SCIENTIA: Journal of Multi Disciplinary Sciences
Volume 03 Number 2 | July-December 2024: 89 - 99
p-ISSN: 2828-7665
e-ISSN: 2828-609X

A Comprehensive Analysis of Indonesia's Coffee Exports to the Global Market from 1991 to 2021

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Received: 2024-06-27 Revised: 2024-07-28 Accepted: 2024-12-09

ABSTRACT

This study aims to analyze the factors influencing the decline in Indonesia's coffee exports and to formulate strategies to enhance these exports. Using a quantitative methodology, data from 1991 to 2021 were analyzed via regression analysis employing SPSS software. The independent variables considered included coffee production volume, harvested coffee land area, the GDP of the United States, and the exchange rate of the Indonesian Rupiah to the US Dollar. The results indicate that Indonesia's coffee production and harvested area significantly influence export volumes. The regression model developed demonstrated a moderate explanatory power with an R^2 value of 53%, indicating that the model explains 53% of the variance in coffee exports. The Analysis of Variance (ANOVA) test confirmed the model's significance, highlighting that the included variables collectively impact coffee exports. Partial t-test analysis revealed that the harvested area, producer coffee prices, and exchange rates are significant factors. The study concludes that enhancing the quality and competitiveness of Indonesian coffee, improving infrastructure, and adopting supportive government policies are crucial strategies to boost coffee exports. These efforts must address the challenges posed by global market dynamics, competition, and environmental factors to ensure the sustainable growth of Indonesia's coffee sector.

Keywords: Indonesia; Coffee exports; Regression analysis; Export factors; Sustainable growth.

INTRODUCTION

Coffee is one of Indonesia's major export commodities (Editiawarman & Idris, 2020; Kartini & Daryono Soebagyo, 2018; Lo, 2017; Marpaung & Purba, 2017; Utama & Mustika, 2022). Since the early 19th century, coffee has been a prominent Indonesian product in the international market. However, in recent years, Indonesia's coffee exports have seen a significant decline. According to the Central Statistics Agency (BPS), in 2020, Indonesia's coffee exports reached only about 270,000 tons, down approximately 10% from the previous year. This decline is attributed to several factors, including climate change, a lack of innovation in coffee production technology, and limited access to global markets. Additionally, competition with other coffee-producing countries has intensified.

To analyze the limitations in global market access for Indonesian coffee, several approaches can be taken. Analyzing international coffee trade data can provide insights into the contribution of Indonesian coffee exports in the global market and identify potential new markets. Such data can be obtained from international trade

organizations like the International Coffee Organization (ICO), the International Trade Centre (ITC), or the Central Statistics Agency (BPS).

Indonesia is the fourth largest coffee producer in the world, following Brazil, Vietnam, and Colombia, with a production volume of 639,305 tons in 2016 and a cultivation area of 1,228,512 hectares (Editiawarman & Idris, 2020; Kartini & Daryono Soebagyo, 2018; Lo, 2017; Lubis et al., 2022; Marpaung & Purba, 2017; Rosalia & Karyani, 2020; Utama & Mustika, 2022). South Sumatra is the region with the highest production volume and the largest cultivation area in Indonesia, followed by Lampung. These provinces are known for producing robusta coffee. In 2012, Indonesia's coffee exports reached USD 1.5 billion, but this figure declined until 2014, then strengthened in 2015, and dropped again in 2016 to USD 1.4 billion. The decline in exports was due to a decrease in domestic coffee production, which only reached 639,305 tons in 2016, a slight decrease of 0.02% from the previous year's 639,412 tons.

To support the coffee trade, Indonesia is a member of the International Coffee Organization (ICO). The primary goal of the ICO is to strengthen the global coffee sector and promote sustainable development within a market-based environment for the benefit of all member countries. The ICO comprises 42 exporting/producing members and 8 importing/consuming members, representing 97% of global coffee production and over 80% of global consumption. Nineteen ICO members are least-developed countries, with low incomes and economic vulnerabilities, and there are over 25 million smallholder farmers and their families who produce 70% of the world's coffee and are heavily influenced by price fluctuations and supply and demand uncertainties.

