NTM)	-0.094733	-7.995570	0.0000
Constant	-21.52401	-13.64884	0.0000
Weighted Statistics:			
R-squared	0.990437		
Adjusted R-squared	0.989723		
F-statistic	1386.716		
Prob(F-statistic)	0.000000		
Durbin-Watson stat	1.769003		

Source: Author's computation.

Indonesia might expand its global coffee market share as demand rises. In order to optimize opportunity, it is important to understand the Indonesian coffee trade's potential in exporting countries. Coefficient estimations from the last gravity model equation can predict Indonesian coffee trade volumes. By comparing expected quantities with actual volumes, Indonesian coffee trade potential in export destination nations can be determined. If the value of the trade potential ratio exceeds one, it can be interpreted as an opportunity for expanding trade with that country.

The analysis shows six countries have potential trading ratios below one or over trade (Table 3). Most of these countries are middle-income countries, such as Malaysia, Egypt, India, Vietnam, and the Philippines. The potential trading ratios in seven high-income developed countries' export destinations exceed one or under trade.

4 DISCUSSIONS

For Indonesian coffee GVC, importing countries are lead firms that have the power to control Indonesian farmers and producers in producing coffee in the field, as these actors have closer relationships with end consumers. Suryana et al. (2023a) stated that the lead firms responsible for the Indonesian coffee industry could be a worldwide exporter, an international coffee processing corporation, or a global network of coffee shops. Within the value chain governance conducted by these lead firms, the development of coffee products meeting particular criteria and standards is an integral component.

The leading importers of Indonesia's green coffee beans are the United States, Malaysia, Italy, Japan, and Germany.

From 2017 to 2021, the import volume from these countries accounted for 51.72 percent of the total imported green beans. The importers of Indonesian green beans are mainly from developed countries, as these beans will be processed into more complex forms by coffee processing industries that require high capital and technology support. This capital support is crucial for the coffee processing industry, which tends to be downstream in the value chain. It aligns with the findings of Becerra-Fernandez, Cosenz and Dyer (2020). This places Indonesia in a disadvantaged position within the GVC, as the Indonesian coffee industry is concentrated in the early stages of the value chain, which include the coffee production process and the initial transformation of coffee beans into green beans, as illustrated in Figure 4. While the major value addition within the coffee industry is concentrated in downstream activities.

Since the added value is concentrated in importing countries that carry out further coffee processing, Indonesia needs to change its paradigm from volume to value, shifting its focus from quantity to value. Suryana et al. (2023b) propose various strategies to enhance the competitiveness of Indonesian coffee. These include improving quality through post-harvest processes, differentiating the coffee product, and expanding market strategies by developing instant and roasted coffee for domestic and international markets while exploring new coffee chains and penetrating new markets with coffee beans or roasted coffee. It supports Gizaw et al. (2022) study, which suggests that adding value to coffee beans before exporting can result in more significant long-term economic growth. Until now, because Indonesia's domestic coffee industry is not yet fully developed, green beans remain the main export commodity for Indonesia.

Table 3: The potential of Indonesian coffee trade in export destination countries.

Destination Countries of Indonesian Coffee Exports	Average Trade Potential Ratio	Trade Potential
United States	1.26	Under trade
Malaysia	0.77	Over trade
Egypt	0.86	Over trade
Italy	1.08	Under trade
Japan	1.00	Under trade
Germany	1.13	Under trade
United Kingdom	1.25	Under trade
Russia	1.07	Under trade
India	0.94	Over trade
Belgium	0.96	Over trade
Vietnam	0.66	Over trade
Canada	1.23	Under trade
Philippines	0.71	Over trade

Source: Author's calculation.

Most countries where Indonesia exports coffee have experienced a yearly decrease in export value (UN Comtrade, 2023). However, some exceptions, such as Egypt, India, Vietnam, and the Philippines, have shown positive export growth. It is likely because these countries have a higher consumption growth rate than developed nations. The ICO (2021) data supports this trend, suggesting that Africa and Asia are emerging markets for coffee due to population growth and potential increases in coffee consumption. Although per capita consumption rates in these regions remain low, at approximately 0.5 kg, the consumption growth rates in Asia and Africa have been notably higher than the global average over the long term. As a result, Indonesian coffee has considerable potential to be exported to these regions. The prevalence of instant coffee and the growing presence of large industries in Asia and Oceania that rely heavily on Robusta coffee make these regions a promising market for Indonesian coffee, typically dominated by Robusta beans.

