

Research Article

Factors Affecting Granulated Sugar Demand in Indonesia

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ORCIDErmi Tety: <https://orcid.org/0000-0002-5499-3357>**Abstract.**

Sugar is one of the staple food commodities that has a strategic position toward the basic needs of the community. The high dependence on granulated sugar consumption is due to the small tendency of the public to substitute granulated sugar with other sweeteners. The high demand for granulated sugar is not accompanied by an increase in cane sugar production. The imbalance between the production and consumption of granulated sugar requires Indonesia to take action to fulfill instant needs by importing sugar. This study aims to (1) determine the development of consumption of granulated sugar in Indonesia during 2011-2020. (2) Analyze the factors that influence the demand for sugar in Indonesia. The data used in this study is secondary data and processed using descriptive statistical analysis, and multiple linear regression analysis. The results of this study are: (1) the development of sugar demand in Indonesia during the period 2011-2020 has a pattern that tends to increase. (2) The population has a partial and significant effect on the demand for granulated sugar, while the price of granulated sugar, tea, and coffee prices had no partial effect on sugar demand. The coefficient of determination (Adjusted R-Square) shows that 93.5% of the variation in the variable demand for granulated sugar can be explained by independent variables, namely the population, the price of sugar, the price of tea, and the price of coffee. While, the remaining 6.5% is explained by other variables outside the equation model.

Keywords: sugar, demand, population, prices

1. Introduction

Sugar is one of the staple food commodities that has a strategic position towards the basic needs of the community as regulated in Presidential Regulation No. 59 of 2020 concerning the determination and storage of basic necessities and essential goods [1]. Dependence on high consumption of granulated sugar due to the small tendency of people to substitute granulated sugar commodities with artificial sugar or other sweeteners. The high demand for granulated sugar along with the increase in population, economic growth, and the increasing number of processed foods and beverages that require granulated sugar as an additional ingredient. But the high demand for granulated sugar is not accompanied by increased cane sugar production.

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In 2020, cane sugar production has decreased, producing only 2.1 million tons of sugar with a land area that has also decreased by only 418,570 Ha.

Based on Muhaimin and Sari's research entitled *Factors Affecting the Demand and Import of Indonesian Sugar*, with the aim of research to analyze factors that affect sugar demand and imports in the country [2]. This study used econometric models through simultaneous models with time series data from 1982-2013. Model estimation is carried out by the two-stage least squares method. The results of the analysis show that Indonesia's sugar demand is influenced by sugar prices, population, income level, and sugar demand in the previous year. The value of the coefficient of determination (R-Square) of 0.73019 shows that 73 percent of the variation in the sugar demand variable can be explained by the independent variable, while the remaining 27 percent is explained by other variables outside the equation model. The sugar price variable negatively affects sugar demand with a coefficient of -199.762. The population variable positively affects sugar demand with a coefficient of 0.010763. The income level variable negatively affects sugar demand with a coefficient of -0.01704. The previous year's sugar demand variable had a positive effect on sugar demand with a coefficient of 0.662398. Meanwhile, Indonesia's sugar imports are influenced by the difference between Indonesia's sugar demand and production, time, and sugar imports in the previous year. The value of the coefficient of determination (R-Square) of 0.95551 shows that 95 percent of the variation in the sugar import variable can be explained by the independent variable, while the remaining 5 percent is explained by other variables outside the equation model.

According to the Directorate General of Plantations [3], national sugar productivity has decreased because most sugar factories are old, in addition to cultivation techniques that do not apply modern cultivation, especially from community plantation production. Furthermore, the problem of expanding sugarcane area in Indonesia, 57% of which is done by smallholder plantations, is closely related to the level of production productivity and income of sugarcane farmers.

The imbalance between domestic sugar production and consumption requires Indonesia to import sugar. In 2020, Indonesia has imported 5.53 million tons of sugar. The largest sugar import volume came from Thailand at 2.02 million tons or 36.59% of the total sugar import volume last year. Brazil ranked second as the largest sugar importer to Indonesia, recorded importing sugar of 1.54 million tons. Then volume sugar exports from Australia, India, and South Korea imported sugar of 1.21 million tons, 619.9 thousand tons and 4,742.4 tons respectively [4].