Indonesia's membership in the ICO is based on Presidential Regulation No. 63 of 2008 concerning the Ratification of the International Coffee Agreement 2007. By ratifying the ICA 2007, Indonesia, as a member country, is obligated to adhere to the rules established by the ICO, as outlined in the ICA 2007. These rules include the organization's functions and objectives, the ICO Council's administrative system, the ICO committees, staff regulations, periodic statistical data reporting, issuing export coffee trade documents (SKA), and providing necessary information to the ICO Secretariat for various studies and assessments in the coffee sector. In line with Indonesia's commitment as an ICO member, all coffee export shipments must be accompanied by the ICO form SKA document.

In 2017, the ICO agreed on an Action Plan consisting of 29 activities aimed at achieving four strategic objectives: a) establishing the ICO as a forum for policy development and providing solutions to strengthen the global coffee sector; b) enhancing coffee market transparency and providing economic decision recommendations based on this transparency; c) promoting the development of communication, community support, and dissemination of knowledge about the global coffee economy; and d) promoting a sustainable coffee sector (International Coffee Organization, 2017).

Several factors influence the global market demand for Indonesian coffee, including quality, price, availability, innovation, brand image, trade policies, and consumer preferences. The quality of coffee is a major factor affecting market demand, as global consumers prefer high-quality coffee with distinctive flavors. The price of Indonesian coffee must be competitive with that of other coffee-exporting

countries. The availability of Indonesian coffee in the global market also impacts demand; if Indonesian coffee is not available in sufficient quantities, market demand will decline. Innovation in coffee production and processing is crucial for increasing market demand, as Indonesian coffee producers who innovate can improve the quality and image of their products in the global market. Brand image positively influences market demand, as a strong brand image can increase consumer trust and demand for Indonesian coffee products. International trade policies, such as tariffs and export quotas, also affect market demand. Consumer preferences for coffee types and flavors also play a role, requiring Indonesian coffee producers to align their products with global consumer preferences.

Information about the tariffs imposed by Indonesia on coffee exports can be found from several sources, including the Indonesian Customs Tariff Information Portal, managed by the Directorate General of Customs and Excise of the Ministry of Finance, which provides information on import duties for various commodities, including coffee. This information can be accessed through the official Customs website at https://www.beacukai.go.id/tarif. The Indonesia National Single Window (INSW), a public service portal managed by the Ministry of Trade, also provides information on export and import tariffs for various commodities, including coffee. This information can be accessed through the INSW website at https://www.insw.go.id/. Additionally, the Ministry of Trade of the Republic of Indonesia's official website at https://www.kemendag.go.id/ provides information on coffee export tariffs. It is important to note that coffee export tariffs may vary depending on the type of coffee, export destination, and target market, so it is advisable to check the specific applicable tariffs for coffee export needs.

LITERATURE REVIEW

Researchers have explored various issues such as fair trade, organic farming, climate change, and labor practices with the aim of enhancing the sustainability of the coffee industry and ensuring fair compensation for producers and workers. For example, a study found that sustainable certification programs can help improve the livelihoods of small-scale coffee farmers and enhance the quality of their crops (Barouki et al., 2021). Additionally, the impact of COVID-19 has altered consumer behavior towards enjoying coffee.

The potential for coffee in Indonesia is immense, as the country boasts a wide variety of coffee types and geographic conditions that are conducive to coffee production (Neilson, 2007). Some of the best-known types of coffee in Indonesia include Arabica, Robusta, and Luwak, each with distinct characteristics and flavors. Furthermore, Indonesia has numerous coffee-producing regions spread across the country, such as Sumatra, Java, Bali, Sulawesi, and Papua. Each region has unique climate, soil, and environmental conditions, resulting in coffee with different characteristics. The potential of Indonesian coffee is further supported by the increasing number of coffee farmers adopting modern agricultural technologies and practices to improve productivity and quality. The Indonesian government has also launched various programs to boost coffee production and assist coffee farmers, including replanting programs, infrastructure improvements, and technical training for farmers.

