Research Article

Analysis of Soybean Consumption in Indonesia

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ABSTRACT

Soybean is one of the main food commodities after rice and corn. Indonesian people indicate that soy consumption will continue to increase yearly along with population, per capita income, and public awareness of food nutrition. Increased demand for soybeans can be linked to an increase in public consumption. The objectives of this study were 1) to analyze the development of soybean consumption in Indonesia and 2) to analyze the factors that influence soybean consumption in Indonesia. This type of research is descriptive with a quantitative approach. The type of data used is secondary data (time series). The analysis method used in this research is Trend Analysis with Moving Average and Multiple Linear Regression Analysis. The variables used are soybean price (X1), substitution price (peanuts) (X2), income per capita (X3), and soybean consumption (Y). The study's results using the trend test showed that the value forecast of soybean consumption for the next or future period was 0.29, where the MAD value was 0.01, the MSE value was 0, and the MAPE value was 0.04. The multiple linear regression test showed that the price of soybeans and income per capita had a significant effect on soybean consumption. In contrast, the substitution price had no significant effect on soybean consumption.

INTRODUCTION

Soybean is a legume plant and the world's main protein and vegetable oil source. In Indonesia, soybean is one of the main food commodities after rice and corn. It has various uses, especially as a raw material for the vegetable protein-rich food industry, such as tofu and tempeh (Waliyansyah, 2020), and as raw material for the animal feed industry. In addition to being a source of vegetable protein, soybeans are a source of fat, minerals, and vitamins (Sari et al., 2014). Thus, it is not surprising that there are many soybean-based foods, of which the Indonesian people are most familiar, tempeh and tofu.

Soybean consumption by Indonesian people is sure to continue to increase every year, considering several considerations such as increasing population, increasing income per capita, and public awareness of food nutrition. The increase in soybean demand can be associated with increased public consumption. Communities and home industries process soybeans into various food products, including tofu, tempeh, *tauco*, soy sauce, soy milk, and many others (Aldillah, 2015).

The rapid increase in population has brought significant consequences that must be faced concerning human welfare and development. One of the consequences is the need for food, where the increasing number of people will increase the need for food (Permadi, 2015). The growth of the upstream industry and the driving force behind the growth of the downstream industry contribute significantly to national economic growth. Today, the development of the food and feed industry made from soybeans and the increasing demand for food make the demand for soybeans in Indonesia very high (Sagala et al., 2020).

Based on per capita availability data, Soybean demand had decreased in previous years, although it again experienced a drastic increase in the following year. This data shows that soybeans are still affected by the crisis compared to other agricultural commodities (Riniarsi, 2015). The rapid increase in soybean consumption with the availability of national soybeans becomes unbalanced, creating a considerable gap (Nainggolan et al., 2016).

Considering that the demand for soybean consumption is starting to increase from year to year, but soybean production cannot meet it, the demand for soybean consumption in Indonesia is increasing and affecting soybean prices in Indonesia. Based on the background described, it is necessary to conduct a study focusing on "Analysis of Soybean Consumption in Indonesia." This study aims to (1) analyze the development of soybean consumption in Indonesia and (2) Analyze the factors that influence soybean consumption in Indonesia.

METHOD

This study was based on the results of the National Socio-Economic Survey (*Susenas*) and Quarterly available on the websites of the Central Statistics Agency (*BPS*) and the Food and Agriculture Organization (FAO). The location or place of study is based on the following considerations: (1) Soybeans are one of the foods consumed by the Indonesian people, (2) The report data can be accessed at the Central Statistics Agency (*BPS*) and several websites in the agricultural sector. The research was carried out from March 2020 to April 2020.

The data used in this study is secondary data (Time Series) with a period of 10 years from 2008 to 2018. This study is descriptive research with a quantitative approach. The data used are the statistics of soybean consumption, prices, per capita income, and substitution prices (peanuts).