This study aims to determine the development of granulated sugar demand in Indonesia in 2011-2020, and to analyze the factors that affect the demand for granulated sugar in Indonesia.

2. Research Methods

This study was conducted to analyze the problems that occur in Indonesia with the consideration that the existence of granulated sugar in Indonesia is becoming increasingly important for basic needs due to dependence on high consumption of granulated sugar by the community. The reason is the small tendency of people to substitute granulated sugar commodities with artificial sugar or other sweeteners. The type of data used in this study is secondary data. The data used is data in the form of time series. The types of data analysis used in this study are as follows:

2.1. Descriptive statistical analysis

Descriptive statistical analysis is a statistic used to analyze data by describing or describing data that has been collected into clearer and easier to understand information such as the condition of demand for granulated sugar in Indonesia from 2011 to 2020.

2.2. Multiple linear regression analysis

Analysis of factors affecting the demand for granulated sugar in Indonesia is determined by the OLS (Ordinary Least Square) test [5]. The OLS method is a method used to estimate regression model parameters.

Multiple linear regression in this study was conducted using Statistical Analysis System (SAS) software version 9.0 which aims to analyze the factors that affect the demand for granulated sugar in Indonesia from 2011 to 2020 as presented in the following equation:

$$DG = \beta_0 + \beta_1 JPI + \beta_2 HG + \beta_3 HT + \beta_4 HK + \mu \quad (1)$$

Information:

DG = Demand for granulated sugar Indonesia (kg/year)

JPI = Total Population (soul/year)

HG = Sugar Price (Rp/kg)

HT = Tea Price (Rp/kg)

HK = Coffee Price (Rp/kg)

B_0 = The intercept show average influence on Y

$$\beta_1, \beta_2, \beta_3, \beta_4 = \text{Partial Regression coefficient} \quad (2)$$

μ = Random error

3. Results and Discussion

3.1. Development of granulated sugar demand in Indonesia

The history of the sugar industry in Indonesia has experienced many ups and downs. The sugar industry is ranked second after rice in one of the strategic staple food commodities for the basic needs of the Indonesian people as regulated in Presidential Regulation No. 59 of 2020 concerning the determination and storage of basic necessities and essential goods [1]. The problems faced are the low financial competitiveness of sugar factories and the lack of efficiency in producing granulated sugar. So this has a different influence on the competitiveness and selling price of sugar in the domestic market.

When viewed from geographical and demographic conditions, Indonesia has a comparative advantage as a sugar producer. Because Indonesia has adequate natural resources, human resources, and a suitable climate for planting sugarcane plants. But Indonesia as a developing country with a large population and relatively increasing economic growth, also has the potential to become one of the largest consumers of granulated sugar in the world. This is reinforced by the imbalance in domestic sugar production and consumption. The demand for granulated sugar in Indonesia has not been fully fulfilled from domestic production, because the growth of granulated sugar production is relatively slower than demand.

Figure 1 shows that the development of demand for granulated sugar in Indonesia during the period 2011-2020 has a pattern that tends to increase. In 2011, domestic demand for granulated sugar reached 4.6 million tons with a production of granulated sugar of only 2.26 million tons. Sugar production in 2011 was produced from a sugarcane plantation area of only 451,788 ha. Domestic production is certainly not able to meet

