Factors Affecting Exports of Arabica Coffee (Coffea Arabica) In North Sumatra Province

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Abstract

North Sumatra Arabica coffee which has been exported to various main destination countries fluctuated. There were years when North Sumatra coffee exports to these countries experienced increases or shrinkages. The purpose of this study was to analyze the effect of the destination country's GDP, the rupiah exchange rate, Arabica coffee production, Arabica coffee domestic prices and Arabica coffee international prices on Arabica coffee export volume in North Sumatra. The method used in this research is panel data regression analysis. The independent variables in this research are the GDP of the destination country, the rupiah exchange rate, Arabica coffee production, the domestic price of Arabica coffee and the international price of Arabica coffee, and the dependent variable is the export volume of Arabica coffee in North Sumatra. The panel data regression estimation model used in this study is the Common Effect Model. The results show that the variables GDP, nominal exchange rates, production, domestic prices, and international prices have an effect of 57.9% on the export volume of North Sumatra Arabica coffee. Simultaneously or together the variables GDP, nominal exchange rates, production, domestic prices, and international prices have a significant effect on the export volume variable of North Sumatra Arabica coffee. While partially the GDP, nominal exchange rate and domestic coffee prices have a positive and significant effect while the production and international price variables have a positive but not significant effect on the export volume variable of North Sumatra Arabica coffee.

Keywords: Panel data, GDP, exchange rates, production, domestic prices and international prices.

Introduction:

Coffee is one of the prominent commodities in the agricultural estate (plantation) sub-sector in Indonesia because it has abundant market opportunities both domestically and abroad. Most of the coffee production in Indonesia is a plantation commodity which is traded to the international market. According to the International Coffee Organization (ICO), coffee consumption upsurges from year to year thus increased coffee production in Indonesia has a

great opportunity to export coffee to the world's main coffee-consuming countries such as the European Union, the United States and Japan.

Indonesia is one of the leading coffee-producing countries for coffee cultivation. Various types of coffee exist in Indonesia and have different tastes from each region that produces it. In addition, the level of coffee consumption in Indonesia is relatively large, mainly due to the increasing standard and lifestyle of people in urban areas. Indonesia is currently ranked fourth as the largest coffee-producing country in the world, after Brazil, Vietnam and Colombia. As one of the countries with the world's largest coffee production, Indonesia is also the world's fourth-largest coffee exporter.

The coffee sold around the world is usually a combination of the roasted beans of two varieties of coffee trees: Arabica and Robusta. The main difference between the two varieties lies in the taste and level of caffeine. Arabica beans, which are more expensive on the world market, have a milder taste and a caffeine content that is 70% lower than Robusta beans. Subtropical and tropical regions are good locations for coffee cultivation. Therefore, countries that dominate world coffee production are the regions of South America, Africa and Southeast Asia (Fernanda et al., 2018).

Most of the coffee production in North Sumatra is produced by smallholder plantations. The data presented in the figure below shows the higher production of Arabica coffee than Robusta coffee in North Sumatra. Arabica coffee production reached 54,776.4 tons per year, while Robusta coffee 8,641.25 tons per year. This is due to several considerations by farmers in growing Arabica coffee because it has a distinctive taste. In addition, Arabica plants are easier and faster to harvest than Robusta which takes up to five years to be harvested. Likewise, the processing process after picking can be sold within a day, while Robusta generally requires six days of drying time.

As a coffee-producing region, exports are the main target in marketing the coffee products it produces. Export destination countries are traditional and modern consumer countries such as the United States, Japan and Germany. The increase in foreign markets has also resulted in an increasing demand for these exports, so the number of products produced has also increased. The United States, Japan and Germany have been the main destinations for North Sumatra coffee exports for a long time, this is because the production and quality of coffee from North Sumatra are one of the finest. It can be said that currently, the dependence on the need for coffee is so great, that with this export relationship, it is hoped that North Sumatra can improve the quality of its exports in the coffee commodity (Asosiasi Eksportir Kopi Indonesia, 2017).

