

The Competitiveness and Efficiency of Coffee Trade: Like-Minded Countries to European Union

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ABSTRACT

Coffee is a key commodity in international trade, particularly within the European Union (EU), which serves as the primary market for countries in the Like-Minded Countries (LMC). However, trade restrictions, particularly those related to environmental policies, have emerged as significant barriers to agricultural trade, including coffee exports. As LMC countries remain major suppliers to the EU, it is crucial to examine the factors influencing coffee's competitiveness and untapped export potential. This study analyzes the competitiveness and efficiency of coffee exports from 16 LMC to the EU between 2013 and 2022. The analysis employs several methodologies, including Revealed Comparative Advantage (RCA), Export Product Dynamics, the X-Model, and Stochastic Frontier Analysis (SFA). The findings reveal that LMC that adapt to stricter sustainability standards and increase transparency in their supply chains can increase competitiveness. Empirical estimates indicate that the EU's Gross Domestic Product (GDP) positively influences coffee imports, while economic distance, exchange rates, and coffee import prices have a negative impact on import volumes. Additionally, the study highlights a significant gap between actual and potential coffee imports, suggesting opportunities for greater import efficiency. Based on these findings, it is recommended that LMC countries enhance coffee quality through sustainability certifications, capitalize on Free Trade Agreements (FTA), and improve trade infrastructure to reduce logistical barriers and transaction costs, thereby maximizing export potential to the EU.

Key words: Comparative advantage; European Union; like-minded countries; potential analysis; stochastic frontier.

1 INTRODUCTION

Global coffee consumption has significantly increased in recent decades. Syofya (2023) mentioned that coffee is one of the leading commodities traded, showing a continuously increasing trend in world demand. According to data from the International Coffee Organization (International Coffee Organization - ICO, 2023), global coffee consumption reached 175.6 million 60 kg bags in 2021-2022. As the world's largest coffee importer, with a market share of 35.89%, the European Union imported 1.4 million bags of roasted coffee from 2022–2023, as well as 3.7 million bags of soluble coffee, which has increased significantly, with a trade value of USD 10.95 billion (European Coffee Federation, 2024). Marinache (2024) noted that coffee consumption in the European Union has been growing continuously since 2010, reflecting increased consumer preferences.

Most raw coffee imported by the European Union (EU) comes from non-EU countries, particularly developing nations. However, recent environmental policies implemented by the EU have had a detrimental impact on its coffee suppliers. One such policy is the European Union Deforestation-Free Regulation (EUDR), which aims to address environmental concerns but has sparked significant opposition. In response, a coalition of 16 Like-Minded Countries (LMC), including Indonesia, Argentina,

Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, Ghana, Guatemala, Honduras, Malaysia, Mexico, Nigeria, Ivory Coast, Peru, and Thailand, has emerged to protest the regulation (Akdogan; Cazzini, 2025; Weber, 2023). This resistance reflects the growing discontent with the European Commission, particularly as trade data from 2012 to 2023 reveals a notable decline in coffee exports. According to UN Comtrade (2025), 16 of LMC collectively account for 44.96% of coffee exports to the EU. Given the critical role of LMC countries in the European coffee market, it is essential to assess their competitiveness, taking into account factors such as the EU's Gross Domestic Product (GDP), economic distance, import prices, exchange rates, Free Trade Agreements (FTA), language similarity, landlocked status, and the prices of substitute products, such as tea.

Several studies have examined the comparative advantages of coffee from LMC, including Indonesia (Suryana et al., 2024; Innayatuhbah; Rahayu; Ferichani, 2024; Syahputri; Hasnah; Khairati, 2023; Sulistiyo; Kusnaman; Wijayanti, 2023; Syofya, 2023; Sitanini, 2022; Pratita; Budiarto, 2021; Zuhdi; Yusuf, 2021; Rahardjo et al., 2020), Malaysia (Omar et al., 2022), Thailand (Sitikarn et al., 2022), and Brazil (Santoso, 2022; Copetti; Coronel, 2019a; Copetti; Coronel, 2019b; Mariano; Braga, 2022; Matos; Braga, 2020). Similar advantages have been identified in Andean countries such as Argentina, Bolivia, Colombia,

