# The Determination Analysis of Inflation in North Sumatra

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## Abstract
The differences in inflation rates among several cities in North Sumatra still occur even though local governments have been struggling to control it. There are many conditions and uniqueness in North Sumatra that may bring the unique figure of inflation. This research aims to analyze the factors causing inflation based on four cities, that is Sibolga, Padang Sidempuan, Pematang Siantar, and Medan, as the distribution line for the basic needs in North Sumatra. Variables that will be examined as independent variables are inflation, population, regional minimum wages, economic growth, and rice prices from 2007-2017. Data are taken from various related sources, such as Bank of Indonesia, Central Bureau of Statistics, Departement of National Development and Planning, and Government of Medan City. Data will be investigated the approvement of its classical assumption before analyzed using Panel Data Regression. Results indicate that the population, regional minimum wages, population, and price of rice have a positive effect, while economic growth and regional minimum wages have a negative impact on the inflation rate in North Sumatra.
***Keywords**: inflation, population, regional minimum income, price of rice, economic growth*

## Introduction
High inflation creates uncertainty, thereby reducing incentives for investment and consumption and eroding the competitiveness of domestic exports. High inflation is also a social problem because low-income people will directly feel its impact. The lower classes are the most vulnerable to inflation because their wage movements are relatively slow. Therefore, it is not surprising that workers often take action to demand an increase in wages because their wages cannot catch up the inflation. By understanding the negative effects of high inflation, the target to create low and stable inflation is almost certainly the goal of every ruling Government.

Low and stable inflation can be achieved when various obstacles that contribute to the creation of inflation can be minimized. Constraints and problems that remain a chore for, among other things, are high distribution costs, low production efficiency, and access to expensive financing. Also, imperfect market structure factors triggered an increase in the price of goods.3 These constraints ultimately affect the competitiveness of domestic products (Utari et al., 2015)

In reality, inflation in Indonesia, as in other developing countries, is not only a monetary phenomenon but is also heavily influenced by structural problems on the supply side. Therefore, efforts to control inflation are not enough to be done only with monetary instruments which are generally short-term in nature but must also be accompanied by reforms in the real sector to eliminate structural constraints that exist in the national economy. Synergy is needed between Bank Indonesia and the Government, both at the central and regional levels, to create low and stable inflation. Given the importance of managing inflation to achieve quality development goals, understanding inflation in Indonesia by policymakers is very important. With the same understanding, it is expected that control efforts can be carried out more effectively.

North Sumatra, as one of the biggest provinces in Indonesia, also has inflation problems in regencies and municipalities. Differences in natural resources, infrastructure, human resources, community income, economic growth, and many other things cause different levels of inflation in various municipal districts.

North Sumatra has four cities as inflation determinants, including Padang Sidempuan, Pematang Siantar, Medan, and Sibolga. Those cities tend to densely populated which have higher inflation rates compared to areas that are more sparsely populated. It is because the level of public consumption will be higher, and if not accompanied by production, will cause the rise of inflation rate (demand-pull inflation).

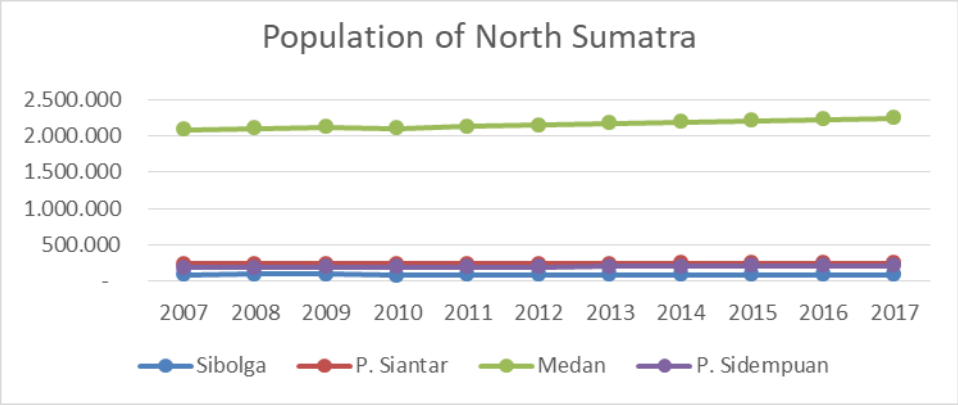


**Figure 1 Population of P.Siantar, Medan, P.Sidempuan and Sibolga**

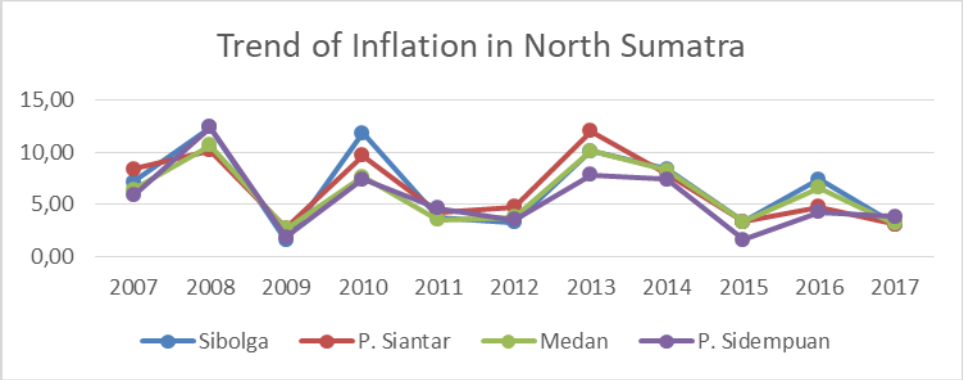


**Figure 2 Trend of Inflation in P.Siantar, Medan, P.Sidempuan and Sibolga**

Figure 1 and Figure 2 presents that the trend of the population in the four cities in North Sumatra tends to be stable, and there is no significant growth, but when viewed from the level of inflation in the same period, the value is very fluctuating. This condition illustrates the gap between theory and the actual conditions that occurred in 2010-2017. It probably caused by the level of public consumption in the period 2010-2017 increased rapidly for each household while the amount of production of primary commodities decreased in number. Then, it is resulting in an increase in prices of basic commodities, increased public income, or many more things that caused an increase in inflation in the period 2010-2017.

