

Indonesian molasses export supply in world trade

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Abstract

This study examines the factors affecting Indonesian molasses exports in international trade using time series data from 2003 to 2019. The analysis tool used is the Error Correction Model (ECM). The analysis results show that in the long run, the variables of molasses production, exchange rates, and inflation have a significant effect on Indonesia's molasses export supply. In contrast, Indonesia's GDP, molasses export prices, and world CPO prices have no significant effect. In the short run, the variables of molasses production, world molasses prices, exchange rates, and inflation have a significant effect. The variables of Indonesia's GDP, molasses export prices, and world CPO prices have no significant effect on Indonesia's molasses export supply in world trade.

Keywords: *Error Correction Model, Export supply, Molasses, World trade*

JEL Classification: E23, F14

INTRODUCTION

The plantation is one of the sub-sectors with a vital role in the agricultural sector, namely a national economy that can improve farmers' welfare and reduce unemployment (Suryana 2014). The plantation sub-sector has considerable potential. In 2019, the plantation sub-sector contributed 3.27 percent to the Gross Domestic Product (GDP), the first contributor to the agriculture, livestock, hunting, and agricultural services sectors. Apart from contributing to GDP, the plantation sector is also a provider of raw materials for industry, an absorber of labor, and a foreign exchange earner (BPS 2020). Sugarcane is one of the plantation products that has been processed into various products and traded on the international market. Sugarcane has been cultivated extensively and intensively in Indonesia. The sugarcane plantation area reaches 413.05 thousand ha with around 2.23 million tons of production. Smallholders cultivated around 239.23 thousand ha in this area (BPS 2020).

Along with the development of technology, besides being processed into sugar, sugar cane can also be used as a variety of alternative food, feed, fiber, and energy products in the form of biofuels to support the needs of the electrical and automotive industries. Apart from being used for domestic consumption, some products are also exported in derivative products, namely molasses. The development of sugarcane derivative products, especially cane molasses, can be traded on the world market. Indonesia's molasses export contribution to world trade in 2019 reached 14.7 percent and was in second place after India. Indonesia's molasses exports have increased compared to exports in 2017, which reached 9.43 percent (OEC 2020). India is the

world's foremost exporter of molasses, accounting for 19.4 percent of the world's total molasses exports. After Indonesia, Thailand and Guatemala contributed 11.9 percent and 9.33 percent of world exports, and the rest were met by other countries such as El Salvador, Australia, and Pakistan.

The export contribution of Indonesian molasses is around 78.4 percent of the total export of sugarcane products (Erliza et al., 2007). Nearly 50 percent of Indonesia's molasses production is exported to destination countries such as Japan, South Korea, the Philippines, and other export destination countries. During the last three periods, Molasses exports grew from 426,000 tons in 2017 to 642,000 tons in 2019. Molasses production in 2019 reached 1.24 million tons, and 52 percent was exported from domestic supplies. This excess of domestic molasses that has not been utilized is then exported. Inefficiency is a vital problem in the national sugar industry because much sugar cane is wasted during processing in sugar factories. It resulted in the yield tending to be below. Therefore, the government revitalized and built several new factories to diversify products from sugar cane derivatives to add value.

The Government of Indonesia requires the use of E5 bioethanol in 2020 with a formulation of 5 percent ethanol and 95 percent gasoline and increases to E20 in 2025 (Government Regulation of the Republic of Indonesia No. 79 of 2014 concerning energy policy and the Minister of Energy and Mineral Resources Regulation No. 12 of 2015 concerning biofuels' supply, utilization, and trading as other fuels). It is done because the utilization of molasses in Indonesia is still very low. However, the plan has faced various obstacles, such as the limited production infrastructure, the less competitive cost of processing bioethanol, and the distribution of biofuels, especially in Eastern Indonesia, and the limited raw material for molasses is often exported. In addition, the selling price of bioethanol is not compatible. So the government revised the use of bioethanol by lowering the ethanol content to 2 percent. Ghani & Gheewala (2021) stated that the sale of E5 has not been implemented throughout the country, resulting in the export of molasses and bioethanol being greater than consumption in the domestic market. The lack of financial support to run the blending program and the mandate that was never enforced resulted in the downstream molasses not being optimal (Rahmanulloh, 2021).

