

Analysis of Rice Demand and Supply in North Sumatra Province

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Abstract: This study aims to analyze the effect of factors on rice demand and supply in North Sumatra Province. The data used are secondary data from 1988-2017. Processing data using the indirect last square (ILS) method with the help of eviews10 software program. The results of this study indicate that the retail price of rice, population, and per capita income have a significant effect on the demand for rice in North Sumatra Province. The rice price variable partially has a positive and not significant effect on the demand for rice in North Sumatra Province, while the variable population and per capita income partially have a positive and significant effect on the demand for rice in North Sumatra Province. The retail price of rice, population, and price of urea fertilizer have a significant effect on the supply of rice in North Sumatra Province. Variable retail prices of rice and population partially have a positive and significant effect on the supply of rice in North Sumatra Province while the urea fertilizer has a negative and significant effect towards the supply of rice in North Sumatra Province. Per capita income and the price of urea fertilizer together have a significant effect on the retail price of rice in North Sumatra Province. Variable per capita income and price of urea fertilizer partially have a positive and significant effect on the price of rice spread in North Sumatra Province.

Keywords: Rice, Demand, Supply, Price, Population

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I. Introduction

Rice is the staple food of 98 percent of Indonesia's population and is often considered a commodity that is strategic and political. Therefore the existence and adequacy are always considered by the Government (Noeriati et al., 2008). Furthermore, Krisnamurthi (2006) states that as a commodity with demand that is inelastic changes in prices almost do not cause changes in the number of consumer demand. consumers do not make adjustments to their consumption.

One of the important things in national rice management is knowing the level of supply, demand, and rice stock so that there is no excessive scarcity or surplus of rice in the market which ultimately harms the community as a consequence of farmers as rice producers. At the desired level will be achieved the price of rice that is feasible and able to be reached by the community and benefit the Farmers as producers (Winarto, 2009).

The Province of North Sumatra has potential natural resources, when viewed from the economic conditions the agricultural sector has a very strategic role in supporting the economic development of this region. The government has determined that North Sumatra is one of Indonesia's rice granary provinces from 14 rice production centers which are expected to be able to increase agricultural production.

North Sumatra is one of the provinces in Sumatra Island which almost all of its regions are cultivating rice. From 20 level II regions in this province only Sibolga does not produce rice because in this area the livelihood of the people is the majority of Fishermen. While Padang Sidempuan is an area Level II which was formed in 2003 has been able to produce rice. This proves that North Sumatra is one of the rice barns that can support national rice needs.

The amount of retail demand and price of rice in North Sumatra Province can be seen in Table 1.1.

Table 1.1 Amount of Demand and Retail Prices of Rice in North Sumatra Province

Year	Demand (Ton)	Retail Prices of Rice (Rp/Kg)
2012	2.123.417	9.168
2013	2.151.333	9.399
2014	2.198.678	9.616
2015	2.147.964	10.261
2016	2.299.100	10.313
2017	2.300.260	11.100

Source: Central Statistics Agency of North Sumatra Province

The increasing demand for rice must be balanced by the amount of rice offered by producers in North Sumatra Province. The existence of continuous developments in the field of food science and technology, enables an increase in rice production, both in quantity and quality. The increase in rice production without being accompanied by improved marketing will not benefit farmers as the main producer of rice. Marketing activities are generally closely related to rice supply by farmers and demand for rice by residents in general. Although the increase in rice production can occur in North Sumatra Province, but because it involves national food security, the production can be diverted to the interests of other regions that need rice.

Bidding quantity is not able to meet the demand quantity needed by consumers is a factor that can lead to price increases. Rice offers made by producers do not occur throughout the year because they are related to the planting season and harvest season. While consumer demand will last throughout the year because rice consumption throughout the year considering rice is a staple food requirement of the community and an increasing population throughout the year. The unmet demand of buyers, or excess demand causes sellers to increase prices (Sukirno, 2010).

The increase in rice prices has actually become a common thing, one of which causes a price increase can be attributed to the increasing cost of production, for example the price of fertilizer used for successful harvests. However, extreme price increases in a relatively short time will be a big question mark. Not only natural factors, post-harvest factors also have the potential to affect this problem. In this case it returns to the ability of the community to buy rice with prices that are relatively increasing each year, based on how much income the community receives.

