

The Influence of External Factors on the Price of Domestic Corn in Indonesia

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Abstract: The movement in the international commodity price is essential when the world economy has shocks in the world food price, which can influence the economy in Indonesia. The action in the world food price tends to keep increasing, affecting the price or inflation in Indonesia. This study analyzes the influence of the rupiah exchange rate, the international corn price, and the international rice price on the domestic corn price in Indonesia. This study uses secondary data, which are time series data from 1980 to 2022. The analysis model uses the multiple linear regression model and is then estimated using the Eviews 12 program. The results show that the rupiah exchange rate and the international corn price positively and significantly influence the domestic corn price. In contrast, the international rice price has a positive and insignificant influence on the domestic corn price at the 95 percent confidence level.

Keywords: Domestic corn price, Rupiah exchange rate, corn price, international rice price.

INTRODUCTION

Corn is a food-crop commodity that can play a role in developing the agricultural sector. The need for corn will continue to increase yearly in line with improvements in the community's economy and advances in the animal feed industry. Therefore, efforts are needed to increase production through human resources, natural resources, land availability, yield potential, and technology. (Isnuriadi, 2019, Ze et al., 2023).

Corn is very beneficial for human and animal life. In Indonesia, corn is the second staple food after rice. Based on 206 staple food ingredients worldwide, corn ranks third after wheat and rice. Moreover, superior hybrid seeds were discovered, with many advantages compared to ordinary corn seeds. These advantages include a faster harvest period, more excellent resistance to pest and disease attacks, and higher production.

Corn is one of the most critical food crops besides wheat and rice. Apart from being a source of carbohydrates, corn is also grown as animal feed (greens and cobs); the oil is extracted (from the grains), made into flour (from the grains, known as corn flour or maize), and used as industrial raw materials (from grain flour and cob flour). From a consumption perspective, corn is a substitute for rice and cassava. For some Indonesians, corn is the second staple food after rice.

Corn is a much-needed food crop. Corn can be used as a public or processed food ingredient in the flour and livestock industries. The strength of the economy will also have an impact on the many benefits of corn. Corn is a food crop as a

source of carbohydrates, after rice, which supports the national economy (Dahlia & Tahir, 2021).

Indonesia is a country rich in natural resources, including various types of plants (Li et al., 2023, Lisha et al., 2023 and Liu et al., 2023). These types of plants are divided into food crops, horticulture, and industrial crops. Corn is a food crop that can play a role in developing the agricultural sector. There is quite a considerable potential for corn to be farmed as an agribusiness because corn has bright prospects for its cultivation aspect, and the opportunities are plentiful. Corn is not that difficult to cultivate. Corn can grow in almost all soil types (Trinia, 2019). Indonesia is a country with a tropical climate and fertile soil. As an agricultural country, Indonesia has a high biodiversity (Hendarto et al., 2022). Climate suitability and historical developments have explained that food commodities in Indonesia consist of rice, wheat, and corn, which are plant products that can become staple food for humans. Corn is a commodity choice that can be pretty reliable because, currently, it is not only a food commodity but also an industrial commodity. One industry that uses corn as an industrial supporting element is the livestock industry, especially poultry. The need for corn continues to increase along with the increase in population, which impacts the need for animal protein. Corn is the primary raw material for the animal feed industry, cooking oil, low-calorie sugar, and corn flour or maize (Ministry of Agriculture, 2018).

For Indonesia, with a large population and a livestock and feed industry that is growing quite rapidly, the vital role and potential of corn can be a solid reason to prioritize corn development. In order to meet domestic needs, there is also great potential for export opportunities to international markets and the development of new products. Fulfilling needs that rely on imports will be at high risk due to fluctuating world markets and shifts in exporting countries, which can