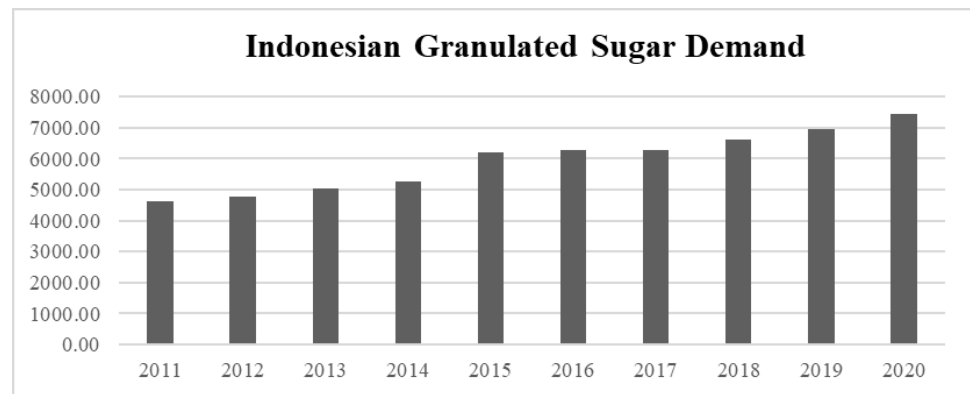


Figure 1: Indonesia's sugar demand in 2000 – 2020.

domestic sugar needs, so the government through the Minister of Industry and Trade imports granulated sugar amounting to 2.42 million tons with the provision that import duty rates of Rp. 790 per kilogram are charged.

In 2012, the yield of sugar production reached a value of 8% with the price of granulated sugar around Rp. 10,000, - per kilogram. Then in 2013 the amount of yield decreased to 7% with prices also dropping to Rp. 8,500 per kilogram. If the amount of yield decreases, the sugar yield obtained by farmers will decrease and sugar prices will also be low [6]. The decline in sugar prices made the demand for granulated sugar increase by 4.76 million tons in 2012 and 5.03 million tons in 2013. The trend of sugar demand continues to increase to 5.25 million tons in 2014, 6.2 million tons in 2015, and 6.3 million tons in 2016. Although in 2017 sugar demand had decreased to 6.26 million tons, in 2018 to 2020 sugar demand increased sharply. As for the area of sugarcane plantations, the graph continued to decline from 2015 to 2019. The narrowing of sugarcane plantation land caused sugar production to also decline by around 2.49 million tons in 2015 to 2.22 million tons in 2019.

In 2020, the spread of COVID-19 caused people to experience panic buying So that some foodstuffs are experiencing scarcity, including granulated sugar commodities. According to Shadiqi et al. [7], behavior panic buying What consumers do tends to lead to negative things such as anxiety and feelings of insecurity, running out of stock in large quantities, and eventually can have a negative impact on the market. Granulated sugar in the midst of a pandemic experienced a shortage of stocks due to several parties that hampered the supply of sugar. The cause of the scarcity of sugar stocks is the existence of sugar factories that hold sugar stocks in warehouses and even lead to cartels or cooperation between several groups of sugar producers who dominate the market. In addition, data between government agencies is inaccurate which causes no

predictions at all by the government before there is finally a shortage of sugar stocks [8]. This made the government open the tap for granulated sugar imports to reach 5.53 million tons in 2020. To overcome this problem, the government through the Ministry of Trade intervened in the market by supervising sugar distribution activities directly, aiming to ensure that the sugar supply chain was well distributed. In addition, the Ministry of Trade stipulated Minister of Trade Regulation No.14 of 2020 concerning the provisions of imported sugar. This regulation stipulates that import activities are carried out to fulfill industrial raw materials, fulfill national sugar stocks, and as price stability [9].

3.2. Factors affecting the demand for granulated sugar in Indonesia

3.2.1. Classical assumption test

Before conducting multiple linear regression analysis, there are several assumptions that must be met in the regression model which are proven through a series of classical assumption tests including tests for normality, multicollinearity, heteroscedasticity, and autocorrelation tests presented in table 1 as follows.

TABLE 1: Classical assumption test.

No.	Variable	Normality	Multicollinearity	Heteroscedasticity
1	DG	0,204069		
2	JPI	0,099167	8,64741	0,0069
3	HG	0,146687	2,90169	0,9632
4	HT	0,224594	4,06604	0,5980
5	HK	0,179230	8,46370	0,8774

The normality test aims to test whether in the regression model the data is normally distributed or not. The normality test in this study was carried out using the test kolmogorov-Smirnov with a significance above 0.05 which indicates normally distributed data and vice versa. Table 1 shows that all variables included in the regression model are normally distributed because they have significance values above 0.05.