North Sumatra Arabica coffee exports to various main destination countries fluctuated, there were years when North Sumatra coffee exports to these countries experienced increases or decreases. The ups and downs of North Sumatra coffee exports are assumed to be influenced by several factors such as the amount of coffee production, the GDP of export destination countries, world coffee prices, domestic coffee prices and the rupiah exchange rate against the dollar(Badan Pusat Statistik Provinsi Sumatera Utara.).

The purpose of this study was to analyze the effect of the destination country's GDP, the rupiah exchange rate, Arabica coffee production, Arabica coffee domestic prices and Arabica coffee international prices on Arabica coffee export volume in North Sumatra.

Research Methods:

Research sites: The research was conducted in North Sumatra Province. The determination of the research area was carried out by purposive sampling, that is, it was determined deliberately

by considering the purpose of the research. North Sumatra Province was chosen with the consideration that North Sumatra Province is one of the largest Arabica coffee production centres in Indonesia.

Method of collecting data: This research was conducted using secondary data sourced from official government agencies. The data used is time series data, namely in the form of annual data for 11 years for the 2010-2021 period obtained from the Central Statistics Agency (BPS), the Plantation Office of North Sumatra Province, AEKI (Indonesian Coffee Exporters Association), ICO website (International Coffee Organization), World Bank and other sources such as journals and research results.

Data analysis method: In this study, examiners used quantitative and descriptive data, using panel data or a combination of time series and region data. Panel data is a collection of observation data within a certain period. To analyze the identification of the research problem, the researcher used the *Eviews* Software application program tool. The researcher conducted a classical assumption test before conducting a panel data regression analysis test.

Classic assumption test: The classic assumption test in this study consists of a normality test, multicollinearity test, autocorrelation test and heteroscedasticity test. The normality test can be done by looking at the Jarque-Bera (JB) value and its probability. If the JB value is less than 2 and the probability value is less than 0.05, the research data is normally distributed. The multicollinearity test can be seen from the VIF value. If the VIF value ≤ 10, the research data does not experience multicollinearity. The autocorrelation test can be tested using the Durbin-Watson test. Statistical values of the Durbin-Watson test range between 0 and 4. Statistical values of the Durbin-Watson test that are less than 1 or greater than 3 indicate autocorrelation. The heteroscedasticity test can be seen from the probability value. If the probability value is > 0.05, the research data does not experience heteroscedasticity problems. (Suliyanto, 2011)

Regression Equation Analysis: Panel data is a combination of periodic data (time series) and individual data (cross-section). Time series data is data collected from time to time on an individual. Meanwhile, cross-section data is data collected at one time for many individuals (Widarjono, 2007). The regression equation of this study is as follows:

$$\boldsymbol{Y} = \beta_0 + \beta_1\mathbf{X_1} + \beta_2\mathbf{X}_2 + \beta_3\mathbf{X_3} + \beta_4\mathbf{X}_4 + \beta_5\mathbf{X}_5 + \mu$$

Descriptions:

$\boldsymbol{Y}$ = Arabica coffee export volume in North Sumatra Province (kg)
β_0 = Constant
X_1 = Destination Country GDP (Rp)
X_2 = Rupiah Exchange Rate to US$,Yen, Euro (Rp)
X_3 = Production (Kg)
X_4 = Domestic Prices (Rp)
X5 = International Prices (Rp)
β_1-β_5 = Koefisien variabel regresi
μ = Error rate or interference rate

Modelling using panel data regression techniques can be done with three alternative processing methods, namely, Common Effect Model, Fixed Effect Model, and Random Effect Model.

Panel Data Regression Method Selection Test:

Chow test: The Chow Test is a test to compare the common effect model with the fixed effect (Widarjono, 2007). The Chow Test in this study used the *Eviews* program. The hypothesis formed in the Chow Test is as follows:

H0: Common Effects Model
H1: Fixed Effects Model

H0 is rejected if the P-Value is less than the value a. otherwise H0 is accepted if the P-Value is greater than the value a. The value of a used is 5%.