II. Theoretical Review

2.1 Demand Theory

Demand is the amount of goods consumers demand in a market. While the market is a place for transactions between producers and consumers of economic goods. Some experts say that the notion of demand is the amount of goods capable of being bought by buyers at a certain place and time at prices prevailing at that time. While some other experts stated "demand is used to determine the relationship of the amount of goods purchased by consumers with alternative prices to buy goods concerned with the assumption that the prices of other goods remain (Daniel, 2004).

The variables that determine the number of commodities desired by the household are: 1. The price of the goods in question; 2. Average household income; 3. Total population; 4. Commodity prices that have to do with the commodity. To understand the influence of each of the above variables, all other variables are considered to be constant (*ceteris paribus*).

According to Mankiw (2003) Factors or variables that influence the demand for an item include:

a. Price

Consumer demand can be influenced by price, price of goods to be purchased (P), price of substitute goods and prices of complementary goods. Consumers will limit the purchase of the desired amount of goods if the price of goods is too high, there is even a possibility that consumers will transfer their consumption and purchases to substitute goods that are cheaper in price. The price of complementary goods will also influence the decision of a consumer to buy or not the main item, if the demand for the main item increases, the demand for substitute goods will decrease and vice versa.

b. Consumer Income

Consumers will not be able to make purchases of goods if the income is absent or inadequate. Thus, changes in income will encourage consumers to change the demand for their goods. Based on the nature of changes in demand for various goods in the event of changes in income, can be distinguished in several groups, including:

1. Essential goods are goods that are very important in everyday life, so that the needs or demand for these goods will not change even though there is a change in income.
2. Normal goods are goods whose demand is directly related to consumer income. When the consumer's income increases, the demand for the item also increases and vice versa, if the consumer's income decreases, the demand for the item also decreases.
3. inferior goods are goods whose demand is inversely related to consumer income. If the consumer's income increases, the demand for the item will decrease and vice versa, if the consumer's income decreases, the demand for the item will increase.

c. Number of Consumers

The increase in the number of consumers, for example the population, does not necessarily lead to an increase in the number of requests for an item. However, the increase in population is followed by the development of employment opportunities. Thus more people will receive income and this will also increase people's purchasing power. Increasing purchasing power will increase demand.

d. Consumer Tastes

Changes in tastes can manifest into market behavior. Changes in consumer tastes can be indicated by changes in the shape or position of an indifference map, without any changes in the price of goods or income, the demand for an item will change due to changing tastes.

e. Predict The Situation in The Future

Predicted changes regarding future conditions can affect demand. Predictions of consumers that prices will rise in the future will encourage consumers to buy more to save expenses in the future.

2.2 Supply Theory

Bidding is the number of agricultural commodities offered by producers / sellers. While the law of supply basically states the higher the price of an item, the more the amount of goods will be offered by the producer / seller. Conversely the lower the price of an item, the less the amount of goods offered by producers, assuming other factors do not change (Daniel, 2002).

Factors that influence the offer, including:

a. Price of The Item

The relationship between price and supply of goods is directly proportional. The cheaper the price, the fewer items offered will be lower and the more expensive the price, the greater the number of goods offered.

b. Price of Other Item

The more expensive the price of substitute goods, the less supply of the item.

c. Price of Production Factors

When the price of production factors increases, it will cause production costs to be expensive. If the production costs are increasingly expensive, then the producer becomes less able to produce.

d. Price Expectations in The Future

If there is an assumption that in the future there will be an increase in the price of an item, the supply of the goods will decrease.

e. Number of Producers

If the number of producers increases, there will be more offers.

f. Technology

With the increasing technology, it means that the cost of producing becomes lower, thus the number of goods that can be produced becomes more.

g. Number of Consumers

If the number of consumers increases, usually more and more offers will be made by producers.

2.3 Prices

Price is the amount of money exchanged to consumers with benefits from owning or using products and services. Price acts as the main determinant of the buyer's choice. Price is the amount of money charged on a product or service, or the amount that consumers exchange for benefits because they have or use the product or service (Sudarsono, 1990).