Waste treatment is still a problem in the sugar industry because waste cannot be adequately treated, so production is hampered, and factory performance will decline. It has caused the incessant export of molasses so that the stock of molasses raw materials is decreasing, and the price of raw materials is not controlled. The low domestic molasses price makes farmers sell molasses abroad than domestically. Utami & Hasanah (2017) mention that the high price of molasses in the global market is why molasses are exported more than sold in the domestic market. Domestic molasses development is a challenge for the Indonesian government. Limitations in processing molasses into processed products are an obstacle for Indonesia in exporting processed molasses products. It is what makes Indonesia export molasses in its raw form. In the face of declining exports and competition with the fellow world, molasses producers will increase in the future. The existence downstream can increase employment, and factories will create demand for a product which ultimately gives value to the product (Szulczyk et al., 2021).

In contrast to previous studies on export offers, this study focuses on examining the export offers of molasses, which is a by-product of sugarcane processing. The limited research related to molasses, especially in the economic field, makes this research interesting to study by adding several economic variables. Therefore, a more

in-depth analysis will be carried out on supply performance and production capability determined by farmers' response to changes that occur either due to market mechanisms or government policies.

METHODS

This study uses secondary data in the form of time series (quarterly time series) for 17 years from 2003 (2003:Q1) to 2019 (2019:Q4). Data sources were obtained from various sources such as the Central Bureau of Statistics, International Trade Center, Food Agriculture of Organization, UN Comtrade, and the World Bank. Analysis of quantitative data and factors that affect molasses export supply using the *Error Correction Model* (ECM) method. The data was processed quantitatively using Microsoft Excel and Eviews 12 programs.

Stationarity test

Regression using non-stationary data will lead to spurious regression. This problem arises due to a strong trend of the dependent and independent variables in the time series. This study for stationarity uses the unit root test by comparing Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF). If the value of DF and ADF is greater than the critical value, then the data is stationary. Vice versa, if the DF and ADF values are smaller than the critical value, the data is not stationary and is continued with the cointegration test (Dzakiyah *et al.* 2018).

Cointegration test

The cointegration test is used to continue the analysis of non-stationary time series data (Falanta 2017). The cointegration technique was first introduced by Engle & Granger (1987) and developed by Johansen (1988). A cointegration test is carried out to see the long-run equilibrium, while the imbalance fluctuations in the short run are corrected using an Error Correction Model (ECM). The formation of the Error Correction Model (ECM) in the equation of Indonesian molasses export supply, in the long run, can be formulated as follows:

$$LnXMo = \alpha_0 + \alpha_1LnQMo + \alpha_2LnGDP + \alpha_3LnPXMoi + \alpha_4LnPWMoi + \alpha_5LnER + \alpha_6LnPCPO + \alpha_7LnInf + \epsilon_t \dots\dots\dots (1)$$

Where:

- XMo = Molasses export volume to destination country (tons)
- QMoi = Indonesian molasses production (tons)
- GDPi = Gross Domestic Product of Indonesia (US\$)
- PXMoi = Indonesian molasses export price (US\$/ton)
- PWMoi = World molasses export price (US\$/ton)
- ERij = Exchange rate (Rp/US\$)
- PWCPO = World palm oil price (US\$/ton)
- Inf = Inflation (%)
- ϵ = Error term

The model specification using ECM is then tested on the *Error Correction Term* (ECT) coefficient. In this model, the coefficient value must be negative and statistically significant. If these conditions are violated, the variables will move further away from the balance line and form a new imbalance so that the model cannot be used (Iladini and Agustina 2020). In order to know the relationship between Indonesian molasses exports and the independent variable empirically, the balance cannot be known directly.