Ecuador, and Peru (Majcher, 2020; Cristina et al., 2022; Jiménez et al., 2023; Morales et al., 2024; Cerquera; Pérez; Sierra, 2020; Muñoz-Belalcázar et al., 2021). Research has also highlighted these benefits in Central American countries like Guatemala and Honduras (Rosiana et al., 2017; Gois; Thomé; Balogh, 2023; Enríquez; Retes-Cálix; Vásquez, 2020; Rodrigues et al., 2024). In Africa, studies by Eponon et al. (2023), Pelupessy (2018), and Torok, Mizik and Jambor (2018) have explored the comparative advantages of coffee production in Nigeria, Ghana, and the Ivory Coast.

However, until now, no comprehensive study has compared the competitive position of coffee from the 16 countries that make up the LMC with that of the world's largest coffee market, the European Union. This comparison is crucial for understanding the dynamics that shape trade strategies and identifying potential inefficiencies in export performance, particularly in light of emerging trade barriers and shifting global demand patterns. By addressing this gap, the study aims to analyze the competitive position and factors influencing the flow of LMC' coffee trade in the European Union. This research is expected to provide valuable insights for policymakers and coffee industry players in the formulation of more effective export strategies while strengthening the competitiveness of LMC coffee in the global market. In the second section, we explain the materials and methods used in this study, detailing the formula used to measure LMC' competitiveness and trade flows. The third and fourth section analyze and discuss the findings in detail, whereas the fifth section summarizes the key findings of this study.

2 MATERIAL AND METHODS

2.1 Material

This study utilizes panel data, combining time-series data from 2013 to 2022 with cross-sectional data from 16 Like-Minded Countries. The study is divided into two periods: 2013-2017, when the EU focused on post-crisis economic stabilization and the digital single market, and 2018-2022, when EU policies expanded to include stronger environmental protections, such as anti-deforestation regulations. The analysis focuses on coffee classified under the four-digit HS code HS 0901. Since international trade data does not differentiate between robusta and arabica varieties, this study considers all coffee types collectively. The data used in this research comes from secondary sources, including UN Comtrade (<https://comtradeplus.un.org/>), the International Coffee Organization (ICO) (<https://icocoffee.org/>), and the World Bank (<https://data.worldbank.org/>) (World Bank, 2025).

2.2 Methods

2.2.1 Analysis of competitiveness LMC's coffee in the EU

This study employs the revealed comparative advantage (RCA) approach, which was designed by Balassa (1965). RCA is used to determine the coffee export performance of LMC by comparing the proportion of total exports of these commodities with their export share in global trade against total exports in the European Union via the following [Equation 1](#):

$$RCA_{ij} = \frac{(X_{ij} / W_{ij})_t}{(X_{wj} / W_{wj})_t} \quad (1)$$

Where RCA_{ij} is an index taking a value between zero and infinity ($0 \leq RCA_{ij} \leq \infty$). When the RCA index is above 1, the share of coffee products in the total exports of the LMC is greater than the average share of these products in world exports, which means that the LMC have a comparative advantage and strong competitiveness in the European Union. The opposite is true when the RCA index is less than 1.

The export product dynamics (EPD) method analyzes LMC coffee trade performance with the European Union. EPD can estimate whether the performance of coffee is dynamic or static by examining the continuity of its exports ([Table 1](#)).

Table 1: EPD market positioning matrix.

Share LMC in EU	Share coffee LMC in EU	
	Dynamic (+)	Stagnant (-)
Competitiveness (+)	Rising star	Falling star
Non competitiveness (-)	Lost opportunity	Retreat

Source: Esterhuizen, (2006).