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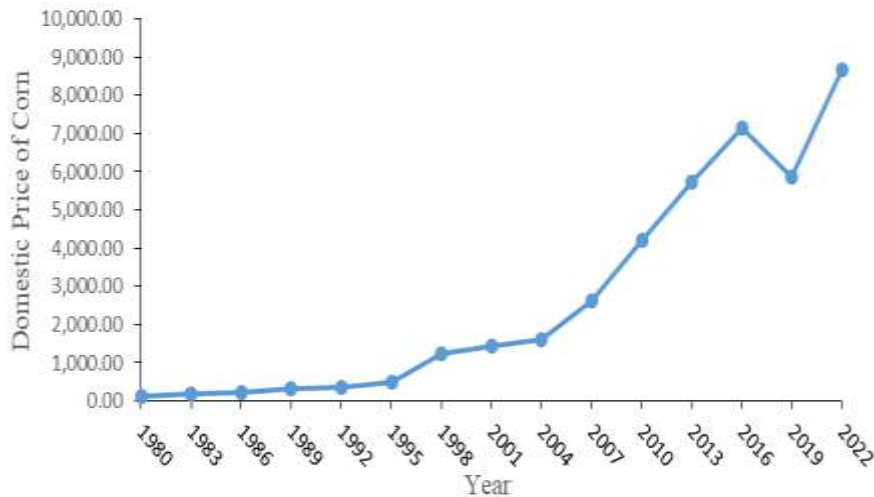


Fig. (1). Domestic corn price development.

impact the livestock industry (domestic feed). One of the consequences is fluctuations in food availability and animal feed prices (Sulaiman et al., 2018).

Corn price certainty is an essential basis for determining the price of a commodity to be traded. It follows the reasons for considering the creation of a Minister of Trade regulation regarding the determination of reference prices for purchases by farmers and reference prices for sales by consumers. Uncertain prices will disrupt demand in the market and give rise to domino effects (a series of causes and effects); the high price of corn commodities and other production is also high.

The exchange rate is the price of a country's currency expressed in other currencies that can be bought and sold. Exchange rates greatly influence international trade activities between one country and another country. Foreign exchange rates are essential in determining the relative prices of goods and services in other countries, whether they are cheaper or cheaper than domestic goods (Puspita et al., 2015).

Price is an essential factor to pay attention to because it will influence the profits received or the potential risks due to price reductions. Price integration between importing and exporting countries is one of the benchmarks to see the response of exporting countries to changes that occur in importing countries. An integrated market occurs if price changes in one party can impact or be transmitted to other parties (Zahara et al., 2020).

The change in the agricultural commodity market regime towards a free market has the consequence that prices of agricultural commodities, especially food, namely corn, in the domestic market are increasingly open to international market fluctuations. In other words, the price of food commodities on the world market will directly influence the price of domestic food commodities. As a food commodity, the dynamics of corn prices cannot be separated from the direction of international trade policy, world food commodity markets, price stability, and exchange rate fluctuations. The accumulation of changes from these various aspects will simultaneously influence the dynamics of domestic corn commodity prices.

Therefore, this study aims to analyze the influence of the rupiah exchange rate, international corn prices, and international rice prices on domestic corn prices in Indonesia.

METHOD

Data Collection

This study used secondary data from 1980 to 2022, or for 43 years, consisting of data on domestic corn prices, rupiah exchange rates, international world corn prices, and international rice prices. The data were obtained from Statistics Indonesia and other sources (Statistics Indonesia, 2022).

Data Analysis

The analytical model used to see the influence of the rupiah exchange rate, international corn prices, and international rice prices on domestic corn prices in Indonesia is the double logarithmic multiple linear regression equation as follows:

$$\text{Log (PJGD)} = c + a_1 \text{Log (ER}_1) + a_2 \text{Log (PJGW}_2) + a_3 \text{Log (PBRW}_3) + e_t$$

Whereas:

PJGD : Domestic Corn Price (Rupiah/Kg)

ER₁ : Rupiah Exchange Rate (Rupiah/\$)

PJGW₂ : International Corn Price (\$/ton)

PBRW₃ : International Rice Price (\$/ton)

The data were then processed using the Eviews 12 program.

RESULTS AND DISCUSSION

Domestic Corn Price Development

Fig. (1) below shows the domestic corn price development.