The first data analysis used is Trend Analysis, where the Forecasting method is a technique for estimating or predicting a value in the future by paying attention to past or current data or information mathematically or statistically. This method is very helpful in making the right decision (Hakimah et al., 2015). The purpose of forecasting is to get a forecast that can minimize forecast errors, usually measured by Mean Absolute Error (MAE) and Mean Square Error (MSE) (Muryati, 2017). The forecasting method used is the Moving Average (MA) method. The Moving Average (MA) method is an indicator often used in technical analysis that shows the average value of data over a specified period (Abbas, 2016). Wibowo et al., (2020) state that the Moving Average is a forecasting method based on the arithmetic average obtained.

The second analysis used is multiple linear regression analysis. It is an analytical tool used to test the hypothesis in this study. The independent variables used in this study include soybean prices, substitution prices, and per capita income. After getting the data, the researchers then analyzed the data using the multiple linear regression analysis methods. The F-test was conducted to determine whether all variables (soybean prices, substitution prices, and per capita income) simultaneously influence the dependent variable (soybean consumption). The t-statistical test or t-count is a test to determine whether each regression coefficient is significant or not on the dependent variable. The coefficient of determination is used to see how the independent variables can explain the dependent variable where the value of R^2 ranges from 0 to 1 ($0 \leq R^2 \leq 1$) (Nainggolan et al., 2016).

RESULTS AND DISCUSSION

### Soybean Consumption Projection in Indonesia

The development of soybean consumption fluctuates annually. Therefore, a trend analysis test is implemented to predict the movement of soybean consumption in Indonesia. Trend analysis is a forecasting method to estimate the future. The data used for testing trend analysis is on soybean consumption in Indonesia from 2008 to 2018 (10 years). The following result is from analyzing soybean consumption trends in Indonesia using the Moving Average method.

Table 1. Forecasting Soybean Consumption in Indonesia with the Moving Average Method

Measure	Value
Error Measures	
Bias (Mean Error)	0.01
MAD (Mean Absolute Deviation)	0.01
MSE (Mean Squared Error)	0
Standard Error (denomination=n-2=4)	0.02
MAPE (Mean Absolute Percent Error)	0.04
Forecast	
Next period	0.29

Source: Processed Secondary Data (2021)

Based on the forecasting results in table 1, it is found that the forecast value of soybean consumption for the next period or future is 0.29. The MAD (the average absolute forecasting error of the data) value is 0.01. The MSE (the average of forecasting errors squared) value is 0. MAPE (the average percentage error absolute forecasting of the data) value is 0.04, the bias is 0.01, and the standard error is 0.02. Based on the output, the error rate of using this method is 0.01 for MAD and 0 for MSE. The smaller the value (MAD, MAPE, MSE), the more accurate the forecasting. The calculation with the smallest MAD value means the smaller the difference between the forecast results and the actual value. If the forecast results have the smallest MSE and MAPE values and are accurate forecasts, they will be useful for future planners (Paruntu & Palandeng, 2018).
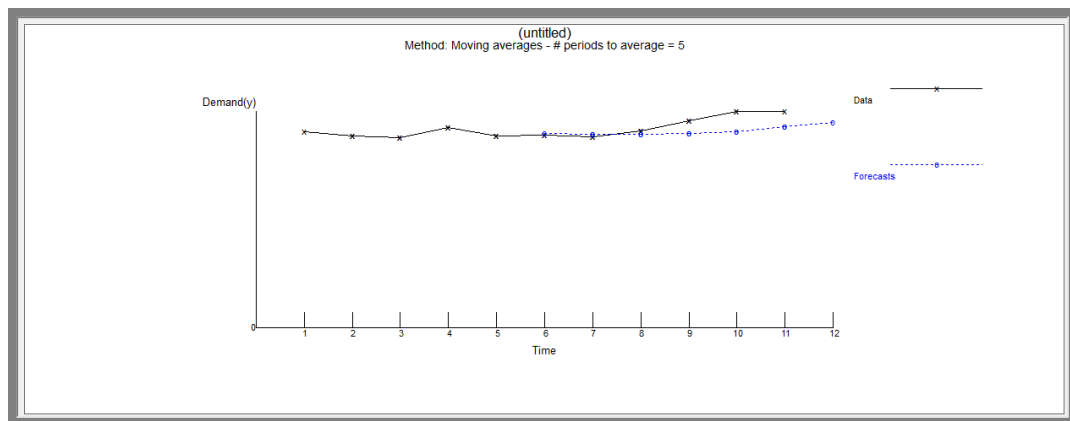
Figure 1. Soybean Consumption Forecasting Chart
Source: Processed Secondary Data (2021)