The four market position categories in Table 1 are visualized in a scatter plot, where the X-axis represents business strength or export market share growth, and the Y-axis represents market attractiveness or product market share growth. The quadrants are defined as follows:

Quadrant I (Rising Star): Dynamic LMC commodities that are competitive in the EU market. Quadrant II (Falling Star): Increasing trade volume but lacking competitiveness. Quadrant III (Lost Opportunity): A decline in market expansion potential. Quadrant IV (Retreat): A reduced willingness of LMC to enter the EU with the following EPD [Equation 2 and 3](#):

$$X - Axis = \frac{\sum_{t=1}^t \left(\frac{X_{ijk}}{X_{wjk}} \right)_t \times 100\% - \sum_{t=1}^t \left(\frac{X_{ijk}}{X_{wjk}} \right)_{t-1} \times 100\%}{T} \quad (2)$$

$$Y - Axis = \frac{\sum_{t=1}^T \left(\frac{W_{ij}}{W_{wj}} \right)_t \times 100\% - \sum_{t=1}^T \left(\frac{W_{ij}}{W_{wj}} \right)_{t-1} \times 100\%}{T} \quad (3)$$

Where X_{ijk} is the export value of commodity k of country i in country j (USD), X_{wjk} is the world export value of commodity k in country j (USD), W_{ij} denotes the total export value of country i 's commodity in country j (USD), W_{wj} stands for the total value of world commodity exports in country j (USD), and T is the number of years of analysis, namely 10 years, while t is the analysis period, namely 2013–2022. Further, j represents the European Union and i represents 16 LMC.

The X-Model method is used to identify the potential for developing the coffee export market of LMC in the European Union by comprehensively assessing comparative and competitive advantages (Meliany; Novianti, 2022; Sembiring; Syaukat; Hastuti, 2021). This method integrates the RCA analysis with the EPD analysis to evaluate coffee competitiveness from two perspectives. By combining these approaches, the study provides a more thorough assessment of market potential and trade dynamics, making the analysis more comprehensive (Table 2).

Table 2: X-Model clustering.

RCA	EPD	Market Position
RCA > 1	Rising star	Optimistic
	Lost opportunity	Potential
	Falling star	Potential
	Retreat	Less Potential
RCA < 1	Rising star	Potential
	Lost opportunity	Less Potential
	Falling star	Less Potential
	Retreat	No Potential

Source: Meliany and Novianti (2022).

2.2.2 Analysis of efficiency and potential LMC's coffee in the EU

The empirical model estimation, which focuses on the determinants of EU coffee import demand from LMC, uses the stochastic frontier analysis (SFA) approach with the maximum likelihood estimation (MLE) method. This regression technique addresses the problem of heteroskedasticity and estimates the efficiency of EU coffee exports and the potential for EU coffee imports from LMC. The coffee import quantity (MCOF) is used as the dependent variable. When SFA is added to the panel data regression model, the SFA model formula of import demand minus V_{ijt} is formulated as Equation 4:

$$\begin{aligned} \ln MCOF_{jt} = & \beta_0 + \beta_1 \ln GDP_{jt} + \beta_2 \ln DIST_{ajt} + \beta_3 \ln EXCR_{ajt} + \\ & + \beta_4 \ln PM_{jt} + \beta_5 \ln PY_{jt} + \beta_6 \ln FTA_{ajt} + \beta_7 \ln LANG_{aj} + \beta_8 LL_a + \\ & + \varepsilon_{ajt} - V_{ajt} \end{aligned} \quad (4)$$

In the SFA model, the independent variables include the European Union's gross domestic product (GDP), economic distance (DIST), exchange rate (EXCR), coffee import price (PM), price of substitute products in the form of tea (PY), free trade area (FTA), language similarity (LANG), and landlocked (LL). The constant is denoted as β_0 , and the coefficient of each equation is β_1 to β_8 . β_1 , β_5 , β_6 , and $\beta_7 > 0$. β_2 , β_3 , β_4 , $\beta_8 < 0$. ε_{jt} is defined as a two-sided error term, which considers statistics calculated via residual estimation. $N(0 \sim \sigma^2)$ represents a one-sided error term, which is assumed to follow a normal distribution. $N(\mu \sim \sigma^2)$ indicates the measurement of technical inefficiency. $\phi(\cdot)$ represents the density function, and γ indicates the efficiency estimate with a value between 0 to 1. A value closer to 1 indicates higher efficiency, while a value closer to 0 indicates lower efficiency. The technical efficiency is calculated as described by Battese and Coelli (1995) as Equation 5.