The multicollinearity test is used to see whether or not there is a high correlation relationship between independent variables in the regression model through the magnitude of the correlation coefficient by looking at the value Variance Inflation Factor (VIF). When viewed from the decision based on the VIF value, if the VIF value is smaller than 10.00 it means that there is no multicollinearity in the regression model and vice

versa. Table 1 shows that all models or independent variables have a VIF value smaller than 10.00 which means that there are no symptoms of multicollinearity to the regression model.

The heteroscedasticity test is used to see if there is a difference in variance from the residual to other observations. Test heteroscedasticity in this study using the Spearman correlation test with criteria if the probability value is greater than alpha ($\alpha = 0.05$) then the data is normally distributed, and vice versa. According to Ghazali [10], a good research model is a model that does not have symptoms of heteroscedasticity. Based on table 1, the variable population of the data is still heteroscedasticity. To solve these problems, it is necessary to transform the data. By transforming the data into natural logarithms, the error will shrink and the symptoms of heteroscedasticity will be reduced.

Autocorrelation test can be interpreted as a correlation between members of a series of observations or studies sequenced for time series data using the Durbin Watson test, where the value of d (Durbin Watson) is between 4-dU and 4-dL ($2.4137 < 2.255 < 0.3760$) which means there are no definite autocorrelation results in regression models or inconclusive testing when using Durbin Watson. In an effort to overcome the problem, a test was carried out Run Test which results in a value of 0.737 which has a significance value greater than 0.05 which means that there is no auto relation in the regression model.

3.2.2. Statistical test

F Test (Simultaneous). The results of the F test found that the variables of domestic demand for granulated sugar together can be explained by independent variables, namely the number of population, the price of granulated sugar, the price of tea, and the price of coffee This can be shown from the results of F_{count} (33.44) greater than F_{table} (5.19) and very significant at the real level $\alpha = 5\%$. In other words, the effect that the whole independent variable has on the dependent variable is good.

Test t (Partial). The t test is used to test whether or not the effect of the independent variables of granulated sugar production, population, and volume of individual granulated sugar imports on the demand for Indonesian granulated sugar as a dependent variable. This can be done by comparing the values of t_{count} with the value of t_{table} .

Table 2 shows that the variables of granulated sugar price (HG), tea price (HT), and coffee price (HK) partially have no significant effect on sugar demand. Meanwhile, the

TABLE 2: Test results t.

No	Variable	T-count	T-table
1	JPI	4,42	2,57
2	HG	-0,05	2,57
3	HT	-0.56	2,57
4	HK	-0,16	2,57

variable population (JPI) partially has a significant effect on the demand for granulated sugar in Indonesia.

Coefficient of determination. Based on the results of the analysis, the value of the coefficient of determination (Adjusted R-Square) of 0.9353. This shows that 93.5% of the variable variation in domestic sugar demand can be explained by independent variables, namely population, sugar prices, tea prices, and coffee prices. While the remaining 6.5% is explained by other variables outside the equation model.

Regression equation analysis. The results of the multiple regression analysis output obtained from the SAS program version 9.0 with the regression equation in this study are as follows:

$$DG = -21743 + 111.31824JPI - 0.00535HG - 0.01377HT - -0.00988HK \quad (3)$$

Constant (β_0) of -21743. This means that if all independent variables, namely the number of population (JPI), the price of granulated sugar (HG), the price of tea (HT), and the price of coffee (HK) are assumed to be zero (none) and are in a state ceteris paribus, Then the demand for granulated sugar is 21743 kg. A negative constant generally occurs if there is a considerable range between the independent variable and its dependent variable. Negative constants do not matter and can be ignored as long as the regression model tested meets the classical assumptions. In addition, as long as the slope value is not zero then the negative constant can be ignored.

