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To cite this article: D J Irawati *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **260** 012016

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The impact of fluctuation of the price of food commodity on inflation in North Sumatera Province

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Abstract. Inflation in North Sumatera Province fluctuates annually. The contribution of foodstuffs to inflation in North Sumatera Province shows a high contribution. This study analyzes the fluctuations in commodity prices for rice, red chilies, onion and garlic. The data used are monthly time series data in the form of Consumer Price Index (CPI) and food commodity prices in the period January 2000 to December 2017. The purpose of this study was to analyze the impact of fluctuations in food commodity prices (rice, red chilies, onion, and garlic) to inflation in North Sumatera Province. The data analysis method used in this research is robust regression. The results of this study indicate that the commodities of rice, red chilies, and onion had positive and significant impact on inflation in North Sumatera Province, while garlic commodity did not have any significant impact on inflation in North Sumatera Province.

1. Introduction

Inflation in North Sumatera Province fluctuates each year. The contribution of food stuffs to inflation in North Sumatera Province is high. The highest contribution was in 2005 at 23.83%, this was driven by an increase in the price of red chilies by 7.97% due to a decrease in production from 111,594 in 2004 to 106,432 tons in 2005. In addition, an increase in the price of onion by 4.3% was also the cause inflation. This was due to a decrease in onion production from 16,034 tons in 2004 to 9,226 tons in 2005. Similar to the commodity of red chilies and onion, an increase in the price of garlic by 2.9% was the cause of inflation in the foodstuff sub-group. This was due to the decrease in garlic production from 18,158 tons in 2004 to 3,200 tons in 2005. The highest contribution was in 2001 at 17.7%, this was due to an increase in rice prices by 0.781%. Increased rice prices due to a decrease in rice production from 221,543,473 tons in 2000 to 206,056,417 in 2001. So it can be concluded that fluctuations in the prices of food commodities, namely rice, red chilies, onion and garlic are thought to occur due to supply shocks. This is consistent with research [1], which suggests that supply-shock variables are more dominant to explain changes in food prices in India. This illustrates the increasingly important role of fluctuations in the prices of food commodities as a cause of inflation. Therefore, it is important to conduct research The Impact of Fluctuation of the Price of Food Commodity on Inflation in North Sumatera Province.



2. Research Methods

A data with an abnormal distribution of residuals can contain outliers and outliers can affect the estimation results of the least squares. Robust regression is a tool that can be used to analyze data containing outliers and provide results that are resistant to the existence of outliers [2].

The existence of outliers will interfere with the data analysis process and must be avoided in many ways. However, removing outliers in a data cluster is not the right procedure because sometimes outliers provide information that other data cannot provide [3]. There are several stages in conducting robust regression analysis, namely; classic assumption test, stationary test, outlier detection, and robust regression estimation.

The classic assumption test consists of normality test using the Jarque-Berra method, mulcholinierity test using the Variance Inflation Factors Test (VIF Test) method, heteroscedasticity test using Breusch Pagan Godfrey Test method, and autocorrelation test using the Breusch Godfrey Serial Correlation method.

Then the stationarity test is carried out, data stationary testing is very important because the data used is a form of time series. In general, time series data contains the unit root and the average value and variance change over time. Data that is not stationary or has a unit root, if included in statistical processing it will produce spurious regression phenomena [4]. In this study, the data stationary test was carried out by unit roots test, using the Augmented Dickey Fuller test (ADF Test). The criteria used in Augmented Dickey-Fuller (ADF) are with a 5% confidence interval. If in this stationary test shows the ADFstatistic value is greater than Mackinnon critical value, it can be seen that the data is stationary because it does not contain a root unit [5].