However, the potential of Indonesian coffee faces several challenges, such as global market price fluctuations, pest and disease attacks, and climate and environmental issues. Therefore, a collective effort from the government, farmers, and other stakeholders is necessary to optimally and sustainably develop Indonesia's coffee potential. Consumer trend and preference analysis can help understand global market demand for specific types of coffee, such as organic or single-origin coffee. This analysis can utilize consumer data and surveys from organizations like the National Coffee Association (NCA) or the Specialty Coffee Association (SCA). Trade policy analysis can help identify regulations and trade policies affecting Indonesia's coffee exports in the global market, such as tariffs and trade barriers. This analysis can use data and information from organizations like the World Trade Organization (WTO) or the Indonesia Investment Coordinating Board (BKPM).

Competitor analysis can reveal the strengths and weaknesses of competitors in the global market, including other coffee-producing countries and popular coffee brands. This analysis can use data and information from organizations like the International Coffee Organization (ICO) or SCA. By analyzing the limitations of global coffee market access, factors influencing these limitations can be identified, and strategies to overcome them can be formulated to increase Indonesia's coffee exports.

Therefore, research is needed to identify factors affecting the decline in Indonesia's coffee exports and formulate strategies to increase these exports. This research is expected to contribute positively to boosting Indonesia's coffee exports, which in turn will impact the country's economic growth. Several factors influence Indonesia's coffee exports, including coffee production levels, which affect coffee availability for export. Factors influencing coffee production include weather, harvest season, and agricultural practices.

Coffee prices in the global market, driven by supply and demand, also impact Indonesia's coffee exports. If coffee prices fall, Indonesian coffee exports may decline due to lower selling prices. Coffee quality is another crucial factor in determining coffee prices. Higher quality coffee from Indonesia will likely increase demand. Government policies regarding coffee exports, such as trade regulations, export duties, and import policies, also influence Indonesia's coffee exports. Competition with other coffee-producing countries, like Brazil, Vietnam, and Colombia, affects Indonesia's market share in the global coffee market. Lastly, global economic conditions, including currency exchange rate fluctuations, impact coffee prices and demand, thereby influencing Indonesia's coffee exports to the global market.

METHOD

The methodology employed in this study is quantitative. According to Supriatin et al. (2022), quantitative methods involve a systematic approach to investigating phenomena using numerical data and statistical analysis. These numerical data can include figures, scores, or other measurable outcomes that can be mathematically calculated and analyzed.

For data analysis, this study utilized regression analysis through the SPSS statistical software. Linear regression was used to ensure that the model met classical assumptions, and diagnostic tests were conducted to check for violations of regression assumptions such as multicollinearity or heteroscedasticity. Following the regression

analysis, the results were interpreted. The regression analysis yielded coefficients for each independent variable, indicating the direction and strength of the relationship between the variables and coffee exports.

These coefficients were interpreted considering their statistical significance, effect size, and direction. The results of the analysis were used to draw conclusions about the factors influencing coffee exports in Indonesia. The regression model developed in this study is as follows:

$Y=\alpha+\beta1Q+\beta2GDP+\beta3L+\beta4E+\epsilon$

Where:

- Y represents the coffee exports from Indonesia to the United States (in tons).
- $\beta i,\beta2,\beta3,\beta4$ are the regression coefficients.
- Q is the coffee production in Indonesia (in tons).
- GDP is the Gross Domestic Product of the United States (in dollars).
- L is the harvested area of coffee in Indonesia (in hectares).
- E is the exchange rate of the Indonesian Rupiah to the US dollar.
- ϵ represents the error term.