$$E[EXP(-V_{ijt}) | e_{ijt} + V_{ijt}] = \frac{1 - \phi[\sigma_* + \gamma(e_{ijt} + V_{ijt}) / \sigma_*]}{1 - \phi[\gamma(e_{ijt} + V_{ijt}) / \sigma_*]} \cdot \exp[\gamma(e_{ijt} + V_{ijt}) + \frac{\sigma_*^2}{2}] \quad (5)$$

Efficiency is obtained from the ratio of actual to potential import values. The potential value is calculated as the difference between actual and predicted values. The actual value represents the observed trade value, considering existing barriers, while the predicted value represents the trade value without barriers. A higher actual value compared to the predicted value indicates smaller trade barriers, whereas a lower actual value compared to the predicted value suggests larger trade barriers.

3 RESULTS

3.1 Analysis of the Competitiveness of LMC Coffee in the European Union

The trend in competitiveness through the RCA analysis of coffee from LMC in the European Union from shows Brazil's RCA increased from 21.94 in 2013 to 28.84 in 2020 but slightly declined to 28.65 in 2022. Colombia experienced a significant rise from 22.80 in 2013 to 62.51 in 2021 before dropping to 40.45 in 2022. Other countries, such as Guatemala and Honduras, showed greater fluctuations. Guatemala peaked at 79.08 in 2013, dropped to 42.25 in 2020, and slightly recovered to 48.51 in 2022. Honduras had a high RCA of 208.62 in 2014 but experienced a sharp decline, reaching 0 in 2022. Indonesia, which started at a lower RCA of 7.40 in 2013, showed large fluctuations and recorded 4.04 in 2022.

The export product dynamics (EPD) scatter plot of coffee from LMC in the European Union during 2013–2017 and 2018–2022 reveals significant changes in market position. In 2013–2017, Brazil and Colombia were in a retreat position but shifted to rising stars in 2018–2022, indicating improved competitiveness. Indonesia and Peru moved from retreat to lost opportunity, reflecting a decline in market strength. Argentina, Bolivia, and Ivory Coast remained in the falling star category, showing persistent challenges in competitiveness. In contrast, Malaysia, Guatemala, Ecuador, and Nigeria experienced a positive shift to rising star status. Meanwhile, Honduras and Mexico showed a significant decline, moving toward a retreat position, signaling a loss of competitiveness in the European Union coffee market.

X-Model analysis mapping based on RCA and EPD reveals significant shifts in market position, as shown in Table 3. Brazil has transitioned from an under-potential to an optimistic market, reflecting a notable increase in competitiveness. Colombia and Guatemala have also improved, moving from potential markets to optimistic markets. Indonesia, Honduras, and Peru have advanced from less potential to potential markets, indicating moderate improvements in competitiveness. Argentina and Thailand remain in the less potential category, showing no significant change. Ghana has slightly improved from a non-potential to a less potential market. However, the Dominican Republic has experienced a decline, shifting from a potential market to a non-potential one, indicating weakening competitiveness in the European Union market.

3.2 Determinant of the Efficiency of EU Coffee Imports from Like-Minded Countries

Table 3 shows the variation in the statistical data estimates of the demand for EU coffee imports from other countries. The variables EU GDP, economic distance, coffee import prices, tea prices, and language have low variation, with averages greater than standard deviations. The variables coffee import quantity, real exchange rate, FTA, and landlock have high variance, indicating significant differences that affect import demand as shown in Table 4.

The SFA regression with maximum likelihood estimation on 80 data points from 2013–2017 and 70 data points from 2018–2022 (Table 5) yields a gamma value (γ) of 1.00 from 2013–2017 and 0.83 from 2018–2022, which is significant at the 1% level, indicating that the SFA model is robust and valid.

From 2018–2022, Brazil and Colombia had very high export efficiency, reaching 57.13% and 59.47%, respectively. From 2018 to 2022, Brazil and Colombia demonstrated exceptionally high export efficiency, with rates of 57.13% and 59.47%, respectively. According to Copetti and Coronel (2019a) and Copetti and Coronel (2019b), Brazil experienced an increase in the concentration of green coffee exports during the period from 2000 to 2016, which was closely linked to the growth of trade partnerships with Germany, Italy, and the United States. However, there was a slight decrease compared with that in the previous period (63.11% for Brazil and 65.01%

Table 3: Coffee mapping of LMC countries in the European Union.