However, it can be estimated in the short-run equation by including the element of ECT. The equation of the short-run model is shown as follows:

$$LnXMo = \alpha_0 + \alpha_1\Delta QMo + \alpha_2\Delta GDP + \alpha_3\Delta PXMo + \alpha_4\Delta PWMo + \alpha_5\Delta ER + \alpha_6\Delta PCPO + \alpha_7\Delta Inf + ECT_{t-1} + \varepsilon_t \dots\dots\dots (2)$$

The ideal and optimal linear regression estimation model must produce an estimator that meets the Best Linear Unbiased Estimator (BLUE) criteria. The classical assumption test includes multicollinearity, heteroscedasticity, and autocorrelation tests.

RESULTS AND DISCUSSION

The dependent variable in this model is Indonesian molasses export, influenced by independent variables such as molasses production, Indonesian GDP, molasses export price, world molasses price, exchange rate, world palm oil price, and inflation. The stages in the Error Correction Model analysis are as follows:

Heteroscedasticity test

Heteroscedasticity is a regression problem that does not have the same variance or variance is not constant. The heteroscedasticity test used the Breusch-Pagan-Godfrey. The results of the Breusch-Pagan-Godfrey test obtained the value of Prob. Chi-Square of 0.8243 > 0.05 (α = 5%), it can be concluded that the regression model made does not have heteroscedasticity. The results of the heteroscedasticity test can be seen in Table 1.

Table 1. Heteroscedasticity test results

| | | | |
|--------------------|----------|----------------------|--------|
| F-statistic | 0.503309 | Prob. F(8,58) | 0.8489 |
| Obs*R-squared | 4.349331 | Prob. Chi-square (8) | 0.8243 |
| Scale explained SS | 10.10468 | Prob. Chi-square (8) | 0.2578 |

Multicollinearity test

Multicollinearity is a deviation that occurs due to the relationship between the independent variables that make up the model. This study determines the presence or absence of multicollinearity by calculating the *Variance Inflation Factor* (VIF) value. Based on the results of the multicollinearity test in Table 2, all independent variables have a VIF value of less than 10. So it can be concluded that the regression model is free from multicollinearity problems.

Table 2. Multicollinearity test results

| Variable | Coefficient Variance | Centered VIF |
|-----------------------|----------------------|--------------|
| Constanta | 74.97140 | NA |
| Production | 0.003461 | 1.021278 |
| Indonesia's GDP | 0.627893 | 7.638991 |
| Molasses export price | 0.227821 | 1.845274 |
| world molasses price | 0.005749 | 1.917338 |
| Exchange rate | 2.192618 | 5.263387 |
| World palm oil price | 0.216196 | 2.700599 |
| Inflation | 0.077726 | 2.063878 |

Autocorrelation test

Autocorrelation shows a high correlation between the errors. The occurrence of correlation is caused by standard errors that are biased downwards or smaller than the actual value so that the statistical value is high (Juanda & Junaidi, 2012). This study uses the *Breusch-Godfrey test*. If the probability value is less than 0.05, it indicates an autocorrelation. The autocorrelation results show that the probability value is 0.2372 >

0.05 ($\alpha = 5\%$). So it can be concluded that the model made has no symptoms of autocorrelation.

Table 3. Autocorrelation test results

| | | | |
|---------------|----------|----------------------|--------|
| F-statistic | 1.475170 | Prob. F(2,58) | 0.2372 |
| Obs*R-squared | 3.291584 | Prob. Chi-Square (2) | 0.1929 |

Stationarity test

The first step in the ECM analysis is the unit root test. Data that contains a unit root test means that the data is not stationary by comparing the *Augmented Dickey-Fuller* (ADF) value with the critical value. Anfosino et al. (2016) found that the ADF value is greater than the critical value. The data is stationary, and vice versa; if the ADF value is less than the critical value, the data is not stationary.