The next stage of outlier determination, outliers are data that deviate from the majority of the data group, or if graphically described the data will be located outside the majority of the data [3]. In this study outlier detection was done using scatter plots. In scatter plots can be seen visually the data located farthest from the majority of the data, so that we can find out that there is an outlier in the research data. The last stage is estimated robust regression, the general form of the robust regression model is as follows [6]:

$$LNY_t = \beta_0 + \beta_1 LNX_{i1} + \beta_2 LNX_{i2} + \beta_3 LNX_{i3} + \beta_n LNX_{in} + \epsilon_t \quad (1)$$

Where:

Y_t	= Dependent Variables
X_{i1}, X_{i2}, X_{i3}	= Independent Variables
β_0	= Constants
$\beta_1, \beta_2, \beta_3, \dots \beta_n$	= Estimation parameter
LN	= Natural Logarithm
ϵ_t	= Error Term (error, $i = 1, 2, 3, \dots n$)

So according to the research variables, the specifications of the robust regression equation model are as follows.

$$LNIHK = \beta_0 + \beta_1 LNBRS + \beta_2 LNCAM + \beta_3 LNBWM + \beta_4 LNBWP + \epsilon_t \quad (2)$$

Where:

LnIHK	= consumer price index
LnBRS	= price of rice
LCAM	= price of red chilies
LnBWM	= price of onion
LnBWP	= price of garlic
$\beta_1, \beta_2, \beta_3, \beta_4$	= Parameter estimation
ϵ_t	= Error term

The test criteria are as follows:

H0 = Fluctuations in the prices of food commodities (rice, red chilies, onion and garlic) do not have significant impact on inflation in North Sumatera Province.

H1 = Fluctuations in the prices of food commodities (rice, red chilies, onion and garlic) have significant impact on inflation in North Sumatera Province.

If the probability of each independent variable is smaller than the 5% confidence interval, then H0 is rejected and H1 is accepted. So it can be concluded that the fluctuations in the prices of food commodities (rice, red chilies, onion and garlic) have a significant impact on inflation in North Sumatera Province.

3. Result and Discussion

3.1. Classic assumption test

In this study, classical assumption tests were carried out which included; normality test, multicollinearity test, heterocedasticity test and autocorrelation test. Based on the results of the classical assumption test it can be concluded that the four assumptions, namely normality, multicollinearity, homokedasticity and non-autocorrelation cannot be fulfilled. So that it cannot be estimated using Ordinary Least Square (OLS). Then the stationarity test is carried out to find out whether the data is stationary or not at the level. If it is not stationary, it can be concluded that the data has problems with heterocesticity and autocorrelation. So that the data must be diffused and transformed into natural logarithms before estimating.

3.2. Stationary test

The stationary test results can be seen in table 1. as follows.

Table 1. The Results of Stationary Test at Level

Variable	ADF Statistics	MacKinnon critical value (5%)	Probability	Explanation
LNIHK	-2.397058	-3.430864	0.3800	Not stationary
LNBR	-1.505594	-3.430864	0.8250	Not stationary
LNCAM	-5.492881	-3.430963	0.0000	Stationary
LNBWM	-3.067360	-3.430864	0.1169	Not stationary
LNBWP	-1.789764	-3.430864	0.7066	Not stationary

The results of stationary test at the level indicate that there is only one stationary variable, namely the variable price of red chilies. In this variable, shows the ADFstatistic value greater than Mackinnon critical value at a 5% confidence interval. While other variables are not stationary at the level, which is indicated by the ADFstatistic value that is smaller than Mackinnon critical value at a 5% confidence interval. Therefore, the stationarity test must be carried out again using diffrensiation data as follows.

Tabel 2. The Results of Stationary Test at First Difference

Variable	ADF Statistics	MacKinnon critical value (5%)	Probability	Explanation
LNIHK	-14.61371	-3.430963	0.0000	Stationary
LNBR	-14.27726	-3.430963	0.0000	Stationary
LNCAM	-11.84598	-3.430963	0.0000	Stationary
LNBWM	-15.07924	-3.430963	0.0000	Stationary
LNBWP	-13.86715	-3.430963	0.0000	Stationary

Stationary test results at the first difference level indicate all stationary variables. This is seen from the ADF statistic value greater than Mackinnon critical value. Therefore, it can be concluded that the data is not stationary at level but stationary at the first difference level. So to do the estimation in this study using data in the form of first difference.