Country	RCA		EPD		X-Model	
	2013-2017	2018-2022	2013-2017	2018-2022	2013-2017	2018-2022
Argentina	0.00	0.00	Falling Star	Falling Star	Less Potential	Less Potential
Bolivia	2.34	1.63	Lost opportunity	Falling Star	Potential	Potential
Brazil	26.07	26.71	Retreat	Rising Star	Less Potential	Optimistic
Colombia	34.73	51.39	Falling Star	Rising Star	Potential	Optimistic
Cote D'Ivoire	2.25	2.83	Lost opportunity	Falling Star	Potential	Potential
Dominican Rep.	1.74	0.92	Lost opportunity	Retreat	Potential	No Potential
Ecuador	0.19	0.32	Lost opportunity	Rising Star	Less Potential	Potential
Ghana	0.02	0.00	Retreat	Falling Star	No Potential	Less Potential
Guatemala	58.24	50.78	Lost opportunity	Rising Star	Potential	Optimistic
Honduras	157.98	185.94	Lost opportunity	Retreat	Less Potential	Potential
Indonesia	5.73	4.11	Retreat	Lost opportunity	Less Potential	Potential
Malaysia	0.00	0.01	Rising Star	Rising Star	Potential	Potential
Mexico	5.90	6.20	Lost opportunity	Retreat	Potential	Less Potential
Nigeria	0.00	0.00	Falling Star	Rising Star	Less Potential	Potential
Peru	22.07	22.46	Retreat	Falling Star	Less Potential	Potential
Thailand	0.00	0.00	Rising Star	Falling Star	Potential	Less Potential

Source: Author's computation.

Table 4: Summary of descriptive statistics.

Variable	Average	St. dev.	Median	Maximum	Minimum
Import Quantity (thousand tonnes)	90586.36	208466.81	6164.62	968639.27	0.02
GDP EU (billion USD)	22125.68	1138.00	22078.19	24050.14	20356.47
Distance (USD/km)	889.29	216.64	944.20	1315.00	382.92
Exchange Rate (Euro)	1006.49	3034.57	17.63	13642.60	0.96
Price of coffee import (USD/kg)	4.91	3.42	3.76	21.67	1.53
Price of substitute product (tea 0902) (USD/kg)	3.93	0.63	3.61	4.92	3.38
Dummy FTA	0.37	0.48	0.00	1.00	0.00
Dummy language	0.81	0.39	1.00	1.00	0.00
Dummy landlocked	0.06	0.24	0.00	1.00	0.00

Source: Author's computation.

for Colombia), as shown in [Figure 1](#). Indonesia (53.78%), Peru (47.82%), and Mexico (49.05%) experienced significant increases in coffee efficiency in the European Union. Argentina and Ghana experienced significant declines, with very low-efficiency values (0.00% for Argentina in 2018–2022 and 0.02% for Ghana in 2013–2017). Bolivia, Guatemala, and Honduras show a moderate increase in the efficiency of coffee exports. However, it is still far from the optimal value, with Bolivia increasing to 29.29% from 1.38% and Guatemala increasing to 37.41% from 19.40%.

Table 5: Comparison of estimated SFA demand for coffee imports.

Variable	2013–2017			2018–2022		
Constant	20.81 (1.00)	***		-256.48 (114.09)	**	
LnPDB _{jt}	0.34 (0.06)	***		9.21 (3.78)	**	
LnDISTCOF _{ijt}	0.07 (0.09)	ns		-0.32 (0.10)	***	
LnEXCR _{ajt}	-0.05 (0.01)	***		-0.08 (0.08)	ns	
LnPM _{jt}	-6.18 (0.45)	***		-4.27 (0.62)	***	
LnPY _{jt}	-3.06 (0.98)	***		1.21 (1.72)	ns	
Dummy FTA _{ajt}	5.69 (1.27)	***		10.90 (3.96)	***	
Dummy LANG _{aj}	-0.96 (0.82)	ns		4.28 (2.10)	**	
Dummy LL _a	-0.65 (1.00)	ns		-3.19 (4.35)	ns	
σ^2	21.09 (0.99)	***		9.90 (4.81)	**	
γ	1.00 (0.00)	***		0.83 (0.14)	***	
Log-likelihood function	-181.13			-146.61		
Observation (N)	80			70		

Notes: ns (nonsignificant); * (significant 10%); ** (significant 5%); *** (significant 1%).