Table 4. Unit root test results at the level

| Variable | ADF Value | Test Critical Value | Description |
|-----------------------|-----------|---------------------|----------------|
| Molasses export | -6.882178 | -2.906210 | Stationary |
| Molasses production | -7.496940 | -2.906210 | Stationary |
| Indonesia's GDP | 0.490174 | -2.906210 | Not Stationary |
| Molasses export price | -2.229426 | -2.906210 | Not Stationary |
| world molasses price | -2.913210 | -2.906923 | Stationary |
| Exchange rate | -1.156728 | -2.906210 | Not Stationary |
| Palm oil price | -2.151974 | -2.906210 | Not Stationary |
| Inflation | -2.073911 | -2.906210 | Not Stationary |

Based on the unit root test results above, it shows that the variables of Indonesia's GDP, molasses export prices, exchange rates, palm oil prices, and inflation are not stationary at levels with the ADF value less than the critical value. These circumstances do not meet the requirements to proceed to ECM estimation. So it is necessary to do a unit root test at the first difference level ($\alpha = 5\%$). Table 5 shows that the variables of molasses exports, molasses production, Indonesia's GDP, molasses export prices, world molasses prices, exchange rates, world palm oil prices, and inflation have negative values and are less than the critical value. Stationary at the first difference level.

Table 5. Unit root test results at 1st difference

| Variable | ADF Value | Test Critical Value | Description |
|-----------------------|-----------|---------------------|-------------|
| Molasses export | -6.882178 | -2.906210 | Stationary |
| Molasses production | -7.496940 | -2.906210 | Stationary |
| Indonesia's GDP | -9.222981 | -2.906923 | Stationary |
| Molasses export price | -4.494588 | -2.906923 | Stationary |
| world molasses price | -9.361071 | -2.906923 | Stationary |
| Exchange rate | -6.571988 | -2.906923 | Stationary |
| Palm oil price | -5.485797 | -2.906923 | Stationary |
| Inflation | -5.837182 | -2.906923 | Stationary |

Cointegration test

The cointegration test is a follow-up test of ECM estimation after the unit root test. Muhammad (2014) states that cointegration occurs when the dependent and independent variables are both a trend so that each is not stationary. If the dependent and independent variables are not stationary but are mutually cointegrated, there can be a long-run equilibrium relationship between the dependent and independent variables. The cointegration test results in this study can be seen in Table 6.

Table 6. Cointegration test results

| Cointegration Hypothesis | Lag | Trace Test | | Max Eigen-Value Test | |
|--------------------------|-----|------------------|----------------|----------------------|----------------|
| | | Trace Statistics | Critical Value | Max Eigen Statistics | Critical Value |
| None* | 2 | 212.3564 | 159.5297 | 67.98803 | 52.36261 |
| At most 1* | 2 | 144.3684 | 125.6154 | 47.83636 | 46.23142 |
| At most 2* | 2 | 96.53205 | 95.75366 | 36.54840 | 40.07757 |
| At most 3 | 2 | 59.98365 | 69.81889 | 27.95190 | 33.87687 |
| At most 4 | 2 | 32.03176 | 47.85613 | 16.68670 | 27.58434 |
| At most 5 | 2 | 15.34505 | 29.79707 | 8.953644 | 21.13162 |
| At most 6 | 2 | 6.391409 | 15.49471 | 6.390917 | 14.26460 |
| At most 7 | 2 | 0.000492 | 3.841465 | 0.000492 | 3.841465 |

*significant at 0.05%

The Trace Test and Max Eigen-Value Test values cointegrate with the tested variables. According to Annisa (2021), the cointegration test has at least two cointegration relationships on the test variables. The existence of cointegration between variables can be continued to the ECM estimation because it has met the stationary and cointegration requirements.