Based on Figure 1, we get the results of the chartr where the x-axis shows the periods, 12 periods. The y-axis shows the actual demand. The black line shows product sales for the past 11 periods. The chart of forecasting results tends to be stable because the differences among periods are not far. On the other hand, the blue line shows the forecasting results where the results obtained are 12.03.

Forecasting should be done for a short period because forecasting is uncertain by future conditions such as weather, natural disasters, and the possibility of economic and political crises. These future conditions can cause uncertain forecasting results that do not follow the reality that will happen in the future (Aldillah, 2015). The results of previous studies regarding the projection of soybean consumption in Indonesia are as follows. Komalasari (2008) shows the projection of consumption using the time series method, and the results show a decrease of 3% for total consumption in tons and 4.20% for consumption per capita per year in kg. It can be informed that there is a shift in people's protein intake. It is when people are shifting to consume animal protein compared to vegetable protein such as soybeans. On the contrary, Riana & Hardiyanto (2011) state in their study that the results of soybean consumption in the next ten years have increased. Therefore, this condition requires a balance to meet consumption needs. Soybean consumption forecasting results show that in 2019 when Indonesia's population reaches 267,106 million people, the need for soybeans in Indonesia is estimated to reach 2,864,840 tons. The gap between production and consumption in that year will be large. It means that it is estimated that in 2019 Indonesia will experience a very large shortage of domestic soybeans compared to the predicted demand for that year. The forecasting results conclude that self-sufficiency in soybeans cannot be implemented until 2020 because the projection results show that national soybean needs can only be met by national soybean production.

Coefficient of Determination (R²)

Table 2. Coefficient of Determination (R²)

Table R	Score
R	0.939
R Square	0.882
Adjusted R	0.831

Source: Primary Data Processed (2020)

Based on table 2, R Square is 0.882, so the R Square number is 0.882 or equal to 88.2%. This figure shows that the influence of the soybean price variable (X1), soybean substitution price (X2), and per capita income (X3) on the soybean consumption variable (Y) is 88.2%. In comparison, the rest, 11.8%, is influenced by other variables outside the independent variables unrelated to this study. This condition illustrates that the independent variable's existence is crucial in influencing the dependent variable, namely soybean consumption.

F Test (Simultaneous)

Table 3. F Test

Model	Sum of Squares	Df	Mean Square	F-count	F-table	Sig.
Regression	.002	3	.001	17,430	4.07	.001a
Residual	.000	7	.000			
Total	.002	10				

Source: Processed Secondary Data (2020)

Based on table 3, the probability obtains a sig. value of 0.001 using an alpha value of 0.05 and an F-count value of 17.430 with an F-table value of 4.07. The value of sig. 0.001 < 0.05, and the value of F-count 17.430 > F-table 4.07 can reject H0 so that there is a significant effect between soybean price variables, substitution prices, and per capita income on soybean consumption in Indonesia. It is in line with (Junianto et al., 2019) who explain that there is an influence on the independent variable simultaneously on the dependent variable. Based on the results of the F-test, the result is similar to a study conducted by (Mahdoh & Risyanto, 2018). The results are that F arithmetic > F table is 7.574592 > 3.14, and when viewed with the sig. value, <0.05, is 0.003521 <0.05 then H0 is rejected and H1 is accepted. It can be concluded that soybean consumption, soybean production, and foreign exchange reserves have a significant effect on soybean imports in Indonesia for the period 2000-2016.

