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Demand analysis of cayenne chilli pepper in Surakarta City

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ABSTRACT
Background: This study aims to analyze the factors that affect the cayenne chilli pepper demand, to know its elasticity and to forecast its demand for 2019 up to 2023. **Findings:** By using time series data of 1993-2017, this study applies multiple regresiion analysis. **Methods:** The method used for demand foreasting analysis is Least Squares Method and for the error estimator is used Mean Average Deviation. **Conclusion:** The results show that cayenne chilli pepper price, red chilli pepper price, onion price, the population and income per influence the cayenne chilli pepper demand in Surakarta City. The price elasticity of demand is inelastic and the pruduct categorized as normal goods. Cross elasticity indicates that cayenne chilli pepper subsituted with red chilli with the value of cross elasticity 0,137 and complementered with onion which the value of cross elasticity is -0,094. The result of cayenne chilli pepper demand forecasting for 2019 up to 2023 shows that the potential demand will always increas every year. The value of demand forecast on 2019 is 852.350,24 kg; the value of demand forecast on 2020 is 854.291,99 kg; the value of demand forecast on 2021 is 856.233,74 kg; the value of demand forecast on 2022 is 858.175,49 kg and the value of demand forecast on 2023 is 860. 117,24 kg with the value of error estimator is 0,0048 kg.

KEYWORDS: cayenne chilli pepper; demand; forecasting; regression.

1. Introduction

Cayenne chilli pepper (Capsicum frutescens L.) is one of populer vegetable commodities among Indonesian people. The domestic production of cayenne chilli pepper is nott always meet the consumer needs. The lack of cayenne chilli pepper in the attempt to fulfill domestic demands causing the price of cayenne chilli pepper often has to undergo fluctuation (Yanuarti and Afsari, 2016). Cayenne chilli pepper are consumed by household, small industries as well as big industries. According to Persatuan Ekonomi Pertanian Indonesia (Perhepi) in Sembiring (2017), 40% of chili consumption in total are in industrial sector. Cayenne chilli pepper consumption of Indonesian people in 2016 decrease to 12,440 ounce from 13,0210 ounce in 2015. But the consumption points, in 2016 it increased to Rp. 50.440,00 from the one in 2015 that was only Rp. 38.372,00. This information shows that the decreasing of consumption are happening because of the increase in price.

Calorie consumption from vegetables in Central Java Province are the highest among other provinces in Java Island. Based on the Indonesian eating culture, the pattern of green-vegetables consumption are prone to differ each day, but cayenne chilli pepper are being consumed almost daily by people as complementary food. On average the spending per

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capita by people of Surakarta are Rp. 1.153.561,00 monthly on 2017 and this is the number 4 highest spending among other big cities. This proves that the food consumption of the people of Surakarta City is considerably high. The average of spending made by people of Surakarta for vegetables family in 2017 are Rp. 35.662,00 in which higher than the spending on meat and egg consumption. According to Saeroji and Wijaya (2017) Surakarta City known as the Keplek Ilat city, which means that this city are famous for the various specific culinary such as gudeg ceker, tengkleng kambing, nasi liwet, sate buntel, bestik Solo and selat Solo. Most of those food using complementary food such as cayenne chilli pepper. The consumption standard on cayenne chilli pepper by people of Surakarta in 2017 reaches 1.58 kg but Surakarta city does not have its own cayenne chilli pepper production therefore all of the supplies are coming from outside of Surakarta city.

According to Sanjaya, et al (2017), cayenne chili pepper is the most consumed varieties of chilli pepper by 74% respondent becuase of such factors like habit, taste and price. According to Ratag, et al (2018) the factors affecting cayenne chilli pepper's demand in Tomohon City is cayenne chilli pepper's price itself, red chilli pepper's price and onion's price. Surakarta is one of the biggest city in Central Java with small precentage of farming land about 2,17%. Among the amount of the farming land, none of it are used for the cultivation of cayenne chilli pepper therefore the production of it are 0 kg and all of the supplies for the market are coming form outside of Surakarta. In this research, beside knowing the factors affecting cayenne chilli pepper's demand, will also analyzed the demand forecasting so that we can predicting the future demand of cayenne chilli pepper.