The Indonesia's domestic corn price development from 1980 to 2022 tended to fluctuate. The domestic corn price general-

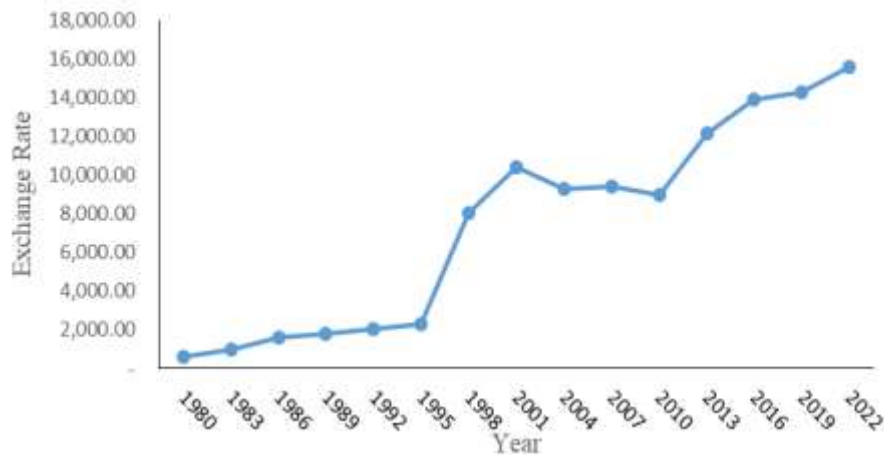


Fig. (2). Rupiah exchange rate development.

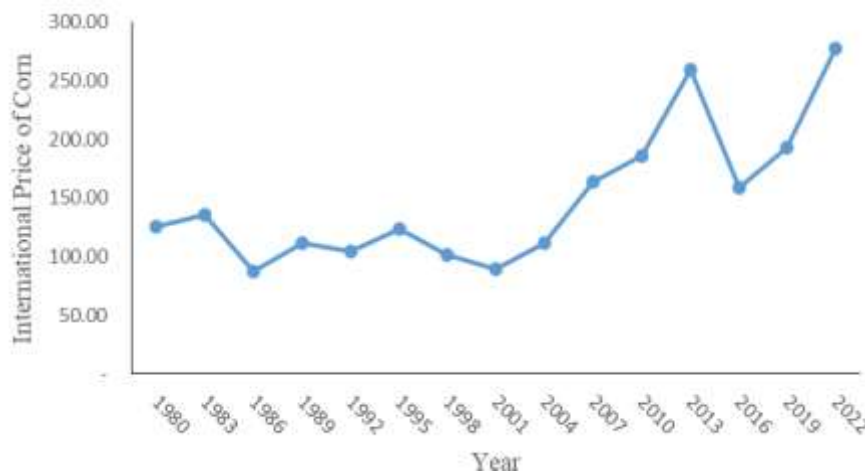


Fig. (3). International corn price development.

ly tended to increase and decrease in 2019 due to the COVID-19 pandemic. Therefore, people's purchasing power declined, and demand for corn fell, so domestic corn prices dropped.

Rupiah Exchange Rate Development

The following Fig. (2) shows the detailed rupiah exchange rate.

The Indonesia's rupiah exchange rate development in 1980-2022 tended to increase. The highest rupiah exchange rate was achieved in 2022, i.e., IDR 14545/\$.

International Corn Price Development

The following Fig. (3) shows the international corn price development.

The international corn price development tended to fluctuate from 1980 to 2022. However, the international corn price generally tended to increase. The highest international corn price was achieved in 2012, i.e., 298.42/\$/ton.

International Rice Price Development

The following Fig. (4) shows the international rice price development.

The international rice price development from 1980 to 2022 tended to fluctuate. However, it generally tended to increase. The highest international rice price was in 2012, i.e., 562.98/\$/ton.

A classical assumption test is required to have a good and non-biased regression analysis, which can be used as a correct prediction tool (Widarjono, 2018).

Normality Test

The normality test tests the significance of independent variables on dependent variables through the *t*-test, and will only be valid if the residual obtained has a normal distribution. The following Figure 5 shows the normality test results.

The test results show that if the probability value of the Jarque Bera test is greater than the 5% alpha or $0.165 > 0.05$, then the hypothesis is null, meaning that the residual is normally distributed, or the distribution data analyzed is normal since there is no extreme value on the data.