T Test (Partial)

Table 4. T Test

Model	Unstandardized Coefficients		Standardized Coefficients	T count	T table	Sig.
	B	Std. Error	Beta			
(Constant)	.397	.038		10,447		.000
Soybean_price	-2.657E-5	.000	-1,471	-4,304	2.37	.004
Substitution_price_peanut	1.086E-6	.000	.502	1,346	2.37	.220
Income_per_capita	1.935E-9	.000	1,590	4,795	2.37	.002

Source: Processed Secondary Data (2020)

Based on table 4, the T-test results include the value of T-count, T-table, and significant values. Therefore, the following discussion is obtained:
1. Soybean Price (X1) towards Soybean Consumption (Y)
Based on the probability, the soybean price variable has a sig. value of 0.004. Since the sig value is 0.004 <0.05, H0 is rejected. It means it has a significant effect on the dependent variable. The T-count value (-4.304) and T-table value (2.37) of soybean prices indicate that the T-count value of -4.304 is not between ±Ttable. Thus, there is a significant influence between soybean price variables on soybean consumption.
It can be concluded that some soybean prices in the market can influence the increase in soybean consumption because soybeans are the staple food for people in Indonesia. The interactions between buyers

and sellers in the market can determine the price of an item (soybeans). The Law of supply and demand in Economics explains that the rise and fall of prices will affect public demand for goods. The results of this study align with a study conducted by Junianto et al., (2019) about the analysis of supply and demand trends for soybeans in Indonesia. It shows that the sig value is 0.000 <0.05, which means that the price has a significant effect.

2. Substitution Price (X2) Towards Soybean Consumption (Y)
    Based on the probability, the substitution price variable has a sig value of 0.220. It shows that the sig value is 0.220 > 0.05, so H0 is accepted. It means it does not have a significant effect on the dependent variable. If the T-count value of the substitution price is 1.346 and the T-table value of the substitution price is 2.37, the T-count (1.346) is between ±T-table. It means that there is no significant effect between the substitution price variable and the soybean consumption variable.
This result explains that the price of substitute goods has no significant effect on soybean consumption because the government still imports many soybeans to meet soybean consumption needs. People also rarely use substitute goods as raw materials for soybean substitutes. The results of this study align with Junianto et al., (2019) about the analysis of supply and demand trends for soybeans in Indonesia. The result shows that the value of sig is 0.412 > 0.05, which means that the price of substitute goods has no significant effect.

3. The income per capita (X3) Towards Soybean Consumption
    Based on the probability, income per capita variable has a sig. value of 0.002. Since the sig value is 0.002 <0.05, H0 is rejected. It means it has a significant effect on the dependent variable. If the T-count value of the income per capita is 4.795 and the T-table value of the income per capita is 2.37 in no, the T-count (4.795) is between ±T-table. It means that there is significant effect between the income per capita variable and the soybean consumption variable.
Income is important for meeting the needs of everyone's daily life. The higher a person's income, the more necessities can be met. The country often tries to increase people's income because it can indirectly affect national income. National income is one way to measure the prosperity of a country. Therefore, increasing national and per capita income through a product is necessary to increase the country's prosperity. The results of this study are contrary Sari, (2015) 's study on the analysis of the factors that influence soybean consumption in Indonesia, that state that soybean consumption does not influence per capita income significantly. Because the soybeans demand in Indonesia is mostly used to meet industrial needs. It means that soybean consumers are mostly industrial players, so the fluctuations in the income level per capita have no effect.

Multiple linear Regression Analysis
    The researchers analyzed factors influencing soybean consumption using multiple linear regression tests to determine the effect of the independent variable on the dependent variable. The results of multiple linear regression testing can be seen in Table 5 below.