Error Correction Model (ECM)

Error Correction Model (ECM) is used to see the effect of the independent variable on the dependent variable in the short and long run. In addition, ECM is used to avoid an imbalance in the relationship between variables in the short run.

Table 7. Estimation results of Long-Run Error Correction Model

| Variable | Coefficient | Probability |
|-----------------------|-------------|-------------|
| Constanta | 2.557765 | 0.7687 |
| Molasses production | 0.319332 | 0.0000*** |
| Indonesia's GDP | -0.478583 | 0.5481 |
| Molasses export price | 0.372216 | 0.4386 |
| world molasses price | 0.080248 | 0.2941 |
| Exchange rate | -1.550387 | 0.0299** |
| World palm oil price | 0.462202 | 0.3242 |
| Inflation | 0.290727 | 0.0899* |

R-Squared = 0.392469
Adjusted R-Squared = 0.321591

* significant at 0.1%, ** significant at 0.05%, *** significant at 0.01%

The long-run Error Correction Model (ECM) analysis shows that the production variable has a significant relationship to molasses exports at a level of 0.01 percent. When there is an increase in molasses production by 1 percent, it will increase molasses exports by 0.0319332 percent with a p-value of $0.000 < 0.01$. According to Nainggolan et al. (2021), production is one factor that affects a country's commodity exports. Increased production will affect export supply. This study is by Hamzah & Santoso (2020), where the positive coefficient value indicates a unidirectional relationship between the production and export variables.

The exchange rate has a negative relationship with Indonesia's molasses exports. Every 1 percent increase in the exchange rate will reduce molasses exports by 1.550387 percent. The Indonesian exchange rate is significantly related to molasses exports with a p-value of $0.0299 < 0.05$. Mardhiah et al. (2020) state that if there is a depreciation of the exchange rate, it will increase export demand while the exchange rate appreciates, it will reduce exports. It causes commodity prices in exporting countries to be cheaper

when the exchange rate depreciates, so the demand for molasses will increase. When the Rupiah exchange rate weakens against the US Dollar, this will result in export volumes because domestic commodities will become cheaper for importing countries (Mejaya Saleh et al., 2016; Hamzah & Santoso, 2020).

In this study, the inflation variable has a positive relationship to molasses exports of 0.290727 with a p-value of $0.0899 < 0.1$. Every 1 percent increase in inflation will increase exports by 0.290727 percent. The finding that the effect of inflation on exports is significantly positive is the same as the findings (Kartini & Utomo, 2018; Wijayanti et al., 2021). Contrary to the theory, an increase in inflation causes the price of goods to rise and cannot compete in the international market so commodity exports will fall. The resulting R-squared value is 0.392469, which means 0.392 percent of the independent variable can explain the dependent variable of 39.2 percent. There is a possibility of an imbalance in the short run, so *error correction* (ECT) is needed. The equation is used in the short term with the added error variable (-1). The results of the short-run equation can be seen in Table 8.

Table 8. Estimation results of Short-Run Error Correction Model

| Variable | Coefficient | Probability |
|-------------------------------|-------------|-------------|
| Constanta | 0.006565 | 0.9469 |
| Molasses production | 0.248712 | 0.0000*** |
| Indonesia's GDP | 0.425450 | 0.8848 |
| Molasses export price | 1.084571 | 0.1447 |
| World molasses price | 0.107487 | 0.0736* |
| Exchange rate | -1.274083 | 0.0530* |
| World palm oil price | -0.069955 | 0.9369 |
| Inflation | 0.258258 | 0.0368** |
| ECT(-1) | -0.801059 | 0.0000*** |
| R-Squared = 0.607804 | | |
| Adjusted R-Squared = 0.553708 | | |

* significant at 0.1%, ** significant at 0.05%, *** significant at 0.01%

The Error Correction Model (ECM) test results in the short-run production variable significantly affect molasses exports with a p-value of $0.000 < 0.01$. The coefficient on the production variable is positive, and it can be said that when molasses production increases by 1 percent, it will increase molasses exports by 0.248712. The increase in domestic production increases the supply of domestic goods so that domestic and foreign supply will also increase. Exports will also increase (Hakiki & Asnawi, 2019).