Correlation/Autocorrelation Serial Test

Autocorrelation occurs when errors or residuals from several periods are correlated. The results of the serial correlation test are in the table below.

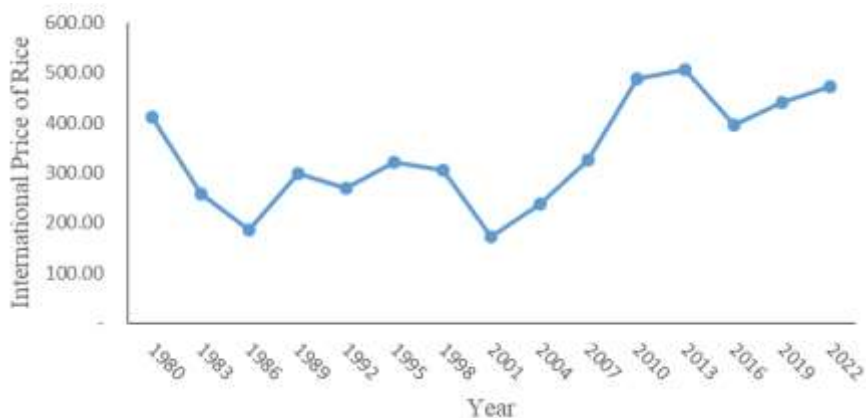


Fig. (4). Perkembangan harga beras dunia internasional

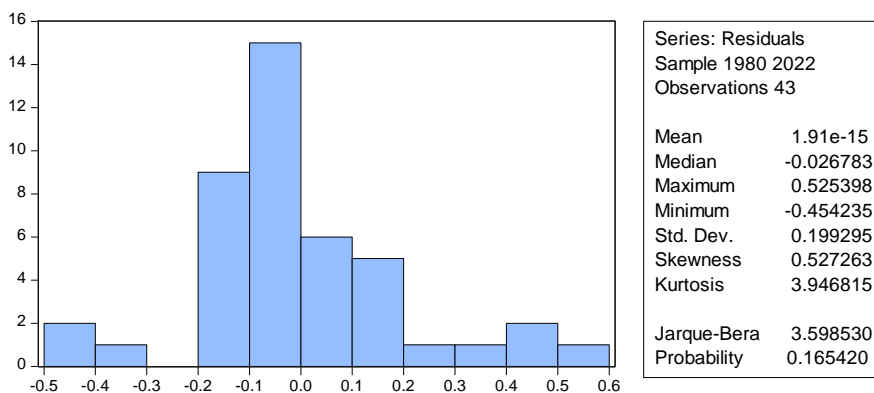


Fig. (5). Normality Test Results.

Table 1. Correlation/Autocorrelation Serial Test Results.

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	3.206365	Prob. F(2,37)		0.0520
Obs*R-squared	6.351764	Prob. Chi-Square(2)		0.0418
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 09/13/23 Time: 20:42				
Sample: 1980 2022				
Included observations: 43				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.142016	0.907603	0.156473	0.8765
LOG(ER)	0.007615	0.033600	0.226631	0.8220
LOG(PJGW)	-0.138518	0.189538	-0.730818	0.4695
LOG(PBRW)	0.107161	0.177406	0.604043	0.5495
RESID(-1)	0.412803	0.167998	2.457188	0.0188
RESID(-2)	-0.032298	0.167444	-0.192891	0.8481
R-squared	0.147715	Mean dependent var		1.91E-15

Adjusted R-squared	0.032542	S.D. dependent var	0.199295
S.E. of regression	0.196025	Akaike info criterion	-0.292362
Sum squared resid	1.421755	Schwarz criterion	-0.046613
Log likelihood	12.28577	Hannan-Quinn criter.	-0.201737
F-statistic	1.282546	Durbin-Watson stat	2.004526
Prob(F-statistic)	0.292194	-	-