The regression coefficient of the population variable (JPI) is 111.31824. The results of the analysis show that the population variable has a positive influence on the demand for granulated sugar in Indonesia. This means that if there is an increase in the population by one unit, it will increase the demand for granulated sugar by 111.31824 kg. Population growth will tend to increase demand. But with a large population, it will have the potential to increase the number of demand. In other words, the more the population, the greater the demand. This result is in line with Satriana's et al. research [11], which shows that

population growth every year encourages the increase in the need for granulated sugar during 1980 – 2011 with a coefficient of 0.03. So that the results have a real positive effect on the consumption of granulated sugar at a real level $\alpha = 15\%$. Likewise, in research conducted by Triyani [12] which states that population is a factor that greatly affects demand in the long run with a coefficient of 0.68 in the short run and 2.30 in the long run during the period 1985 to 2014.

The regression coefficient of the granulated sugar price variable (HG) is -0.00535. The results of the analysis show that the variable price of granulated sugar in the country has a negative influence on the demand for granulated sugar in Indonesia. This means that if the price of granulated sugar decreases by one unit, it will increase the demand for granulated sugar by 0.00535 kg. Based on economic theory, the demand for a good is mainly influenced by the price of the good itself. Consumers will limit the purchase of the desired amount of goods if the price of these goods is too high, even the possibility of consumers will switch to consuming substitute goods (substitute goods) that are cheaper in price. Conversely, when the price of an item falls, consumers will reduce purchases of other goods and increase purchases of goods that have decreased in price. This means that based on demand theory, the price of goods itself has a negative relationship. This result is in line with Muhaimin and Sari's research which shows that sugar price variables negatively affect sugar demand with a coefficient of -199,762. Muhaimin and Sari also stated that sugar is an elastic product in Indonesia even very elastic because a slight change in sugar prices will cause sugar demand to increase or decrease [2].

The regression coefficient of the tea price variable (HT) is -0.01377. The results of the analysis show that the variable price of tea has a negative influence on the demand for granulated sugar in Indonesia. This means that if the price of tea decreases by one unit, it will increase the demand for granulated sugar by 0.01377 kg. The regression coefficient of the coffee price variable (HK) is -0.00988. The results of the analysis show that the variable price of coffee has a negative influence on the demand for granulated sugar in Indonesia. This means that if the price of coffee decreases by one unit, it will increase the demand for granulated sugar by 0.00988 kg. Tea and coffee are complementary goods from sugar, complementary goods are goods that can complement the functions of other goods and are used simultaneously. Two goods that have a complementary relationship if the increase in the price of one good will result in a decrease in demand for the other good. Based on this study, if there is an increase in tea prices and coffee prices, it will reduce the demand for granulated sugar. The increase in tea and coffee

consumption causes an increase in granulated sugar consumption so that it will affect the demand for granulated sugar.

4. Conclusion

The development of demand for granulated sugar in Indonesia during the period 2011-2020 has a pattern that tends to increase. Although the production of granulated sugar has decreased, the demand for granulated sugar continues to increase along with the increasing population, economic growth, and the increasing number of processed foods and beverages that require granulated sugar as an additive or complementary ingredient. Factors that affect the demand for granulated sugar in Indonesia in this study are population, sugar prices, tea prices, and coffee prices.

The value of the coefficient of determination (Adjusted R-Square) is 0.9353. This shows that 93.5% of the variable variation in domestic sugar demand can be explained by independent variables, namely population, sugar prices, tea prices, and coffee prices. While the remaining 6.5% is explained by other variables outside the equation model. The results of multiple linear regression analysis show that the population variable (JPI) has a positive influence with a coefficient of 111.31824 on the demand for granulated sugar in Indonesia. Meanwhile, the variables of granulated sugar prices (HG), tea prices (HT), and coffee prices (HK) have a negative influence with their respective coefficients (-0.00535), (-0.01377), and (-0.00988) on the demand for granulated sugar in Indonesia during 2011-2020.

5. Recommendation

In order to balance between consumption and production and reduce import volumes, efforts that can be made by the government are to increase national granulated sugar production by increasing productivity and increasing the competitiveness of the national granulated sugar industry by prioritizing meeting domestic needs. In addition, it is necessary to build and maintain facilities and infrastructure to support sugar production in Indonesia.

The demand model must always be updated with new data and variables, then incorporate new policy developments and demand patterns. This is done because projected patterns of demand, production, population, and prices of granulated sugar can change along with changing times and technology.

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