3.3. Outlier test

In this research, to detect outliers, the scatter plot method is used. The variables that were detected were the price of rice, red chilies, onion and garlic. The results of the scatter plot are as follows:

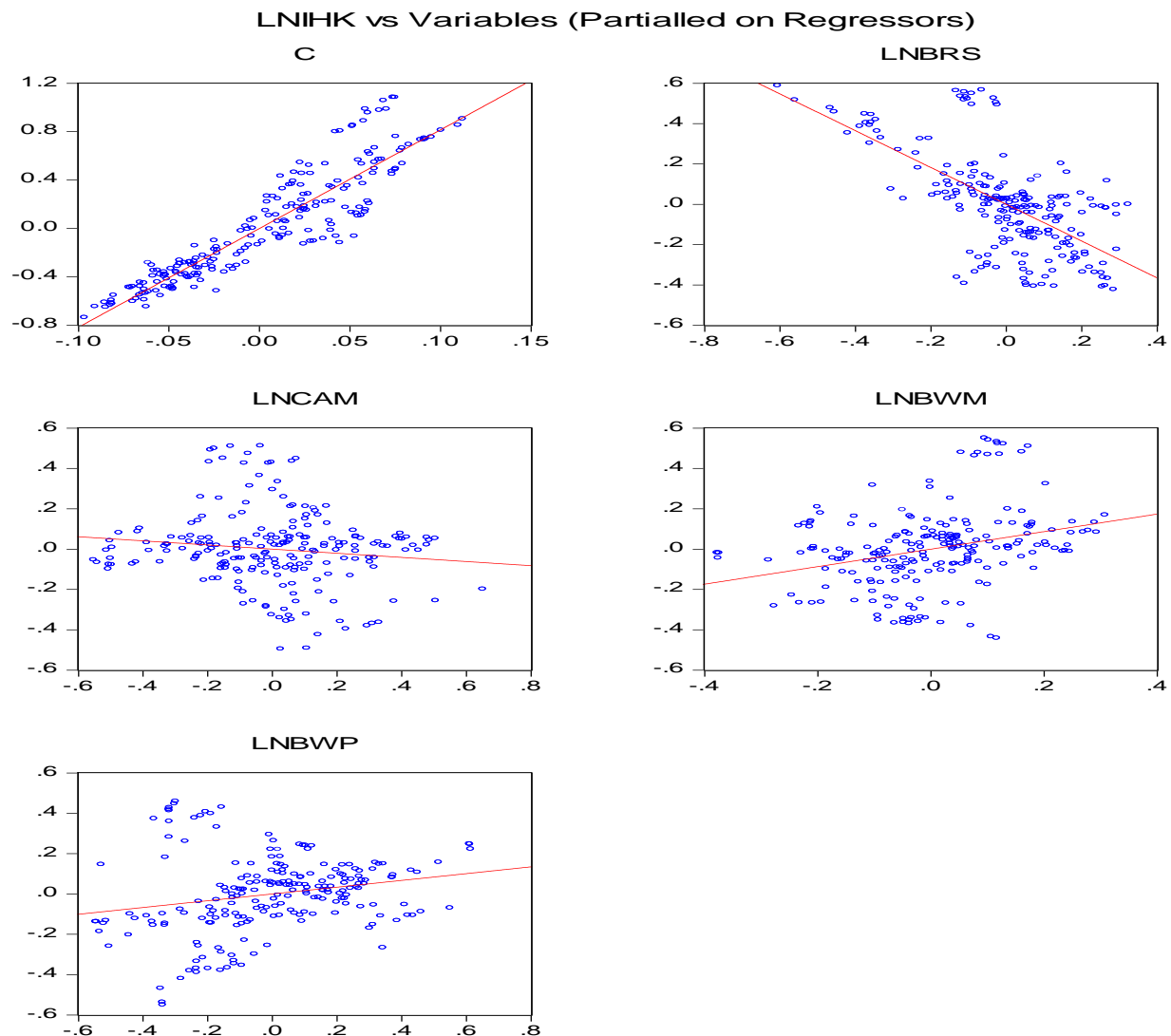


Figure 1. The results of outlier test

Based on the results of the outlier test seen in Figure 1, it can be observed that there are several data that are far outside of the majority of the data. This data entry is found in all independent variables, namely the variable price of rice, red chilies, onion and garlic. So it can be concluded that the data in this study contain outliers. So that it has fulfilled the requirements to use robust regression.