Hausman test: This test compares the fixed effect model with the random effect model in determining the best model to be used as a panel data regression model (Gujarati, 2012). The Hausman test uses a program similar to the Chow test, namely the *Eviews* program. The hypothesis formed in the Hausman test is as follows:

H0: Model Random Effects
H1: Fixed Effects Model

H0 is rejected if the P-value is less than the value a. Conversely, H0 is accepted if the P-value is greater than the value a. The value of a used is 5%.

Lagrange Multiplier Test: To find out whether the Random Effect model is better than the Common Effect (OLS) method, the Lagrange Multiplier (LM) test is used. This Random Effect significance test was developed by Breusch Pagan. The Bruesch Pagan method for testing the significance of the Random Effect is based on the residual value of the Common Effect method. The hypothesis for this test is:

H0: Common Effect Model
H1: Random Effect Model

The LM test is based on the chi-square distribution with a degree of freedom equal to the number of independent variables. If the value of the LM statistic is greater than the critical value of the chi-square statistic, then we reject the null hypothesis, meaning that a more precise estimate of the panel data regression is a random effect model. Conversely, if the statistical LM value is less than the critical value of the chi-square statistic, then we accept the null hypothesis, which means that the common effect model is better used in the regression.

Hypothesis test:

Determination Coefficient Test (R Square): The coefficient of determination (R Square) is used to measure the ability of the independent variable to explain the variation in the dependent variable. For example, an R Square value of 0.946 means that 94.6% of the variation in the dependent variable (Y) can be explained by variations in the independent variables (X1, X2, X3, X4, X5), while the remaining 5.4% is explained by other variables not included into the model (Firdaus, 2011).

Simultaneous Test (Test F): The F test is a simultaneous test of the significance of the effect of changes in the independent variables on the dependent variable. This means that X1, X2, X3, and X4 to Xn are simultaneously tested whether they have significance or not (Firdaus, 2011). The

results of the F test can be seen from the probability value. If the probability value is <0.05, the independent variable simultaneously influences the dependent variable (Firdaus, 2011).

Partial Test (t-test): The t-test is used to show whether partially (individually) the independent variable (X) affects the dependent variable (Y). In this case, t_{count} is compared to t_{table} with a confidence interval of 95 or α = 5% with the following conditions:

If the t-count value > t-table value or sig value < α (0.05) then the hypothesis (H1) is accepted. This means that variable X has a partial effect on variable Y.

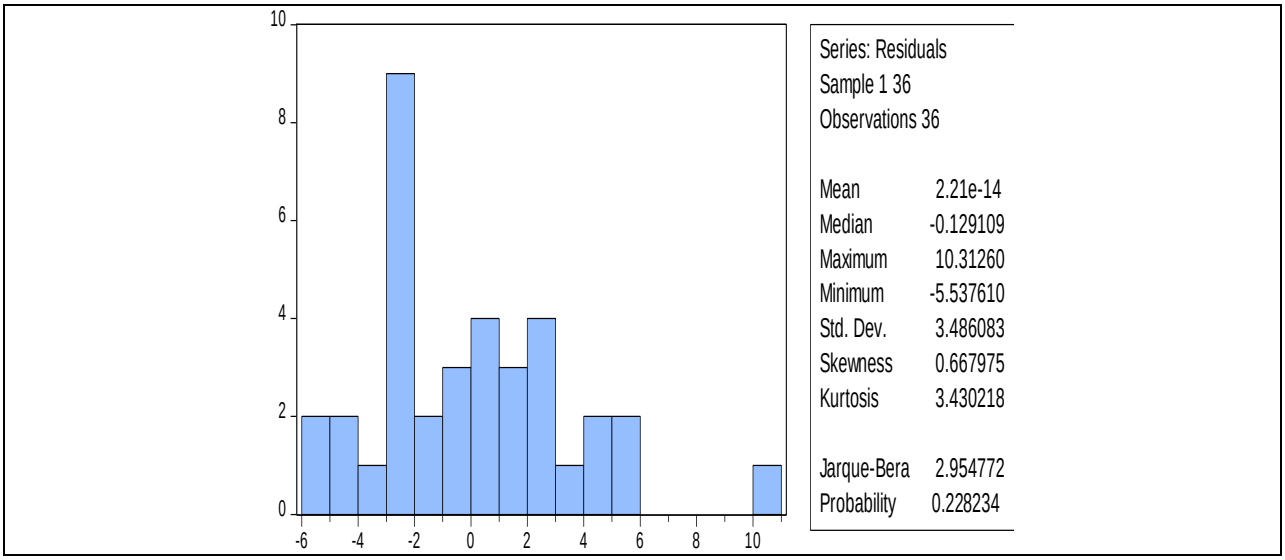
If the t-count value < t-table value or sig value > α (0.05) then the hypothesis (H1) is rejected. This means that variable X has no partial effect on variable Y.