The world molasses price variable has a positive and significant relationship in the short run. When the world molasses price increases by 1 percent, the molasses export will increase by 0.107487 with a p-value of $0.0736 < 0.1$. The relationship between world prices and the volume of exports of a commodity is that if the commodity price in the global market is greater than the price in the domestic market, the number of commodities exported will increase. Oktavian & Maulana (2019) show that world prices positively affect Indonesian coffee bean exports. The greater the influence of world prices, the exports will also increase.

The Rupiah exchange rate variable in the short run is negative, which means that in the short run, an increase in the exchange rate will reduce exports by 1.274083 and significantly by 0.1 percent. This study is the same as that of Setyorani (2018), which states that the exchange rate has a negative value and significantly impacts exports. The exchange rate depreciation will reduce commodity prices in exporting countries to

increase molasses exports (Aziziah & Setiawina 2021). The inflation variable has a significant effect in the short run with a p-value of $0.0368 < 0.05$. Inflation is positively related to molasses export of 0.258258. It shows that an increase in inflation of 1 percent will increase exports by 0.0258258. High and low inflation rates will determine commodity prices in a country. An increase in prices can cause state goods to be unable to compete in the international market and a decline in exports (Dewi 2018). Seen from the R-squared value of 0.607804, 61 percent of the independent variables in the model can explain the variation of the dependent variable.

Molasses are one of the potential products that provide an excellent opportunity to be utilized domestically and exported to the global market. This opportunity will continue to increase with molasses as an industrial raw material. Sugarcane-producing countries have used molasses in various derivative products that have added value. One of them is Brazil processing molasses into bioethanol which makes Brazil one of the largest bioethanol producing countries in the world. In addition, China uses molasses to produce *Monosodium Glutamate* (MSG), which China produces 55 percent of the world's MSG needs.

Based on the results of the analysis that has been carried out, molasses production has a significant effect on export supply. The government should respond to the increase in molasses production to encourage the growth of downstream molasses by expanding sugarcane plantations, improving production technology, and processing the molasses industry. In addition, it increases farmers' interest in producing sugar cane to impact molasses production. The policy to expand the sugarcane agroforestry program is momentum in creating new production centers that impact increasing competitiveness.

The dominance of one type of molasses product is not recommended for long-run trading performance Indonesia's tendency to export molasses in its raw form. If the price falls, it will impact the income of sugarcane farmers because the main export share of Indonesian molasses is still in the form of natural products, so the impact will directly affect farmers. The development of molasses derivative products is needed so that it is not only a primary product, but it is necessary to make efforts to shift from the primary sector to the molasses processing sector. In addition, it is necessary to limit the export of molasses because many farmers sell molasses in raw form, which has low added value. It makes molasses price stable, and domestic molasses absorption can be utilized in other derivative products. These utilization activities provide considerable added value and reduce pollution caused by the sugar industry.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of the ECM analysis show that in the long run, international trade, molasses production, exchange rates, and inflation have a significant effect on Indonesia's molasses export supply. However, Indonesia's GDP, molasses export prices, world molasses prices, and world palm oil prices have no significant effect. In the short run, molasses production, world molasses prices, exchange rates, and inflation significantly affect molasses export supply, while Indonesia's GDP, molasses export prices, and world palm oil prices have no significant effect.

Recommendations

This study recommends that strategic efforts are needed to develop molasses into finished products for domestic needs and can be exported to various potential countries.

To support the industry made from molasses, the government needs to expand sugarcane plantations and revitalize factories and build sugarcane processing factories that are directly integrated with sugarcane plantations so that molasses can be processed directly.

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