3.4. Robust regression estimates

In this study, the use of robust regression is to determine the impact of food commodity price fluctuations on inflation in North Sumatera Province. The results of the robust regression estimation are as follows.

Table 3. Results of robust regression estimates

Variable	Coefficient	Probability
C	0.004185	0.0000
D(Ln Rice)	0.115701	0.0000*
D(Ln Red chilies)	0.025602	0.0000*
D(Ln Onion)	0.025212	0.0003*
D(Ln Garlic)	-0.009409	0.1426

Description: * Significant at 5% confidence interval

In Table 3, it can be explained that rice commodities have a positive and significant impact on inflation of 0.115701. That is, if there is an increase in rice prices by 1%, it will cause an increase in inflation in North Sumatera Province by 0.115701%. These results are in accordance with the hypothesis, the variable probability of rice is 0.0000 less than the 5% confidence interval. Then H0 is rejected and H1 is accepted, so it can be concluded that rice commodities have a positive and significant impact on inflation in North Sumatera Province.

Red chilies commodities have a positive and significant impact on inflation of 0.025602. That is, if there is an increase in the price of red chilies by 1%, it will cause an increase in inflation in North Sumatera Province by 0.025602%. These results are in accordance with the hypothesis, the probability of red chilies variable is 0.0000 less than the 5% confidence interval. Then H0 is rejected and H1 is accepted, so it can be concluded that the red chilies commodity has a positive and significant impact on inflation in North Sumatera Province.

Onion commodities have a positive and significant impact on inflation of 0.025212. That is, if there is an increase in the price of onion by 1%, it will cause an increase in inflation in North Sumatera Province by 0.025212%. These results are in accordance with the hypothesis, the probability of onion variable is 0.0000 less than the 5% confidence interval. Then H0 is rejected and H1 is accepted, so it can be concluded that the onion commodity has a positive and significant impact on inflation in North Sumatera Province.

While the garlic commodity did not have a significant impact on inflation of -0.009409. That is, if there is an increase in garlic prices by 1%, it will cause a decrease in inflation in North Sumatera Province by -0.009409%. These results are not in accordance with the hypothesis, the probability of garlic variable is 0.1426 greater than the 5% confidence interval. Then H0 is accepted and H1 is rejected, so it can be concluded that the garlic commodity has no significant impact on inflation in North Sumatera Province.

The contribution of food commodities from the highest to the lowest is the rice commodity by 0.11%; red chilies commodity by 0.026%; onion commodity by 0.025%; and garlic commodity by 0.009%. This is in line with the average public expenditure in the last six years, namely 2012 to 2017, which shows that expenditure for rice commodity consumption is Rp. 66,151,-/capita/month; consumption of red chilies commodity is Rp. 8,474,-/capita/month; consumption of onion is Rp. 6,306,-/capita/month; and consumption of garlic commodities is Rp. 2,263,-/capita/month.

Based on table 3, it can be concluded that the robust regression estimation results stated that rice, red chilies and onion commodities have a positive and significant impact on inflation in North Sumatera Province. These results are consistent with the results of the study [7,8]. Whereas for garlic commodities did not have a significant impact on inflation in North Sumatera Province.

4. Conclusions

Based on the results of the study, the conclusions in this study are the commodities of rice, red chilies and onion which have a positive and significant impact on inflation in North Sumatera Province. Whereas for garlic commodities did not have a significant impact on inflation in North Sumatera Province.

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Acknowledgments

The author would like to thank the two beloved parents, who have given love, prayer and motivation.