Source: Author's computation.

The comparison between actual and potential coffee imports from LMC to the European Union for the periods 2013–2017 and 2018–2022 is shown in [Table 6](#). During 2013–2017,

Brazil had a significant gap between actual imports (816.88 thousand tonnes) and potential exports (34252.75 thousand tonnes), with a large shortfall of –34252.75 thousand tonnes. Although actual imports from Brazil increased to 906.94 thousand tonnes in 2018–2022, the gap remained substantial, with potential imports estimated at 748.68 thousand tonnes. Indonesia also showed a large gap in 2013–2017, with actual exports at 112.30 thousand tonnes compared to a potential of 33843.08 thousand tonnes. In 2018–2022, Indonesia's actual imports dropped to 73.02 thousand tonnes, while the potential remained nearly the same at 72.90 thousand tonnes. Argentina, Ghana, and Nigeria continue to have significant untapped export potential, as their actual export values remained very low in 2018–2022.

4 DISCUSSION

4.1 Competitiveness of Like-Minded Countries Coffee in the European Union

An analysis of the competitiveness of coffee in the European Union highlights notable differences among producers. Brazil and Colombia have significantly improved their positions in the global coffee market, with Brazil transitioning from a low-potential category to an optimistic market stance. This transformation is primarily attributed to government policies focused on enhancing the coffee sector and investing in quality improvements (Santoso, 2022). According to Mariano and Braga (2022) and Matos and Braga (2020), Brazilian coffee farmers have received substantial support to increase coffee production, particularly organic coffee. The role of cooperatives in implementing strategies such as differentiating green coffee into finished products and expanding internationally presents a promising alternative for Brazilian coffee farmers to achieve higher profit margins while promoting environmental sustainability.

This aligns with the environmental policies currently being enforced by the European Union, such as the European Union Deforestation-Free Regulation, which further supports the move towards more sustainable coffee production practices. Similarly, Colombia has made remarkable progress, benefiting from effective agricultural policies and high productivity, which position it as an emerging leader in the international market (Majcher, 2020). Argentina and Ghana

are experiencing stagnation or decline in competitiveness due to insufficient sector support policies and external challenges, including climate change and fluctuations in global coffee prices. Bolivia and Côte d'Ivoire, despite challenges, have maintained relatively stable competitiveness, due to supportive domestic policies and improvements in coffee quality (Cerquera et al., 2020; Shabri; Saputra, 2023; Torok; Mizik; Jambor, 2018).