The price that occurs in the market is the intersection between the demand curve and the supply curve. But in reality there are farmer-level prices and consumer prices besides the merchant price. The minimum price formation occurs at the large trader price level because only at this level there is rather perfect competition and generally sellers and the buyer has good knowledge of the market situation at a certain time. The price stabilization policy is taken by using reserve stock instruments and price regulation. The government every year determines the basic price for producers and the highest price for consumers. Bulog is responsible for ensuring

that rice prices are between the highest and lowest prices by conducting market operations and distribution (Tarigan, 1997).

2.4 Hypothesis

Based on the formulation of the problem and the conceptual framework, the hypothesis of this study are:

1. Retail price of rice, population, and per capita income significantly influence the demand for rice in North Sumatra Province.
2. Retail Prices Rice, population, and price of urea fertilizer significantly influence the supply of rice in North Sumatra Province.
3. Per capita income and the price of urea fertilizer have a significant effect on the retail price of rice in North Sumatra Province.

III. Research Metodology

3.1 Research Approach

The research approach used in this study is quantitative analysis. Quantitative analysis is research that explains the position between variables, which uses data analysis with statistics and econometrics.

3.2 Place and Time of Research

This research was conducted in North Sumatra Province with an annual period, 1988 - 2017 so as to obtain as many as 30 observations.

3.3 Research Scope

The scope of this study is limited to data on rice demand and supply, retail price of rice, population, per capita income, and price of urea fertilizer in North Sumatra Province. Data used in time series with the period of 1988 - 2017.

3.4 Types and Data Sources

The data used in this study are secondary data. Secondary data is primary data that has been processed and presented in tables and in other forms (Sawit, 2011).

The data used in this study was obtained and published by the Central Sumatra Provincial Statistics Agency, the North Sumatra Province Food Security Service, and other relevant agencies, and the data was also taken from scientific books and journals related to Hard Requests and Offers.

3.5 Data Analysis Technique

This study uses a simultaneous equation approach. Simultaneous equations are estimation equations where the dependent variable of the equation is also an explanatory variable for one or more independent variables. Variables in simultaneous equations whose values are determined in the model are called endogenous variables, while variables in simultaneous equations whose values are determined by other variables outside the model are called exogenous variables. Thus each endogenous variable has its own structural equation or behavioral equation (Nurjayanti, 2011).

IV. Research Results and Discussion

Results of Simultaneous Equations and Discussion

The variables that will be tested in the simultaneous equation are the demand for rice, the supply of rice, the retail price of rice, the population, the price of imported rice, and the price of urea fertilizer. These six variables have different units, such as: rupiah, kilogram, soul, or ton.

a. Factors Effect Rice Demand in North Sumatra Province

In the simultaneous equation, the demand for rice as an endogenous variable which is influenced by 3 independent variables, namely the retail price of rice, population, and per capita income as exogenous variables. Found the results of the equation in Table 4.1 as follows:

Table 4.1 Factors Effect Rice Demand in North Sumatra Province

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	468260,3	213414,8	2.194132	0,0374
HEB	0,808776	8,339399	0.096982	0,9235
JPD	0,119207	0,020046	5.946675	0,0000
PPK	0,003297	0,001513	2.179586	0,0385
R-squared	0,952234	Mean dependent var	1965918.	
Adjusted R-squared	0,946723	S.D. dependent var	203013,4	
S.E. of regression	46859,14	Akaike info criterion	24,47125	
Sum squared resid	5,71E+10	Schwarz criterion	24,65807	
Log likelihood	-363.0687	Hannan-Quinn criter.	24,53101	
F-statistic	172,7752	Durbin-Watson stat	0,923043	
Prob(F-statistic)	0,000000			

Source: Processing Results

In Table 4.1, the results of R^2 from the simultaneous equation of demand for rice in North Sumatra Province are 0.9522 (95.22 percent), meaning the variable variation ability in rice retail prices, population, and simultaneously imported rice prices is 95.22 percent of the demand for rice in North Sumatra Province, while the remaining 4.78 percent is influenced by other variables outside the estimation model.

While the value of the Prob. (F-statistic) of the rice demand equation of 0.0000, meaning the value of the Prob. (F-statistic) is smaller than α value ($0.0000 < 0.05$), then H_0 is rejected and H_a is accepted ie together there is a significant positive relationship between the retail price of rice, the population, and import rice prices against demand for rice in North Sumatra Province.