2. Methods

The basic method used in this research is the analytical descriptive method. The location in intentionally decided or purposive by using Surakarta city by considering that Surakarta City is one of the big city with high spending on consumption and because it has such a variety culinary in Central Java. The type of data used in this is secondary data from 1993-2017 from instances such as Dinas Pertanian Ketahanan Pangan dan Perikanan, Dinas Perdagangan and BPS Kota Surakarta.

Analytical data method that used for identify various factors that affecting the demand of cayenne chilli pepper is the double analytical regression in the shape of natural logarithm. Mathematically, the demand function could be stated as follows :

$$\text{Ln } Qd = b0 + b1\ \text{LnX1} + b2\ \text{LnX2} + b3\ \text{LnX3} + b4\ \text{LnX4} + b5\ \text{LnX5} + e \quad (1)$$

Note :

Y = Demand of Cayenne Chilli Pepper (kg/year)
a = Constanta
b1...b5 = Coefficients
X1 = Price of Cayenne Chilli Pepper (IDR/kg)
X2 = Price of Red Chilli Pepper (IDR/kg)
X3 = Price of Onion (IDR/kg)
X4 = Population (Jiwa)
X5 = Income per capita (IDR/months)
e = Standar erorr.

Classical assumptions were tested on the equation which included normality test, multicollinearity test, heteroscedasticity test and autocorrelation test to prove that the equation met the classical rules and was relevant to use. This equation is estimated by statistical testing through the coefficient of determination test, F test and t test. The elasticity in demand can be seen from the regression coefficients of each estimating variable that are related because of equations in the form of natural logarithms. Demand elasticity is divided into price elasticity, income elasticity and cross elasticity.

The demand forecasting analysis are done by Least Square Method which based on actual demand on the previous period. Therefore time variable (x) are needed, where the amount of variable point is zero or $\sum x = 0$ (Subagyo, 2008). The common equation from this method are :

$y' = \alpha + bx'$
(2)
Note :
y' = Demand Forecasting (kg/year),
α = Constanta,
b = Coefficients for x',
x' = The notation of year

After the equation are obtained, proceed to identifying the smallest mistakes using Mean Absolute Deviation (MAD) with formula :

$$MAD = \frac{\sum |e|}{n} \quad (3)$$

Where e is the difference between the actual demand point with the demand point based on estimation of y(x) from the forecasting equation which is obtained by analysis.

3. Result and Discussion

3.1 Multiple Linier Regression Analytic

Based on the analysis result, cayenne chilli pepper demand function in Surakarta city is : $LnY = -17{,}698 - 0{,}153\ LnX1 + 0{,}137\ LnX2 - 0{,}094\ LnX3 + 1{,}295\ LnX4 + 0{,}911\ LnX5$ (4)

The result of regression analytic in the table 1 showing that value of Adj R2 are 81,3% that means the demand of cayenne chilli pepper in Surakarta can be explained by the variable of cayenne chilli pepper price, red chili price, red onion price population and income per capita, while the rest of 18,7% can be explained by other variable outside the model, such as consumer taste, other commodity price that already fixed and etc. Based on F test that already done it is known that the significance value are 0,000 (0,000 < α = 0,01) which means at the trust level of 99% all of the free variables in the model really affecting the demand of cayenne chilli pepper all together.

Table 1. The results of multiple regression analysis

Variable	Coefficients	Std. Error	Significance
(Constant)	-17,698	5,709	0,006
Price of Cayenne Chilli Pepper (X1)	-0,153***	0,042	0,002
Price of Red Chilli Pepper (X2)	0,137**	0,058	0,030
Price of Onion (X3)	-0,094**	0,044	0,047
Population (X4)	1,295***	0,343	0,001
Income per Capita (X5)	0,911***	0,143	0,000
Adjusted R2	0,813		
F Value	12,951***		0,000
Durbin-Watson	1,857		
Note :	**: significance in the trust value of 95% ***: significance in the trust value of 99%		

(Analysis of Secondary Data, 2018)

3.1.1 Cayenne Chilli Pepper Price

Variable price of cayenne chilli pepper have significance value of 0,002. This value is smaller than α = 0,010 or 1% which means, individually or partially,the price variable of cayenne chilli pepper really affecting the demand of cayenne chilli pepper in the trust value of 99%. The coefficient value of cayenne chilli pepper's price is -0,153 shows that it it is negatively affecting the demand of cayenne chilli pepper. It means that the increase of cayenne chillis pepper's price will cause the decrease of cayenne chilli pepper's demand. Every 1% increase of cayenne chilli pepper's price, the demand of cayenne chilli pepper will decrease by 0,153%. The result of this research is in accordance to the relation between a commodity demands and it's price in the demand law in Sugiarto,et al (2002), that said the higher the price of a certain commodity, the lower the amount of the commodity requested.