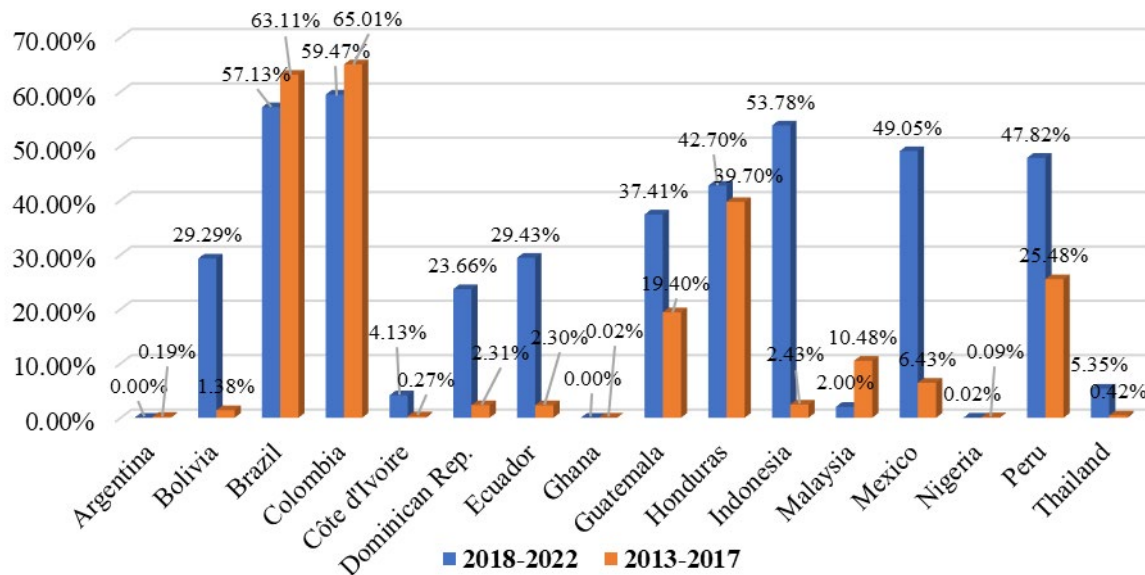


Figure 1: Value of the efficiency of EU coffee imports from LMC.

Source: Author's computation.

Table 6: Comparison of actual and potential imports of LMC in the EU (thousand tonnes).

Country	2013–2017			2018–2022		
	Actual	Predicted	Potential	Actual	Predicted	Potential
Argentina	0.03	1964.36	-1964.33	0.00	0.00	0.00
Bolivia	0.87	885.86	-884.99	0.54	0.14	0.40
Brazil	816.88	35069.63	-34252.75	906.94	158.26	748.68
Colombia	141.63	19.63	122.00	136.33	3.50	132.83
Cote D'Ivoire	15.28	17067.09	-17051.82	15.65	216.44	-200.78
Dominican Rep.	0.57	2.25	-1.68	0.40	0.31	0.08
Ecuador	0.33	135.76	-135.43	0.49	0.24	0.25
Ghana	0.07	3454.02	-3453.95	0.00	0.00	0.00
Guatemala	29.89	13.33	16.56	32.24	7.89	24.34
Honduras	164.05	38.11	125.94	177.88	27.25	150.63
Indonesia	112.30	33955.38	-33843.08	73.02	0.12	72.90
Malaysia	0.00	13.67	-13.67	0.01	58.71	-58.70
Mexico	23.32	31.85	-8.53	30.83	2.59	28.24
Nigeria	0.08	10928.96	-10928.87	0.00	97155.49	-97155.49
Peru	103.00	37.27	65.74	99.66	9.46	90.20
Thailand	0.38	737.55	-737.17	0.25	383.36	-383.11

Source: Author's computation.

Indonesia experiences more pronounced fluctuations in its market positions, marked by periods of decline and instability. Despite producing high-quality coffee, Indonesia faces structural challenges, such as unsupportive policies and inadequate infrastructure, which limit its market opportunities within the European Union (Zuhdi; Yusuf, 2021; Rahardjo et al., 2020). As highlighted by Suryana et al. (2024), to boost its international trade, Indonesia has implemented several policies to strengthen the coffee trade, including tax regulations, export provisions, national quality standards, certification processes, and branding initiatives. Honduras, Mexico, and Thailand have experienced a significant decline in competitiveness due to challenges related to coffee quality and management, which have weakened their position in an increasingly competitive global market (Gois et al., 2023; Enríquez et al., 2020; Sitikarn et al., 2022). Rodrigues et al. (2024) further emphasized that climate instability and extreme weather conditions, including prolonged droughts and unpredictable rainfall, have adversely affected crop yields and coffee quality. These factors have notably diminished Honduras' ability to compete in the European market, which places a high demand on premium-quality coffee products.

4.2 Determinant of coffee export in LMC to European Union

The estimation results via stochastic frontier analysis reveal that the European Union's gross domestic product positively and significantly affects the quantity of coffee imported from LMC. This can be explained by increased purchasing power and market preferences, which are reflected in the consumption of imported goods, including coffee. In line with previous findings, Nguyen (2022) explains that GDP growth drives an increase in per capita income, increasing the demand for coffee from large producers such as Brazil, Indonesia, Colombia, and Honduras. On the other hand, the economic distance between the European Union and the LMC negatively affects coffee imports because structural barriers such as limited post-harvest technology and high transaction costs reduce the competitiveness of LMC coffee exports to the European Union market (Abafita; Tadesse, 2021).