From Table 4.1 it can be seen that the results of the estimated coefficient of the retail price of rice are 0.8087 and the level is significant on prob. $0.9235 > \alpha = 0.05$ then H_0 is accepted and H_a is rejected. That means partially there is a positive and insignificant influence between the retail price of rice and the demand for rice in North Sumatra Province. If there is an increase in the retail price of rice in North Sumatra Province by 1 rupiah per kilogram, then the demand for rice in North Sumatra Province will increase by 0.8087 tons in one year, *ceteris paribus*. The results of this study are not in accordance with the theory of Sukirno (2010) said in the law of demand explained the nature of the relationship between the demand for an item and its level of price. The law is essentially a hypothesis which states: the lower the price of an item, the more demand for the item. Conversely, the higher the price of goods, the less demand for these goods. This is caused by rice that is inelastic, namely price changes do not reduce consumers continue to consume rice considering rice is the staple food of the population, especially the population of Sumatra Province who are used to consuming rice. The results of this study are supported by the theory of Krisnamurti (2006) who says that as a commodity with an inelastic request, that is, changes in prices almost do not cause changes in the number of consumer requests. If availability is lacking, prices immediately rise because consumers do not make adjustments to their consumption.

Estimated results of the variable population coefficient of 0.1192 and a significant level on prob. $0.0000 < \alpha = 0.05$ then H_0 is rejected and H_a is accepted. This means that partially there is a positive and significant influence between the number of residents on the demand for rice in North Sumatra Province. If there is an increase in the population in North Sumatra Province by 1 person, then the demand for rice in North Sumatra Province will increase by 0.1192 ton in one year, *ceteris paribus*. The results of this study are in accordance with the theory of Sukirno (2010) who said that population growth does not in itself lead to increased demand. But usually population growth is followed by developments in employment opportunities. Thus more people receive income and this increases purchasing power in society. This increase in purchasing power will increase demand. The population in North Sumatra Province is a population whose level of rice consumption is high or in other words rice is the main staple food.

While the estimation results of variable income per capita of 0.0032 and significant levels on prob. $0.0385 < \alpha = 0.05$ then H_0 is rejected and H_a is accepted. This means that partially there is a positive and significant influence between per capita income on the demand for rice in North Sumatra Province. If there is an increase in per capita income in North Sumatra Province by 1 rupiah, the demand for rice in North Sumatra Province will increase by 0.0032 tons in one year, *ceteris paribus*. The results of this study are supported by the theory of Rahmanta (2018) who said that changes in income will affect the amount of goods consumed. In fact, often found with increasing income, the goods consumed not only increase but also the quality of these items

will increase as well. For example, before there is an increase in the income of rice consumed, the quality is not as good as the IR variety or other varieties, but after additional income, the consumption of rice will increase and the quality purchased is very good quality, such as Cianjur rice and so on.

b. Factors Effect Rice Supply in North Sumatra Province

In simultaneous equations, the supply of rice as an endogenous variable is influenced by 3 independent variables, namely the retail price of rice, the number of inhabitants, and the price of urea fertilizer. Found the results of the equation in Table 4.2 as follows:

Table 4.2 Factors Effect Rice Supply in North Sumatra Province

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	284842,2	217964,5	1,306828	0,2027
HEB	43,37931	16,30660	2,660230	0,0132
JPD	0,141772	0,021249	6,671896	0,0000
HPU	-127,6415	57,71930	-2,211418	0,0360
R-squared	0,952451	Mean dependent var	1965918.	
Adjusted R-squared	0,946964	S.D. dependent var	203013,4	
S.E. of regression	46753,01	Akaike info criterion	24,46671	
Sum squared resid	5,68E+10	Schwarz criterion	24,65354	
Log likelihood	-363,0007	Hannan-Quinn criter.	24,52648	
F-statistic	173,5999	Durbin-Watson stat	1,452135	
Prob(F-statistic)	0,000000			

Source: Processing Results

In Table 4.2 the results of R² from the simultaneous equation of rice supply in North Sumatra Province are 0.9524 (95.24 percent), meaning that the variable variation ability in the retail price of rice, population, and the price of urea fertilizer simultaneously have a 95.34 percent effect towards the supply of rice in North Sumatra Province, while the remaining 4.76 percent is influenced by other variables outside the estimation model.