Table 2. Heteroscedasticity Test Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	1.150354	Prob. F(3,39)	0.3410	
Obs*R-squared	3.495687	Prob. Chi-Square(3)	0.3213	
Scaled explained SS	4.236894	Prob. Chi-Square(3)	0.2370	
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 09/13/23 Time: 20:43				
Sample: 1980 2022				
Included observations: 43				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.200989	0.304464	-0.660140	0.5130
LOG(ER)	0.007302	0.011345	0.643614	0.5236
LOG(PJGW)	-0.094465	0.061041	-1.547562	0.1298
LOG(PBRW)	0.103769	0.058802	1.764714	0.0854
R-squared	0.081295	Mean dependent var	0.038795	
Adjusted R-squared	0.010625	S.D. dependent var	0.067384	
S.E. of regression	0.067025	Akaike info criterion	-2.479089	
Sum squared resid	0.175203	Schwarz criterion	-2.315256	
Log likelihood	57.30041	Hannan-Quinn criter.	-2.418673	
F-statistic	1.150354	Durbin-Watson stat	1.732443	
Prob(F-statistic)	0.340954	-	-	-

The test results show that the prob value of the F-statistic is greater than the alpha level of 5 percent or 0.05, where the prob value is $0.052 > 0.05$, then the null hypothesis is accepted, meaning that there is no autocorrelation or no correlation between confounding errors in period t and errors in period $t-1$ (previous) in the regression model.

Heteroscedasticity Test

Heteroscedasticity occurs when the error or residual does not have a constant variance throughout the data value, which will affect the statistical test value and confidence interval. The table below shows the heteroscedasticity test results.

The test results show that if the prob value of the F-statistic is greater than the alpha level of 5 percent or 0.05, where the prob value is $0.34 > 0.05$, then the null hypothesis is accepted, meaning that there is no heteroscedasticity or the same variance of error occurs for all observations of each independent variable in the regression model.

Multicollinearity Test

Multicollinearity is a condition where the independent or independent variables are strongly interconnected. The following table shows the results of the multicollinearity test.

Table 3. Multicollinearity Test Results.

Variance Inflation Factors			
Sample: 1980 2022			
Included observations: 43			
	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.882615	887.2874	NA
LOG(ER)	0.001225	89.78182	1.317544
LOG(PJGW)	0.035477	3243.999	4.582304
LOG(PBRW)	0.032922	3577.272	4.163673

The test results show that the VIF values are all less than 10, meaning there is no multicollinearity problem in the regression model or a variable is not strongly correlated with other variables in the analysis model.

Furthermore, the results of multiple linear regression estimates can be seen in Table 4.

Table 4. Multiple Linear Regression Estimation Results

Dependent Variable: LOG(PJGD)				
Method: Least Squares				
Sample: 1980 2022				
Included observations: 43				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.05917	0.939476	-13.90048	0.0000
LOG(ER)	1.075947	0.035007	30.73558	0.0000
LOG(PJGW)	0.789497	0.188354	4.191570	0.0002
LOG(PBRW)	0.341230	0.181443	1.880642	0.0675
R-squared	0.979003	Mean dependent var		7.128197
Adjusted R-squared	0.977387	S.D. dependent var		1.375345
S.E. of regression	0.206818	Akaike info criterion		-0.225550
Sum squared resid	1.668169	Schwarz criterion		-0.061717
Log likelihood	8.849324	Hannan-Quinn criter.		-0.165134
F-statistic	606.1214	Durbin-Watson stat		1.266903
Prob(F-statistic)	0.000000	-	-	-

The coefficient of determination (R^2) is 0.979. In other words, 97.90% of the variation in domestic corn price can be influenced by the rupiah exchange rate, international corn price, and international rice price, while the remaining 2.10% is influenced by other variables excluded from the estimation model.

The simultaneous test results show that the prob (F) value is < 0.05 , meaning that the rupiah exchange rate, international corn price, and international rice price simultaneously significantly influence the domestic corn price with a confidence level of 95%.

The Influence of the Rupiah Exchange Rate on the Domestic Corn Price

The rupiah exchange rate positively influences the domestic corn price, with a regression coefficient 1.075. In other words, every 1 percent increase in the rupiah exchange rate will increase the domestic corn price by 1.075 percent. Based on the test results, the probability value is < 0.05 , which is 0.00, meaning that the rupiah exchange rate significantly influences domestic corn prices, with a confidence level of 95%, assuming that other variables are considered constant or fixed. This is because economic conditions are always unstable, resulting in frequent weakening of the rupiah currency or depreciation, which can trigger inflation and increase domestic prices of goods, especially for goods or products processed from imported raw materials. Producers have to spend more money to buy raw materials from abroad, causing an increase in the domestic corn price.