Results and Discussion:

Classic assumption test:

Normality test: In this study, the normality test for residuals used the Jarque-Bera (J-B) test. In this study, the significance level used is α=0.05. The basis for decision-making is to look at the probability figures from J-B statistics.

Table 1: Normality test results[1]



It can be seen that based on the picture, it is known that the probability value of the J-B statistic is 0.228234. Because the probability value of p, which is 0.228234, is greater than the significance level, which is 0.05. This means that the normality assumption is met.

Multicollinearity Test: In this study, multicollinearity symptoms can be seen from the VIF value. Ghozali (2006) states that if the VIF value is > 10 then this is an indication of multicollinearity. The results of the multicollinearity test are presented in the table below.

[1] Source: Processed results of EViews 10 software

Table 2: Multicollinearity test table with VIF[2]

Independent Variable	VIF
X1	1.171646
X2	1.066393
X3	3.248369
X4	2.719281
X5	1.927881

Based on the table above and the results of the multicollinearity test, it can be concluded that there are no symptoms of multicollinearity between the independent variables. This is because the VIF value < 10.

Autocorrelation Test: The assumption regarding the independence of the residuals (non-autocorrelation) can be tested using the Durbin-Watson test. The statistical value of the Durbin-Watson test ranges between 0 and 4. A statistical value of the Durbin-Watson test that is less than 1 or greater than 3 indicates autocorrelation.

Table 3: Autocorrelation test table with Durbin-Watson test[3]

Log-likelihood	-95.53075	Hannan-Quinn criteria.	5.732712
F-statistic	8.268822	**Durbin-Watson stat**	**1.469962**

Based on the table above, the value of the Durbin-Watson statistic is 1.469962. Note that because the value of the Durbin-Watson statistic lies between 1 and 3, namely 1 < 1.469962 < 3, the non-autocorrelation assumption is fulfilled. In other words, there is no high autocorrelation in the residuals.

Heteroscedasticity Test: To test whether there is heteroscedasticity or not, the Glejser test can be used. The table below presents the results of the heteroscedasticity test using the Glejser test.

Table 4: Heteroscedasticity test with Glejser Test[4]

Heteroskedasticity Test: Glejser			
F-statistic	0.554906	Prob. F(5,30)	0.7334
Obs*R-squared[5]	3.047584	**Prob. Chi-Square(5)**	**0.6926**

Based on the Glejser test results in the table above, it is known that the Prob. Chi-Square 0.6926 > 0.05 which means there is no heteroscedasticity.

Panel Data Regression Method Selection Test:

Chow test: The Chow test is used to determine whether the CEM or FEM estimation model is used to form a regression model, so the Chow test is used. The hypothesis tested is as follows.