3.1.2 Red Chili Price

The variable of red chili have a significance value of 0,030. This value are higher than α = 0,050 atau 5% that means individually or partially, the variable of red chili price really affecting the demand of cayenne chilli pepper at the trust level of 95%. The coefficient value of red chilli pepper's price is 0,137 shows that it it is positively affecting the demand of cayenne chilli pepper. It means that the increase of red chilli pepper's price will cause the decrease of cayenne chilli pepper. Every 1% increase of red chilli pepper's price, the demand of cayenne chilli pepper will increase by 0,137%. The result of this research is in accordance with the result of the research done by Lorensius, et al (2017) that stated that the price of red chili as individu influence positively towards the demand of cayenne chilli pepper.

3.1.3 Red Onion Price

The variable of red onion have a significance value of 0,47 this value are smaller than α = 0,050 or 5% that means individually or partially, the variable of red onion's price really affecting the demand of cayenne chilli pepper at the trust level of 95%. The price of red onion negatively affecting the demand of cayenne chilli pepper, which means that the increase in demand of red onion will causing the decrease in demand of cayenne chilli pepper. The coefficient value of onion's price is -0,094 which is means that every 1% increase of onion's price will cause the decrease of cayenne chilli pepper's demand by 0,094%. This, according to the phenomenon that happens in the community where red onion are one of the main complementary food (Samadi and Cahyono,2005) and the consumption level of red onion in Surakarta city are higher than cayenne chilli pepper. According to BPS Jawa Timur (2017) chilli pepper and onion have the same carateristic, it is perishible and it price fluctuation contribute to inflation. Chilli pepper and onion are two comodities that are determined as strategic supplementary food materials that are irreplaceable. According to that explanation, show that consumption of onion will affecting the cayenne chilli pepper's demand.

3.1.4 Population

The variable of population have a significance value of 0,001. This value is smaller than α = 0,010 or 1% that means individually or partially, the population variable really affecting the demand of cayenne chilli pepper in the trust level of 99%. The coefficient value of population variable is 1,295 shows that it is positively affecting the demand of cayenne chilli pepper. Every 1% of population's increase will cause the cayenne chilli pepper's demand increase by 1,295%. This result of the research are in accordance to the research conducted by Zulfitriyana, et al (2016) that stated, the population as individual or partial affecting the

demand of a certain food commodity in the area. The big populity are going to create a big demand and vice versa.

3.1.5 Income Per Capita

The variable of income per capita have a significance value of 0,000. This value are smaller than α = 0,010 or 1% that means individually or partially, the variable of income per capita really affecting the demand of cayenne chilli pepper at the trust level of 99%. The coefficient value of income per capita variable is 0,911 shows that it is positively affecting the demand of cayenne chilli pepper. Every 1% of income per capita's increase will cause the cayenne chilli pepper's demand increase by 0,911%. The result of this research are in accordance with the demand theory in which the demand of a certain product is affected by the income of the consumer, because the amount of product the demanded by the consumer will be limited by their incomes (Sardjono,2014)

3.2 Analysis of the Demand's Elasticity of Cabe Rawit

The value of elasticity of each variable used in this research can be seen from the regression coefficient. That could be done because the variable data are being processed by double logarithm model, in which the value of regression coefficient also showing elasticity value.

3.2.1 Price Elasticity

The analysis result showing that the elasticity value of cayenne chilli pepper's price are -0,153. Based on the criteria of elasticity demand towards the price changes by Reksoprayitno (2000) cayenne chilli pepper belongs to the inelastic product. This means, that in each changes on cayenne chilli pepper's price 1% causing the change in the demand of cayenne chilli pepper by less than 1% which is 0,153%. The result of this research are in accordance to the research conducted by Palar, et al (2016) that stated that cayenne chilli pepper is an inelastic product. Cayenne chilli pepper is an supplementary seasoning, so its price increase will cause its demand decrease and make the consument prefer to increasing the consumption of staple food such as rice, meat, egg, ect.