The leading importers of Indonesian roasted coffee are Malaysia, Singapore, Hong Kong, Thailand, and Japan. During 2017-2021, the import share of these five countries was 86.58% of the total imported Indonesian roasted coffee worldwide. Indonesian instant coffee is in demand in the Philippines, Malaysia, Singapore, Japan, and Hong Kong. The import share of these countries for Indonesian instant coffee is 16.78% of the total global imports. For the Asian region, Japan has the highest consumption, and the Philippines is in third place. The production growth rate of Philippine coffee decreased by 15.9% per year, while the consumption growth rate increased by 1.9% per year (ICO, 2021), making the Philippines a potential market for instant coffee. According to the Ministry of Industry of Indonesia, processed coffee products such as instant coffee, extract, essence, and concentrate are exported mainly to ASEAN countries, China, and the United Arab Emirates. Therefore, Indonesia can potentially export its processed coffee to these countries.

However, there is another important aspect to consider. Historically, the domestic industry primarily processed green beans that were not exported for consumption within the local market. Nevertheless, with the increase in coffee consumption in Indonesia due to the proliferation of local retail and cafes, the domestic industry is growing, and there is a slow increase in demand for green beans for domestic processing. This is evidenced by the decreased proportion of Indonesian green beans exported to its production volume. In 2019, the green beans exported were 47.71 percent, while a decade earlier, it was 63.51 percent of Indonesia's total production. Indonesia's coffee consumption in 2020 was 0.56 kg per capita for ground coffee and 1.12 kg for instant coffee (Ministry of Agriculture, 2021). It is still relatively low compared to other coffee-consuming countries. However, between 2015 and 2019, 43 percent of Indonesia's coffee production was

consumed domestically, up from only 20 percent in the 1990s (ICO, 2020). This highlights the importance of bridging the gap between the future coffee supply and the demand in the domestic and export industries. As global coffee processing and consumption grows, producing countries gradually increase their consumption. With the development of the coffee GVC, the difference between producing (exporting) and consuming (importing) countries is becoming less clear, and the pattern of coffee supply and demand is slowly changing.

Regarding the determining factors of Indonesian coffee trade flow, the estimation results indicate that the distance between Indonesia and the export destination country does not affect the flow of the Indonesian coffee trade. This finding indicates that despite the increase in transportation costs due to distance, Indonesian coffee beans are still needed by importing countries. It can be explained by the fact that the global coffee value chain has a North-South governance structure, where coffee producers are located in the southern hemisphere, and coffee consumers are located in the northern hemisphere. The United States, Egypt, Italy, Germany, the United Kingdom, Russia, and Belgium are among the top ten major export destination countries for Indonesian coffee in the northern hemisphere, far from Indonesia. Since distance is not significant in Indonesian coffee exports, it can be concluded that transportation costs do not hinder trade with these countries. These importing countries are coffee-consumer countries that do not produce coffee, so they need Indonesian dried coffee beans for their downstream industry. This finding confirms the results of Kareem (2016) study.

GDP variable indicates the size of the economy, the size of the market, and the demand-side effects of importing countries, all of which influence their people's purchasing power and consumption capacity concerning Indonesian coffee. The estimation results indicate that GDP is a variable that significantly affects export commodity trade flows and that a rise will follow an increase in importer purchasing power in Indonesian coffee exports. This result is consistent with the findings of prior studies (Abafita; Tadesse, 2021; Benavidez; Xia, 2022; Eshetu; Goshu, 2021). According to research conducted by Satriana, Harianto and Priyarsono (2019) using the gravity model, the importing country's GDP positively affected coffee exports between Indonesia and five trading partners from 2000 to 2015.

The population of trading partners reflects the size of the importer's market as measured by the public consumption capacity. The larger the population, the greater the likelihood it will consume agricultural products so that these countries will import more coffee from Indonesia. This result is consistent with the study findings of Nam and Huong (2021). Regarding the population of countries that import coffee, China and India have the largest populations in the world, with over one billion people. The United States, Brazil, Russia, Japan, the

Philippines, and Egypt all have populations greater than 100 million. Only Russia and Japan experienced declining growth, so countries importing Indonesian coffee represent future trade opportunities. According to the analysis findings, if the Rupiah weakens, the price of Indonesian coffee will fall relative to other coffees, causing importers to purchase more Indonesian coffee. It suggests that the depreciation of the Rupiah's exchange rate will increase its export competitiveness, increasing Indonesia's coffee exports.