[2] Source: Processed Results of *EViews* 10 Software
[3] Source: Processed Results of EViews 10 Software
[4] Source: Processed Results of EViews 10 Software
[5] Obs*R-squared 3.047584 Prob. Chi-Square(5) 0.6926

H_0: The CEM model is better than the FEM model.
H_1: The FEM model is better than the CEM model

The following results are based on the Chow test using EViews 10.

Table 5: Results from the Chow Test[6]

Redundant Fixed Effects Tests			
Pool: DPANEL			
Test period fixed effects			
Effects Test	Statistic	d.f.	Prob.
Period F	1.077722	(11,19)	0.4263
Period Chi-square	17.454891	11	**0.0951**

Rules for making decisions on the hypothesis are as follows:

If the Chi-square cross-section probability value < 0.05, then H_0 is rejected and H_1 is accepted.

If the Chi-square cross-section probability value is 0.05, then H_0 is accepted and H_1 is rejected.

Based on the results of the Chow test in the table above, it is known that the probability value is 0.0951. Because the probability value is 0.0951 > 0.05, the estimation model used is the common effect model (CEM).

Lagrange-Multiplier Test: The Lagrange-Multipier test is used to determine whether the estimation model is CEM or REM in forming the regression model, so the Lagrange-Multiplier test is used. The following results are based on the Lagrange-Multiplier test using *EViews* 10.

Table 6: Results from the Lagrange-Multiplier Test[7]

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.791807	Prob. F(1,29)	0.1911
Obs*R-squared	2.094877	**Prob. Chi-Square(1)**	**0.1478**

Based on the results of the Lagrange-Multiplier test in the table above, it is known that the probability value is 0.1478. Because the probability value is 0.1478 > 0.05, the estimation model used is the common effect model (CEM).

After carrying out the Chow Test and the Lagrange-Multiplier Test, this study uses the Common Effect Model (CEM).

Hypothesis test:

In testing the hypothesis, an analysis of the coefficient of determination will be carried out, testing the simultaneous effect (F test), and testing the partial effect (t-test).

Analysis of the Coefficient of Determination (R2 Test):

[6] Source: Processed Results of EViews 10 Software
[7] Source: Processed Results of *EViews* 10 Software

The coefficient of determination test is used to find out how much the percentage of influence of the independent variable is, the amount of GDP in the destination country (X1), the rupiah exchange rate (X2), production (X3), the domestic price of Arabica coffee (X4), the international price of Arabica coffee (X5) can afford explains the dependent variable, namely the export volume of North Sumatra Arabica coffee (Y). The following are the results of the R2 test using the Eviews 10 software.

Table 7: Coefficient of determination test results (R2 test)

R-squared	**0.579503**	Mean dependent var	16.53483
Adjusted R-squared	0.509420	S.D. dependent var	5.375962

Based on the table above, it is known that the coefficient of determination (R-squared) is R2 = 0.579. This value can be interpreted as GDP, rupiah exchange rate, production, the domestic price of Arabica coffee, and international price of Arabica coffee simultaneously or jointly affecting the export volume of North Sumatra Arabica coffee by 57.9%, the remaining 42.1% is influenced by factors - another factor.

Simultaneous Test (Test F):

The F test is used to determine whether the effect of the independent variables simultaneously is significant, namely, the amount of GDP in the destination country (X1), the rupiah exchange rate (X2), production (X3), the domestic price of Arabica coffee (X4), the international price of Arabica coffee (X5) on the variable bound is the export volume of North Sumatra Arabica coffee (Y).

Table 8: Simultaneous test results (Test F)

F-statistic	8.268822
Prob(F-statistic)	**0.000053**

Based on the table above, it is known that the Prob. (F-statistics), namely 0.000053 0.05, it can be concluded that all independent variables, namely GDP (X1), the rupiah exchange rate (X2), production (X3), the domestic price of Arabica coffee (X4), the international price of Arabica coffee (X5) simultaneously has a significant effect on the export volume variable of North Sumatra Arabica coffee (Y).