Key factors consist of the locations of major ports, like Hamburg, Germany, which enhances coffee distribution due to its robust infrastructure and supportive business policies (Pancsira, 2022). Exchange rate variations also impact coffee price competitiveness in the European market (Marinache, 2024). The import prices of coffee and alternatives, such as tea, influence import volumes. However, the effect of tea is minor because of strong consumer preferences for coffee within the EU's consumption culture (Czarniecka et al., 2021).

Furthermore, free trade agreements (FTA) contribute positively by lowering tariff and non-tariff barriers, which boosts the competitiveness of coffee from LMC in the EU market (Cipollina; Demaria, 2020). The similarity in language fosters better communication and builds trust among trading partners (Cipollina; Demaria, 2020). While being landlocked can raise logistics costs, its effect on coffee imports is minor due to the presence of transit countries and established international logistics systems (Czarniecka et al., 2021). These insights highlight the significance of economic conditions, port infrastructure, exchange rates, and trade policies in shaping the volume of EU coffee imports from LMC, as well as the necessary measures to enhance the competitiveness of coffee exports from these nations.

4.3 Efficiency and Potential of LMC Coffee in the European Union

A comparison of actual and potential coffee exports to the European Union reveals a significant gap among the 16 LMC. The decline in the export efficiency of Argentina, Ghana, and Malaysian coffee is due to an inability to meet increasingly stringent sustainability standards, with Argentina and Ghana even recording 0% efficiency in the 2018–2022 (Barreto et al., 2022). Indonesia and Peru have seen significant improvements, with Indonesia reaching 53.78% and Peru reaching 47.82%, owing to quality and production capacity improvements that meet international standards (Syofya, 2023). Brazil, Colombia, and Guatemala are highly efficient, although they declined from 2018–2022 due to stricter environmental regulations and global competition (Gorlich et al., 2020; Santoso, 2022; Rosiana, 2017).

Several key factors strongly influence the European Union's coffee needs, including demand for high-quality coffee, organic coffee, and sustainably produced coffee. The European Union prioritizes coffee that meets strict sustainability standards such as Fair Trade, Rainforest Alliance, and UTZ certification, reflecting consumer awareness of the social and environmental impacts of coffee production (Marinache, 2024). The European market also shows great interest in specialty coffee, which has unique flavor characteristics and is produced in a more controlled and environmentally friendly way (European Coffee Federation, 2024). Therefore, coffee-producing countries that want to enter this market must adapt to these requirements, improve product quality, and obtain relevant certifications to remain competitive in the European Union coffee export market (Marinache, 2024).

Further analysis revealed that the most significant coffee export gaps occur in Côte d'Ivoire and Nigeria, which have difficulty accessing the EU market because of structural

barriers and non-tariff regulations (Eponon et al., 2023; Pelulessy, 2018). Overall, the LMC that have succeeded in increasing their export efficiency have been able to adapt to increasingly stringent sustainability standards and trade regulations. Increasing production capacity, applying environmentally friendly agricultural technology, and providing policy support focused on sustainability are key factors in increasing LMC' coffee export competitiveness in the global market. More inclusive trade policies and regulatory harmonization will help LMC overcome existing barriers and exploit untapped opportunities in the European Union market.

5 CONCLUSIONS

The coffee trade from LMC faces a gap in exports to the EU, with Brazil and Colombia gaining competitiveness, while Indonesia and the Dominican Republic decline. LMCs adapting to sustainability standards and improving supply chain transparency can boost competitiveness, while others risk losing EU market access. Governments should promote inclusive trade policies, invest in infrastructure, and leverage free trade agreements to enhance competitiveness and ensure long-term growth in the coffee sector.

6 AUTHORS' CONTRIBUTION

Conceptual Idea: Syaukat, Y.; Widyastutik; Rifin, A. Methodology design: Meliany, B. S.; Rifin, A. Data collection: Meliany, B. S. Data analysis and interpretation: Meliany, B. S.; Widyastutik. Writing and editing: Meliany, B.S.; Syaukat, Y.

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