Non-tariff measures (NTM) are trade barriers more frequently imposed on agricultural goods than manufactured goods. The export volume of Indonesian green beans will decrease due to the implementation of NTM, compared to a scenario in which NTM is not enforced. This finding is consistent with Gowri, Shivakumar and Padmarani (2022) and Kareem (2016) research. NTM raises production costs, which are reflected in higher prices for consumers. The cost increase depends on the stringency of the measures implemented, the application of the NTM, the nature of the supply chain for agricultural products, and the level of compliance on the domestic market. In this study, TBT and SPS constituted the non-tariff barriers for coffee beans. Due to Japan's implementation of non-tariff barriers, Indonesia has encountered trade barriers. In 2010, 1.17 percent of Indonesian coffee exported to Japan was tainted with carbaryl pesticides, causing Indonesian coffee to be rejected in Japan due to SPS/TBT regulations (Manalu et al., 2019). Unless measures are taken to prevent a recurrence, Indonesian trade will be harmed by non-tariff barriers imposed by importing nations. Non-tariff barriers can be viewed as trade restrictions or a challenge to increase the competitiveness of Indonesian coffee by increasing the quality of its products in response to market demand, for instance, by implementing certification that can increase the quality and price of Indonesian coffee on the global market.

RCA is one of the analysis tools to measure a country's comparative advantage based on its trade patterns. From 2002 to 2021, Indonesia's coffee competitiveness had a comparative advantage in the world market, with an average RCA value of 5.77. A value of RCA greater than one provides information that the share of coffee in Indonesia's exports of all commodities is greater than the share of coffee in the value of exports of all commodities to all countries in the world. This confirms the research of Manalu et al. (2019). The calculation of RCA shows that in this study period, Indonesia has a fluctuating export performance competitiveness with an average positive growth rate of 1.54% per year. Since 2020, Indonesia's competitiveness has decreased due to the Covid-19 pandemic, which has caused a decline in coffee exports due to disruptions in international trade. Overall, Indonesia's RCA value is above one because coffee is a major export commodity for Indonesia.

The United States, the United Kingdom, and Canada have the highest potential trading ratios and are experiencing

the most under-trade compared to other countries (Table 3). The United States is the world's largest coffee importer and the largest destination for Indonesian coffee exports. Although coffee imports to the United States have declined globally, Indonesia can still increase its trade. Indonesia's share of coffee exports to the United States was around 3.68 percent in 2021, with a decline of -6.59 percent yearly since 2017 (ICO, 2023). The coffee market in the United Kingdom is rapidly growing and has the fifth-largest coffee market share in Europe after Germany, Italy, France, and Spain. Throughout 2021, the United Kingdom imported coffee from around the world, reaching 148.2 million kg, but Indonesia only contributed 13.6 million kg or 9.20 percent of the UK coffee market share (ICO, 2023). Although Canada is a destination for Indonesian exports with a relatively small amount, Indonesia's coffee exports to Canada have been rapidly increasing in the past decade. It is partly due to Canada being one of the countries with the highest coffee consumption growth rate, at 1.6 percent per year (ICO, 2021). From the analysis, Indonesia can potentially expand its trade in these developed countries. Although developing countries in Asia are potential new markets, such as the Philippines or Malaysia, this research indicates that their trading potential is already saturated. It is partly due to the form of Indonesian coffee exported to the Philippines, which is primarily instant coffee. The Philippines is the main destination for Indonesian instant coffee exports, with a volume of 12 million kg in 2021, while green beans export is only around 2.6 million kg.

5 CONCLUSION

From a geographical coverage analysis at the national level, the production centers of Indonesian coffee are located on the islands of Sumatra, Java, and Sulawesi. The geographical coverage of Indonesian coffee in the global chain shows the flow of coffee trade in the form of green beans, especially to the United States, Malaysia, and Egypt. The export flow of Indonesian roasted coffee is to Malaysia, Thailand, and Timor-Leste. As for instant coffee, the main export destinations are the Philippines, Malaysia, and the United Arab Emirates. The role of countries in the global coffee value chain has not changed much, with advanced and high-income countries generally engaged in further processing activities, where they heavily rely on importing green coffee beans from producer countries, most of which have middle and low incomes.

To further integrate Indonesian coffee into the global value chain, it is necessary to pay attention to the factors that determine the flow of the coffee trade. The analysis results show that all variables except the economic distance variable are significant. Therefore, the proposed strategies are as follows, Indonesia needs to enhance the competitiveness of Indonesian coffee in importing countries. Additionally, to counteract the implementation of non-tariff measures on coffee in importing nations, Indonesia should anticipate these

challenges as part of the effort to improve the competitiveness of Indonesian coffee on the international stage. In the strategy to enhance coffee trade, the potential countries remain the same as Indonesia's current coffee markets, which are high-income developed countries.

A shortcoming of this research is that it only includes green beans in the quantitative trade analysis. In the future, further research is needed to explore the potential for coffee trade in other forms, such as roasted or instant coffee, that were not covered in this study.

6 AUTHORS' CONTRIBUTION

ATS wrote the manuscript and performed the experiment, H and H supervised the experiment and co-work the manuscript, and YS and H review and approved the final version of the work, ATS conducted all statistical analyses.

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