Table 5. Result of Multiple linear Regression Test

No.	Notes/Information	B	Sig. (2-tailed)
1	Soybean Price (X1)	– 2,657	0.000
2	Substitution Price (Peanut) (X2)	1.086	0.000
3	Income Per Capita (X3)	1.935	0.000
4	Constanta	0.397	0.038

Source: Processed Secondary Data (2021)

Based on the multiple linear regression analysis results, the soybean consumption model is Y = 0.397 – 2.657X1 + 1.086X2 + 1.935X3 + e. These equations can be interpreted as follows:
1. The constant is 0.397. It means that if the price of soybean (X1), the price of substitute goods (X2), and per capita income (X3) are 0, the soybean consumption (Y) is 0.397. Based on the results, if one of the variables experiences a change, it will change soybean consumption.
2. The regression coefficient of the soybean price variable (X1) is -2,657. It means that if the other independent variables have a fixed value and the soybean price increases by one unit, the soybean consumption (Y) will increase by -2,657. A negative coefficient means that there is a negative relationship

between soybean prices and soybean consumption. Thus, the higher the soybean price value, the lower the soybean consumption. Based on this study, if the price rises, the demand for goods will decrease. This condition is suspected of causing consumers to be more likely to choose imported soybeans than local soybeans. It is inversely proportional to the study conducted by Junianto et al., (2019) that the regression coefficient value of 0.121 means that if the price of soybeans increases by 1%, the demand for soybeans increases by 0.121%. The results of the study conducted by Anjani et al., (2015) explain that if the results obtained an F-count of 8.406 and that value was greater than the F-table value, the independent variables will significantly affect soybean demand at the 95% confidence level. The results of the regression obtained R^2 of 0.664.

3. The regression coefficient for the variable price of substitute goods (X2) is 1.086. It means that if the other independent variables have a fixed value and the substitution price increases by one unit, the soybean consumption (Y) will increase by 1.086. The positive coefficient means a positive relationship exists between the price of substitution and the consumption of soybeans. The higher the value of the substitution price, the more increasing the consumption of soybeans. It is in line with the study conducted by Junianto et al., (2019) that the corn price coefficient value of 0.038 means that if the price of corn increases by 1%, the demand for soybeans increases by 0.038%, thus affecting soybean consumption.

4. The regression coefficient of the per capita income variable (X3) is 1.935. It means that if the other independent variables have a fixed value and per capita income increases by one unit, the soybean consumption (Y) will increase by 1.935. The positive coefficient means that there is a positive relationship between per capita income and soybean consumption. The higher the per capita income value, the more increasing soybean consumption. It is inversely proportional to the study conducted by Junianto et al., (2019) that the income regression coefficient value of -1.667 means that if the income level increases by 1%, the demand for Indonesian soybeans decreases by 1.667%. The regression result of the study conducted by Anjani et al., (2015) shows that income per capita significantly influences the amount of soybean demand in Indonesia at the 99% confidence level.

CONCLUSION

Based on the results of research and discussion, the following conclusions can be drawn; The forecast value of soybean consumption for the next or future period is 0.29. The forecasting results chart tends to be stable because the difference between periods is not far, while the blue line shows the forecasting results. The result obtained is 12.03. The results of multiple linear regression analysis show that soybean prices and per capita income have a significant effect on soybean consumption, while the price of substitution (peanut) has no significant effect on soybean consumption in Indonesia.

The researchers suggest that other alternatives to meet soybean needs in the short term need to be explored more. In addition, these alternatives need to be considered to be a better solution in the long term so there is no continuous import of soybean. The researchers also suggest further researchers that analyzing soybean consumption within the scope of the region and in general in Indonesia is needed in order to make it easier to find out soybean consumption in the future and what factors influence other than soybean prices, substitution prices, and income per capita with different methods.

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