While the value of the Prob. (F-statistic) of the rice supply equation of 0.0000, meaning the value of the Prob. (F-statistic) is smaller than α value ($0.0000 < 0.05$), then H₀ is rejected and H_a is accepted ie together there is a significant positive relationship between the retail price of rice, the population, and the price of urea fertilizer and towards rice supply in North Sumatra Province.

From Table 4.2 it can be seen that the results of the estimated variable coefficient of the retail price of rice are 43,3793 and the level is significant on prob. $0.0132 < \alpha = 0.05$ then H₀ is rejected and H_a is accepted. This means that partially there is a positive and significant influence between the retail price of rice and the supply of rice in North Sumatra Province. If there is an increase in the retail price of rice in North Sumatra Province by 1 rupiah per kilogram, then the supply of rice in North Sumatra Province will increase by 43.3793 tons in one year, ceteris paribus. This study is in accordance with Sukirno (2010) stating that the law of supply is a statement that explains the nature of the relationship between the price of an item and the amount of goods offered by the seller. In the law this offer is expressed how the sellers want to offer their goods if the price is high and how they want to offer the goods if the price is low. Bidding law basically says that the higher the price of an item, the more the amount of goods will be offered by the seller. Conversely, if the lower the price of an item, the less the amount of the item will be offered by the seller.

The estimation results of the variable coefficients are 0.1417 and the level is significant on prob. $0.0000 < \alpha = 0.05$ then H₀ is rejected and H_a is accepted. This means that partially there is a positive and significant influence between the number of residents on the supply of rice in North Sumatra Province. If there is an increase in the population in North Sumatra Province by 1 person, then the supply of rice in North Sumatra Province will increase by 0.1417 tons in one year, ceteris paribus. The results of this study in accordance with Mankiw (2003) is a factor which affects the supply of an item will increase. Rice is a staple food that must be fulfilled. If the population continues to increase, the amount of rice consumption will also increase.

The results of the estimation of the variable coefficient of urea fertilizer are -127.6415 and a significant level on prob. $0.0360 < \alpha = 0.05$ then H₀ is rejected and H_a is accepted. This means that partially there is a positive and significant influence between the price of urea fertilizer on rice supply in North Sumatra Province. If there is an increase in the price of urea fertilizer in North Sumatra Province by 1 rupiah per kilogram, then the

supply of rice in North Sumatra Province will decrease by 127.6415 tons in one year, *ceteris paribus*. This research is in accordance with Daniel (2002) theory which states that if the price of factor production increases, the tendency to reduce its use has an impact on the results which will also decrease. The decline in yield automatically causes a decrease in supply. But in some situations Farmers continue to plant rice and continue to buy the fertilizer as the needs of farmers' rice plants so that rice production can increase because remembering urea fertilizer contributes 40% to the success of rice production.

c. Factors Effect Retail Prices of Rice in North Sumatra Province

In the simultaneous equation, the retail price of rice as an endogenous variable which is influenced by 2 independent variables is the income per capita and the price of urea fertilizer.

In Table 4.3, the results of R² from the simultaneous equation of the retail price of rice in North Sumatra Province are 0.9853 (98.53 percent), meaning that the variable variation in the price of imported rice and the price of urea fertilizer together have a simultaneous effect of 98.53 percent on the retail price. rice in North Sumatra Province, while the remaining 1.47 percent is influenced by other variables outside the estimation model.

While the value of the Prob. (F-statistic) from the equation of the retail price of rice at 0.0000, meaning the value of the Prob. (F-statistic) is smaller than the value of α ($0.0000 < 0.05$), then H₀ is rejected and H_a is accepted ie together there is a significant positive relationship between variable prices of imported rice and fertilizer prices on retail prices rice in North Sumatra Province.