3.2.2 Income Elasticity

The result of the analysis showing that the elasticity value of the income per capita are 0,911. Based on the elasticity criteria of income by Reksoprayitno (2000), Ep 0,911 > 0 therefore cayenne chilli pepper are belong to the normal product of daily basic needs. The Ep value of 0,911 also means that when the income per capita are increased by 1%, the demands of cayenne chilli pepper will be increased by 0,911%. According to Antriyandarti (2012) if the increase in income causing the amount of consumption to increase, that means the product are belong to normal product. This result are in accordance to the research by Lorensius, et al (2017) that stated that cayenne chilli pepper is normal product.

3.2.3 Cross Elasticity

The elasticity value of red chili is 0,137. Based in the criteria by Reksoprayitno (2000) cross elasticity value (Exy1) 0,137 > 0, therefore red chili correlated in substitution with cayenne chilli pepper. The value Exy1 as 0,137 also means that in each cayenne chilli pepper price increase of 1%, will causing the increase in cayenne chilli pepper deman by 0,0137%.

The result of this research are in accordance with the research done by Indriyani, et al (2017) that stated that cayenne chilli pepper is a product that related in substitute with red chili. Based on BPS Jawa Timur (2017) chili is a food complementary commodity that irreplaceable, this support the result of the analysis in where the substitute product of cayenne chilli pepper are also coming from its commodity which is red chili. Meanwhile the elasticity value of red onion are -0,094. Based on the criteriaby Reksoprayitno (2000) the cross elasticity value (Exy2) -0,094 < 0 therefore red onion are the product that related in complementary with cayenne chilli pepper. The value Exy2 of -0,094 also means that in each increase of 1% on red onion will causing the demand of cayenne chilli pepper decrease as far as 0,094%. This in accordance to the result of a research by Hadi, et al (2016) that stated that red onion is product related as complementary with chili.

3.3 Analysis of the Demand Forecasting for Surakarta City of Rawit Chili in 2019-2023

Demand forecasting being analyzed using the least square method. The result of this demand forecasting based on the actual demand from the previous episodes. Based on the result of this analysis an equation could be made as follows :

$$y = 825165{,}74 + 1941{,}75\ x \quad (5)$$

Table 2. Demand forecasting of cayenne chilli pepper in Surakarta for 2019-2023

Year	Year Notation (x)	Demand Forecasting (kg/year)	Growth (%)
2019	14	852.350,24	-
2020	15	854.291,99	0,228
2021	16	856.233,74	0,227
2022	17	858.175,49	0,226
2023	18	860.117.24	0,225

(Analysis of Secondary Data, 2018)

Based on the equation above, the demand forecasting of cayenne chilli pepper from 2019 to 2023 can be calculated by denoting the forecasted year shown in Table 2. The growth of projection of demand of cayenne chilli pepper from 2019 to 2023 experience a decrease each year. This event related to the growth of the population that are decreased also. The growth of the population number at the result of research are -0,06% that means the increase of population number each year are decreasing by 0,06%. The decreasing in population growth are also making the growth of demand decrease. The equation of demand forecasting of cayenne chilli pepper that obtained later then being identified to find the probability of smallest mistakes using Mean Absolute Deviation (MAD) by calculating the amount of difference in demand value based on the forecasting equation with the actual demand value then divided by the amount of data. Based on the result of calculation, the MAD value are 0,0048 that means the probability of mistakes from the model equation of demand's forecast in Surakarta city are 0,0048kg/year.

4. Conclusion

Based on the research result and the discussion, several conclusion can be drawn, as follows : (1) the factors that affecting the demand of cayenne chilli pepper in Surakarta city are the price of cayenne chilli pepper itself, the price of red chili, the price of red onions, the population number, and the income per capita. Based on the result of research, all five factor could explain 81,3% of icayenne chilli pepper demands. (2) The demand of cayenne chilli

pepper are inelastic towards the change or price, Cayenne chilli pepper are a normal item and a basic necessity based on elasticity analysis towards income. Red chili is the substitute of cayenne chilli pepper while red onion is the complementary item. (3) The projection of demand of cayenne chilli pepper in Surakarta city for year 2019 to 2023 continuously increase with the mistakes probability of 0,0048 kg.

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