RESULT AND DISCUSSION

Increase in Indonesian Coffee Exports

Indonesia is one of the largest coffee producers in the world, and its coffee exports have seen an increase in recent years. Several factors contribute to this growth. Firstly, the high quality of Indonesian coffee plays a significant role. Indonesian coffee, particularly Arabica and Robusta from various regions, is known for its unique flavor and is highly sought after by consumers worldwide. Indonesian coffee farmers are increasingly aware of the importance of maintaining high quality and have been improving eco-friendly farming practices to produce better coffee.

Secondly, global demand for coffee is rising. Countries like the United States, Japan, and those in Europe are major markets for Indonesian coffee exports. Thirdly, political and economic factors in importing countries, such as increased import tariffs or restrictions on coffee from other producing countries, can create opportunities for Indonesian coffee exports. Additionally, the Indonesian government has been supportive, offering incentives and assistance to coffee farmers and industry players to boost production and exports. Initiatives include financial aid programs for coffee replanting, infrastructure development, and technical training to enhance coffee quality and productivity.

However, the increase in Indonesian coffee exports faces several challenges, such as global price fluctuations, competition with other coffee-producing countries, and environmental and climate issues that can affect coffee production. Thus, it requires collective efforts from the government, farmers, and industry players to continuously improve coffee quality and productivity and strengthen the competitiveness of Indonesian coffee in the global market.

Factors Affecting Indonesian Coffee Exports

The production of coffee in Indonesia directly influences the volume of its coffee exports. Increased coffee production in Indonesia translates to more coffee available

for export. Global market demand is another crucial factor affecting Indonesian coffee exports. When global demand rises, Indonesia has a greater opportunity to increase its exports. World coffee prices also impact Indonesian coffee exports, as these prices serve as a benchmark for Indonesian coffee prices on the global market. Higher world coffee prices provide Indonesia with better export opportunities.

Indonesia faces competition from other major coffee producers like Brazil, Vietnam, and Colombia. This intense competition can affect Indonesia's ability to increase its coffee exports. The quality of Indonesian coffee significantly influences its exports. High-quality coffee that meets global market preferences enhances Indonesia's export prospects. Government policies also affect coffee exports. For instance, export tariffs and non-tariff barriers imposed by importing countries can influence the volume of Indonesian coffee exports.

Adequate infrastructure, such as transportation, logistics networks, and coffee processing facilities, is vital for boosting Indonesian coffee exports. Poor infrastructure can limit Indonesia's export capabilities. Environmental and climate changes can affect coffee production in Indonesia, subsequently influencing its coffee exports. To develop Indonesian coffee exports, a collaborative effort from the government, farmers, and industry stakeholders is essential to enhance the competitiveness of Indonesian coffee in the global market and address the challenges faced.

Best Linear Unbiased Estimator (BLUE) Analysis

The Best Linear Unbiased Estimator (BLUE) analysis is a regression technique used to estimate parameters in a linear regression model. The goal of BLUE analysis is to find the optimal parameter estimates by minimizing the resulting errors. This method produces unbiased parameter estimates with minimal variance, making the estimates more accurate and reliable.

In the context of regression analysis, "linear" refers to the linear relationship between independent and dependent variables, while "unbiased" means that the parameter estimates do not have systematic errors. Parameter estimates from BLUE analysis are commonly used in various fields such as econometrics, social sciences, and natural sciences.

However, several assumptions must be met to apply BLUE analysis, such as normality, homoscedasticity, and the absence of multicollinearity among independent variables. In practice, BLUE analysis is often employed in conjunction with other data analysis techniques like linear regression, multivariate analysis, and other statistical methods.

Autocorrelation Analysis

Autocorrelation analysis is a statistical technique used to examine whether there is a correlation between a variable and its previous values over different time intervals in a time series. Autocorrelation, also known as serial correlation or temporal correlation, helps identify patterns or trends in time series data.

If the time series data shows a positive autocorrelation pattern, it indicates that newer values tend to be positively correlated with previous values. Conversely, a negative autocorrelation pattern means that newer values tend to be negatively correlated with previous values. Autocorrelation is measured using the correlation

p-ISSN: 2828-7665
e-ISSN: 2828-609X

coefficient between current and previous time values, known as the autocorrelation function (ACF).