From Table 4.3 it can be seen that the results of the estimated variable income per capita amount to 4.50 and a significant level on prob. $0.0015 < \alpha = 0.05$ then H₀ is rejected and H_a is accepted. This means that partially there is a positive and significant influence between per capita income on the retail price of rice in North Sumatra Province. If there is an increase in per capita income in North Sumatra Province by 1 rupiah, then the retail price of rice in North Sumatra Province will increase by 4.50 screws in one year, *ceteris paribus*. The results of this study are supported by the results of the Sumodiningrat (1994) study that per capita GRDP has a significant effect on the price of rice in the city of Medan. The results of this study are also consistent with the theory of Daniel (2002) stating that actually, the higher the income of consumers, the more diverse and quality desired item. In fulfilling consumer demand, commercial institutions will try to change the form, improve the quality of goods, and so on, so that this also causes the higher costs of trade procedures. Therefore, the value of agricultural products received by consumers gets a relatively greater added value and the percentage value of the rupiah received. Producing farmers are becoming smaller.

Table 4.3 Factors Effect Retail Prices of Rice in North Sumatra Province

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1163,406	175,4041	-6,632717	0,0000
PPK	4,50E-05	1,28E-05	3,526173	0,0015
HPU	2,754156	0,165775	16,61380	0,0000
R-squared	0,985368	Mean dependent var	4506,567	
Adjusted R-squared	0,984284	S.D. dependent var	3646,431	
S.E. of regression	457,1327	Akaike info criterion	15,18246	
Sum squared resid	5642199.	Schwarz criterion	15,32258	
Log likelihood	-224,7370	Hannan-Quinn criter.	15,22729	
F-statistic	909,1125	Durbin-Watson stat	0,949578	
Prob(F-statistic)	0,000000			

Source: Processing Results

Whereas the results of the estimated coefficient of the price of urea fertilizer amounted to 2.7541 and significant levels on prob. $0.0000 < \alpha = 0.05$ then H₀ is rejected and H_a is accepted. This means that partially there is a positive and significant influence between the price of urea fertilizer on the retail price of rice in North Sumatra Province. If there is an increase in the price of urea fertilizer in North Sumatra Province by 1 rupiah per kilogram, then the retail price of rice for rice in North Sumatra Province will increase by 2.7541 screws in one year, *ceteris paribus*. The results of this study are in accordance with the theory of Kleinsteuber (2007) which says that production costs always remain one of the important considerations in determining price and pricing strategies. So if the price of input production rises especially urea fertilizer which is a fertilizer that contributes

40 percent to the success of rice production, farmers also increase the price of rice production. Besides that, it can also be caused, because of the increase in input prices, Farmers reduce the planting which results in reduced production and supply so that the price of these goods will rise.

V. Conclusion and Suggestion

Conclusion

Based on the results of the analysis in this study, conclusions can be obtained as follows:

1. Retail prices of rice, population, and prices of imported rice together have a significant effect on the demand for rice in North Sumatra Province. The retail price variable of rice partially has a positive and not significant effect on the demand for rice in North Sumatra Province, while the variable population and price of imported rice partially have a positive and significant effect on the demand for rice in North Sumatra Province.
2. The retail price of rice, population, and price of urea fertilizer together have a significant effect on the supply of rice in North Sumatra Province. The variable retail price of rice and population partially has a positive and significant effect on the supply of rice in North Sumatra Province while the variable price of urea fertilizer partially has a negative and significant effect on the supply of rice in North Sumatra Province.
3. The income per capit and the price of urea fertilizer together have a significant effect on the retail price of rice in North Sumatra Province. The variable income per capita and the price of urea fertilizer partially have a positive and significant effect on the retail price of rice in North Sumatra Province.

Suggestion

Based on the results of the discussion and conclusions, the suggestions put forward in this study are as follows:

1. It is expected that the government must carry out market operations frequently as a form of controlling rice prices in addition to other programs. By controlling the price of rice in the market, it is expected that all levels of society in North Sumatra Province can meet their basic needs, namely rice at a relatively affordable price.
2. Farmers are expected to be able to increase their total paddy production to meet the demand for rice in the North Sumatra Province so as not to import rice from foreign countries which is able to defeat the competitiveness of local rice because the price of imported rice is cheaper than local rice prices. One way is to use superior seeds and fertilizers that meet the needs of rice plants.
3. For researchers who are interested in conducting this research in the same field, they want to increase the time span of the study and other variables not used in this study.

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