The results of this study are similar to the one by Hanani et al. (2010), who stated that the rupiah exchange rate has a positive influence on the wholesale corn price in the provinces of North Sumatra, West Sumatra, Riau, Central Java, Jogjakarta, East Java, and South Sulawesi. Surbakti (2013) stated that the rupiah exchange rate positively influences the price of shelled corn from the producers.

The Influence of International Corn Price on Domestic Corn Price

International corn price positively influences domestic corn price, with a regression coefficient value of 0.7894. In other words, every 1 percent increase in international corn price will increase the domestic corn price by 0.7894 percent. Based on the test results, the probability value is < 0.05 , which is 0.0002, meaning that international corn price significantly influences domestic corn price, with a confidence level of 95%, assuming that other variables are considered constant or fixed. Market integration has occurred, which indicates that changes or increases in the corn price in the international market will cause an increase in the corn price in the domestic market, or in other words, there is a transmission of the corn commodity price.

The study results are similar to the one by Listiyana (2021), who stated that the international coffee price has a positive influence on the value of Indonesian coffee exports. It shows that the international coffee price influences the increase or decrease in the value of Indonesian coffee exports. In other words, the increase or decrease in prices in the international trade market is caused by the economic condition of the exporting country, where high inflation in the domestic market will cause a price increase in the domestic market. Price on the international market also increases, where international price indicates a balance between export supply and import demand. Arsyad (2019) stated that there is a positive and significant relationship between the domestic tea price and export tea price, with a confidence level of 95%.

The Influence of International Rice Price on Domestic Corn Price

International rice price positively influences domestic corn price, with a regression coefficient of 0.3412. In other words, every 1 percent increase in international rice price will increase the domestic corn price by 0.3412 percent. Based on the test results, the probability value is >0.05 , which is 0.067, meaning that international rice price has no significant influence on domestic corn price, with a confidence level of 95%, assuming that other variables are considered constant or fixed. The international rice price positively influences the domestic corn price since there are indications that the two products are used as substitutes. If the international rice price increases, the demand for rice will decrease, and people will switch to using corn, increasing the demand for corn. The increasing demand for corn with low supply causes domestic corn prices to rise.

The study results are similar to the one by Elawati (2020), who stated that the elasticity value of the Indonesian coffee price towards the chocolate price is positive, both in the short and long term. In other words, if the chocolate price increases by 1%, the Indonesian coffee price will increase by 0.8601% in the short term and 1.2101% in the long term. Research by Hidayat (2012) stated that changes in the rice price on the world market were transmitted to the Indonesian rice market, but not perfectly. An increase in the international rice price can lead to increased welfare of rice farmers, meaning that an increase will follow an increase in the international rice price in the domestic rice price.

CONCLUSION

Simultaneously, the rupiah exchange rate, international corn prices, and international rice prices significantly influence domestic corn prices. Partially, the rupiah exchange rate and international corn prices have a positive and significant influence on domestic corn prices, while international rice prices have a positive and insignificant influence on domestic corn prices at a confidence level of 95 percent.