Autocorrelation analysis is widely used in econometrics and time series analysis, particularly in testing hypotheses about the presence of autocorrelation in regression models and predicting future values in a time series. This analysis can be performed using statistical software such as R, Python, or STATA.

Heteroskedasticity Analysis

Heteroskedasticity analysis is a statistical technique used to examine whether the variance of a variable in a linear regression model changes significantly for specific values of the independent variable. Heteroskedasticity occurs when there is a non-uniform variance pattern in the regression model, which can affect the accuracy of parameter estimates and hypothesis testing results. Heteroskedasticity generally occurs when the independent variable has varying effects on the dependent variable over different value ranges. In regression models, heteroskedasticity can lead to inconsistent and inaccurate coefficient values, resulting in invalid hypothesis testing results.

Several techniques can be used to analyze heteroskedasticity, including the White test, Breusch-Pagan test, and Goldfeld-Quandt test. If heteroskedasticity is found in the regression model, solutions include using better estimation techniques such as generalized least squares (GLS), weighted least squares (WLS), or feasible generalized least squares (FGLS). Heteroskedasticity analysis is typically performed using statistical software like R, Python, or STATA.

Coefficient of Determination (R^2) Analysis

The coefficient of determination, represented as R^2 or r^2, is a statistical measure that indicates the proportion of variance in the dependent variable explained by the independent variables in a regression model. Ranging from 0 to 1, an R^2 value of 0 suggests no relationship between variables, while an R^2 of 1 indicates perfect correlation. A higher R^2 value signifies that the independent variables account for a larger portion of the variance in the dependent variable, making the regression model more accurate in predicting outcomes or testing hypotheses. Conversely, a lower R^2 value implies that the independent variables have limited explanatory power regarding the dependent variable.

In an analysis using SPSS version 23, an R^2 value of 53% was obtained, indicating that the independent variables in the regression model explain 53% of the variance in the coffee harvest area. The coefficient of determination is a crucial measure in regression analysis and is widely used in fields such as economics, finance, and social sciences. Researchers and analysts use it to evaluate the goodness of fit of regression models, compare different regression models, and make predictions about future outcomes based on available data. In summary, the coefficient of determination is a vital measure of the relationship between independent and dependent variables in a regression model, providing valuable information for decision-making across various fields.

Table 1. Coefficient of Determination (R^2)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,731[a]	,534	,389	,08149

a. Predictors: (Constant), LOG_P, LOG_Q, LOG_E, LOG_L, LOG_GDP

Analysis of Variance (ANOVA) Test

In statistics, the F-test, also known as the Analysis of Variance (ANOVA) test, is used to determine whether two or more groups of data have the same variance. Specifically, the F-test compares the variation between the means of sample groups with the variation within the sample groups. It is commonly used in the context of linear regression analysis to test the overall significance of a regression equation. The F-test helps determine whether a model with all the independent variables fits the data better than a null model without any independent variables. A significant F-test result indicates that at least one of the independent variables in the model has a significant relationship with the dependent variable. This test is performed by comparing the calculated F-statistic to the F-distribution with specified degrees of freedom for the numerator and the denominator. If the calculated F-statistic is greater than the critical F-value from the F-distribution, the null hypothesis is rejected in favor of the alternative hypothesis. The significance level for the F-test is usually set at 0.05 or 5%.

In contrast to the F-test, the t-test is used to determine whether two groups of data have different means. The t-test is a hypothesis test that uses the t-statistic to compare the means of two groups of data. Specifically, it compares the difference between the means of the two groups with the variability within the groups. The t-test can be used to test hypotheses about the means of two populations or the difference between two sample means.

The results of the analysis show that the F-test yielded a value of 3.670 with a significance level of 0.021, indicating a significant difference at the 0.05 confidence level. This result suggests that the variables Coffee Production (Q), Harvested Coffee Land Area in Indonesia (L), the Gross Domestic Product (GDP) of the United States, and the Exchange Rate of the Rupiah against the US Dollar (E) collectively influence the dependent variable Y. Thus, the linear regression model is suitable for the given dataset as it compares the variation between the sample group means with the variation within the sample groups. For a clearer understanding, please refer to the table below.