Partial Test (t-test):

The t-test is used to determine whether the effect of the independent variables is partially significant, namely, the amount of GDP in the destination country (X1), the rupiah exchange rate (X2), production (X3), the domestic price of Arabica coffee (X4), the international price of Arabica coffee (X5) on the variable bound is the export volume of North Sumatra Arabica coffee (Y).

Table 9: Partial test results (t-test)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1?	2.265118	0.959031	2.361882	0.0249
X2?	0.739446	0.289645	2.552935	0.0160

X3?	2.525256	8.318971	0.303554	0.7636
X4?	10.71934	4.544255	2.358877	0.0250
X5?	0.867652	6.393611	0.135706	0.8930
C	-247.2450	165.6932	-1.492185	0.1461

Based on the table above, it can be seen that partially the GDP variable of the destination country (X1), the rupiah exchange (X2) and the domestic price of Arabica coffee (X4) have a positive and significant effect, while the production variable (X3) and the international price of Arabica coffee (X5) have a positive effect but not significant to the variable export volume of North Sumatra arabica coffee (Y) so that the following equation and its description can be seen:

Y = -247.2450 + 2.265118X1 + 0.739446X2 + 2.525256X3 + 10.71934X4 + 0.867652X5

The meaning of the equation above, namely:

The constant coefficient is -247.2450, so the constant has a negative effect. This means that if the Real GDP, Exchange Rate, International Coffee Prices, and Domestic Coffee Prices are zero, then the Export Volume of North Sumatra Arabica Coffee is -247.2450. The GDP coefficient of the destination country is 2.265118 with a positive sign, which means that the GDP of the destination country has a positive effect on the export volume of North Sumatra Arabica coffee. This means that when the GDP of the destination country increases by 1 rupiah, the volume of coffee exports will increase by 2.265118 kg, assuming other variables are constant. The coefficient of the rupiah exchange rate is 0.739446 with a positive sign, which means that the rupiah exchange rate has a positive effect on the export volume of North Sumatra Arabica coffee. This means that when the rupiah exchange rate increases by 1 rupiah, the volume of coffee exports will increase by 0.739446 kg, assuming other variables are constant. The production coefficient is 2.525256 with a positive sign, which means that production has a positive effect on the export volume of North Sumatra Arabica coffee. This means that when production increases by 1 kg, the volume of coffee exports will increase by 2.525256 kg, assuming other variables remain the same. The domestic coffee price coefficient is 10.71934 with a positive, which means that the domestic coffee price has a positive effect on the export volume of North Sumatra Arabica coffee. This means that when the domestic coffee price rises by 1 rupiah, the volume of coffee exports will increase by 10.71934 kg, assuming other variables are constant. The international coffee price coefficient is 0.867652 with a positive sign, which means that the international coffee price has a positive effect on the export volume of North Sumatra Arabica coffee. This means that when the international coffee price increases by 1 rupiah, the volume of coffee exports will increase by 0.867652 kg, assuming other variables are constant.

Conclusion:

The panel data regression estimation model used in this study is the Common Effect Model for the dependent variable of Arabica coffee export volume of North Sumatra. The coefficient of determination (R2) for the variable export volume of Arabica coffee from North Sumatra is 0.579. This means that of the five GDP variables, nominal exchange rates, production, domestic prices, and international prices simultaneously or jointly affect the export volume of North Sumatra Arabica coffee by 57.9%, and the remaining 42.1% is influenced by

other factors. Simultaneously or together the variables GDP, nominal exchange rates, production, domestic prices, and international prices have a significant effect on the export volume variable of North Sumatra Arabica coffee. Partially, the GDP, nominal exchange rate and domestic coffee prices have a positive and significant effect, while production and international prices have a positive but not significant effect on the export volume variable for North Sumatra Arabica coffee.

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