REFERENCES

- Arsyad, A. (2019). The Influence of the Rupiah Exchange Rate and Domestic Tea Prices on Export Tea Prices (Case Study of PTPN V Medan, North Sumatra). Thesis, Faculty of Agriculture, Muhammadiyah University of North Sumatra, Medan.
- Central Bureau of Statistics. (2021). North Sumatra in Figures 2021. North Sumatra Province, Medan.
- Dahlia, A.B. & Tahir, R. (2021). Hybrid Corn Marketing Strategy as a Regional Leading Program in Cina District, Bone Regency, South Sulawesi Province. *Agricultural Journal*, Vol. 4 No. 1: 106-115, March 2021.
- Elawati. (2020). Supply and Demand for Indonesian Coffee in the International Market: Simultaneous Equation Model. Thesis, Agribusiness Study Program, Faculty of Agriculture, Islamic University of Riau Pekanbaru.
- Hanani, N., et.al. (2010). The Influence of the Exchange Rate on Wholesale Prices of Main Food Crops in Several Provinces of Indonesia. *Agrires Journal*, Volume 3 August 2010, Malang.
- Hendarto, E., Sharma, S., Opulencia, M. J. C., Hasan, M. K., Al-Dhalimy, A. M. B., & Jabar, N. A. A. (2022). How Did Globalization Boost the Nuts Production in Indonesia?. *Journal of Nuts*, 13(3), 199-210. DOI: 10.22034/jon.2022.1951651.1150
- Hidayat, N.K. (2012). The Impact of Changes in World Rice Prices on the Welfare of Indonesian People in Various Conditions of Price Transmission and Domestic Policy. Thesis, Postgraduate School, Bogor Agricultural Institute, Bogor.
- Isnuriyadi, P.D. (2019). Analysis of Factors That Influence Corn Farmers' Production and Income. Thesis, Agribusiness Study Program, Faculty of Agriculture, Medan Area University, Medan.
- Kementerian Pertanian. (2018). Production of Feed from Corn. Ministry of Agriculture of the Republic of Indonesia, Jakarta.
- Li, Z., Leong, L. W., Aldoseri, M. M. N., Abu-Rumman, A., & Al Shraah, A. (2023). Examining the role of sustainability and natural resources management in improving environmental quality: Evidence from Asian countries. *Resources Policy*, 80, 103136. <https://doi.org/10.1016/j.resourpol.2022.103136>
- Lisha, L., Mousa, S., Arnone, G., Huerta-Soto, R., & Shiming, Z. (2023). Natural resources, green innovation, fintech, and sustainability: A fresh insight from BRICS. *Resources Policy*, 80, 103119. <https://doi.org/10.1016/j.resourpol.2022.103119>
- Listiyana. (2021). The Influence of the Rupiah Exchange Rate and International Prices on the Value of Indonesian Coffee Exports. Thesis, Faculty of Islamic Economics and Business, North Sumatra State Islamic University, Medan.
- Liu, J., Loan, V. T. K., Mousa, S., Ali, A., & Cong, P. T. (2023). Sustainability and natural resources management in developed countries: The role of financial inclusion and human development. *Resources Policy*, 80, 103143. <https://doi.org/10.1016/j.resourpol.2022.103143>
- Puspita, R., Hidayat, K., dan Yulianto, E. (2015). The Influence of Domestic Cocoa Production, International Cocoa Prices, and Exchange Rates on Indonesian Cocoa Exports to the United States. *Journal of Business Administration (JAB)*, Vol 27 No. 1: 1–8.
- Sulaiman, A.A., I.K Kariyasa, Hoerudin, K. Subagyo, F.A. Bahar. (2018). Fast Way to Self-Sufficiency in Corn. Jakarta, Agricultural Research and Development Agency: IAARD Press.
- Surbakti, M.N. (2013). Analysis of factors influencing the price of corn kernels at the producer level in North Sumatra. Thesis, Agribusiness Study Program, Faculty of Agriculture, University of North Sumatra, Medan.
- Trinia, A. (2019). Effect of Planting Distance on the Growth and Yield of Sweet Corn (*Zea mays* L. Saccharata) Jajar Legowo System (2:1). Thesis, Faculty of Agriculture, Andalas University, Padang.
- Widarjono. A. (2018). Introductory Econometrics and its Applications Accompanied by Eviews Guide. Fifth edition. Yogyakarta: UPP STIM YKPN.
- Zahara, et.al. (2020). Integration of the Lampung Robusta Coffee Market with the London Stock Exchange. *Journal of Agricultural and Agribusiness Economics (JEPAA)*, Volume 4, Number 4: 893-907.
- Ze, F., Yu, W., Ali, A., Hishan, S. S., & Khudoykulov, K. (2023). Influence of natural resources, ICT, and financial globalization on economic growth: Evidence from G10 countries. *Resources Policy*, 81, 103254. <https://doi.org/10.1016/j.resourpol.2022.103254>