Table 2. Analysis of Variance (ANOVA) test

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,122	5	,024	3,670	,021[b]
	Residual	,106	16	,007		
	Total	,228	21			

a. Dependent Variabel: LOG_X

b. Predictors: (Constant), LOG_P, LOG_Q, LOG_E, LOG_L, LOG_GDP

Partial Test Analysis (t-Test)

Coffee is one of the most important plantation commodities in Indonesia and has a wide export market. In response to this, the Indonesian government has implemented several strategies to boost domestic coffee production. One such strategy is the segregation of agricultural land for robusta and arabica coffee varieties, aiming to increase coffee production by three to four times.

A significant increase in Indonesian coffee production can positively impact the price of coffee at the producer level. However, policy implications regarding coffee harvesting land and the exchange rate of the Indonesian rupiah against the US dollar can indirectly affect coffee prices. For instance, policy changes related to land use or fluctuations in the exchange rate can impact coffee production costs, which in turn can influence coffee prices in both domestic and international markets. Therefore, it can be concluded that policies related to coffee harvesting land, producer-level coffee prices, and the exchange rate of the rupiah against the US dollar can indirectly affect Indonesia's coffee exports by influencing production costs and coffee prices.

Table 3. t-Test Analysis on Determinants of Indonesian Coffee Exports to the USA

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	30,380	14,106		2,154	,047		
	LOG_GDP	1,098	,760	1,104	1,444	,168	,050	20,073
	LOG_L	-5,491	2,444	-,761	-2,247	,039	,254	3,936
	LOG_E	-,823	,405	-,674	-2,034	,059	,265	3,769
	LOG_Q	1,220	1,056	,422	1,156	,265	,218	4,587
	LOG_P	-,531	,224	-1,135	-2,376	,030	,128	7,838

a. Dependent Variabel: LOG_X
Dependent Variabel: LOG_Y

The analysis results indicate that several variables significantly impact the coffee market at a 1% confidence level. These variables include the harvested coffee land area, the price of coffee at the producer level, and the exchange rate of the Indonesian rupiah against the US dollar. Firstly, the harvested coffee land area plays a crucial role in the coffee market dynamics. An increase or decrease in the area of land dedicated to coffee cultivation directly affects the supply side of the market. Secondly, the price of coffee at the producer level is another significant variable. Fluctuations in producer prices can influence the overall market prices, affecting both the supply chain and consumer demand. Lastly, the exchange rate between the Indonesian rupiah and the US dollar also has a notable impact. A stronger or weaker rupiah can alter the competitiveness of Indonesian coffee in the international market, thereby influencing export volumes and revenue. These findings underscore the importance of these variables in the coffee market and highlight areas for potential policy focus to stabilize and enhance the coffee industry.

CONCLUSIONS

The results of the determination coefficient analysis (R^2) and its implications through the regression model in this study indicate that the harvested coffee area achieves an R^2 value of 53%. This suggests that the independent variables can explain 53% of the variance in the dependent variable, demonstrating a moderate relationship and highlighting the efficacy of the model in predicting coffee yield. This moderate explanatory power signifies that while the model is useful, there are other factors not captured in this analysis that also affect coffee yields.

Furthermore, the Analysis of Variance (ANOVA) test, with an F-test value of 3.670 and a significance level of 0.021, confirms the model's significance at the 0.05 confidence level. This indicates that variables such as coffee production, harvested coffee area, the GDP of the United States, and the exchange rate of the Indonesian rupiah to the US dollar significantly impact the dependent variable. Additionally, partial analysis (t-test) reveals that the harvested coffee area, producer price of coffee, and exchange rate significantly influence the coffee market. These findings underscore the importance of these variables and suggest that policies focusing on land use, producer prices, and exchange rates could stabilize and enhance the Indonesian coffee industry.

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