According to Keynes's theory, inflation occurs because people want to live beyond their economic capacity. Thus the public demand for goods exceeds the amount available. It happens because people know their desires and makes these desires in the form of demand for goods. In other words, the community has succeeded in obtaining additional funds beyond the limits of its economic capacity so that this class of people can obtain goods in greater quantities than their capacity (Mankiw, 2007).

Inflation can also be influenced by factors that originate from the supply side (such as a lot of demand but the goods/services offered are few / rare), or that are shocking (such as an increase in world oil prices and the presence of crop disruptions or floods). Bank Indonesia's ability to control inflation is due to external factors and cannot be predicted (Bank of Indonesia, 2019).

Rice as one of the primary commodities in North Sumatra is also one of the causes of inflation in North Sumatra, following the development of North Sumatra rice price fluctuations in the 2010-2017 periods.

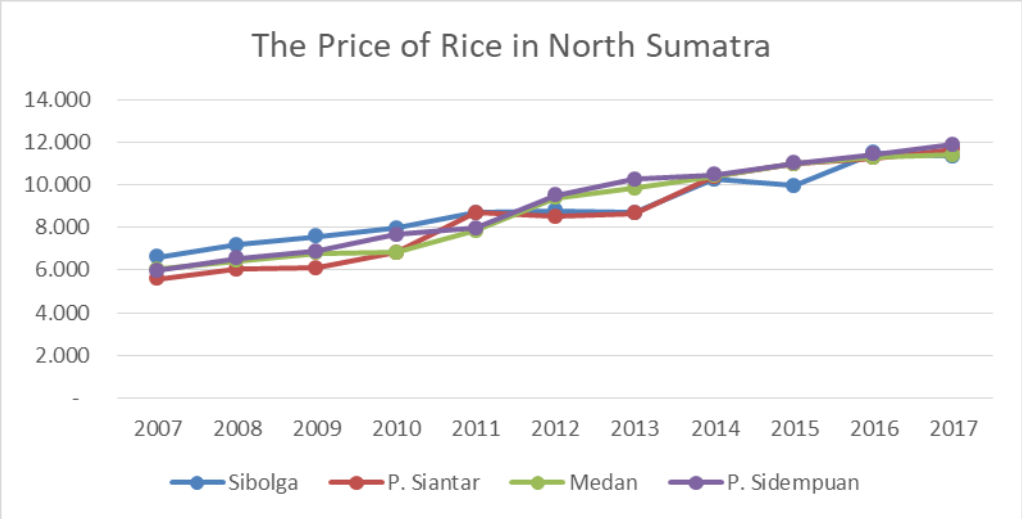


**Figure 3 The Price of Rice of Four Cities in North Sumatera**

Figure 3 explains that the increase in rice prices linearly, in fact, causes the inflation rate to fluctuate irregularly, meaning that the increase in rice prices does not proportionally increase the inflation rate. It also illustrates the gap between theory and actual conditions.

Therefore, in general, this research aims to analyze the factors that causing inflation in North Sumatra based on four strategic cities, that is Medan, Pematang Siantar, Padang Sidempuan, and Sibolga. Those four cities was chosen because it is the distribution channels of the primary commodity to other cities and districts in North Sumatra. Recent study forming the North Sumatra inflation model and generating ideas for controlling the inflation in North Sumatra. The results of this study are expected to produce a North Sumatra inflation model that can be used as a basis for policymaking for government and stakeholders.

**Methods**

This study will observe inflation behavior, population, regional minimum wages, rice prices, economic growth rates in four cities in North Sumatra, namely: Pematang Siantar, Padang Sidempuan, Sibolga, and Medan during 2007-2017. This study uses documentation techniques in collecting data, i.e., gathering data from various related sources. Because this study uses secondary data, the data was taken from Bank of Indonesia, Central Bureau of Statistics, Departement of National Development and Planning, and Government of Medan City, and other relevant sources of research and also used survey method for data that is not obtained by the documentation method.

Analysis of the data in this study uses panel data regression (pooled data). Panel data was chosen because it has a great combination of time series and cross-section data, then in the panel data model, the same cross-section units are surveyed for several time-series (Gujarati, 2003). Panel Data Analysis is used to analyze the impact of population fluctuations, regional minimum wages, rice prices, the level of economic growth on the inflation rates of districts and cities in North Sumatra. From those variables, the research model can be formed as follows:

$$Y_{it} = \alpha_{it} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_{it}$$

Information:

$Y_{it}$ = Inflation Rate (%)

$X_1$ = Population (in million)
$X_2$ = Minimum Regional Wages (IDR per Month)
$X_3$ = The Price of Rice (IDR/Kg)
$X_4$ = Economic Growth (%)
$\beta_1,\beta_2,\beta_3,\beta_4$ = Coefficient od Regression
$\alpha_{it}$ = Intercept
$\varepsilon_{it}$ = residual error

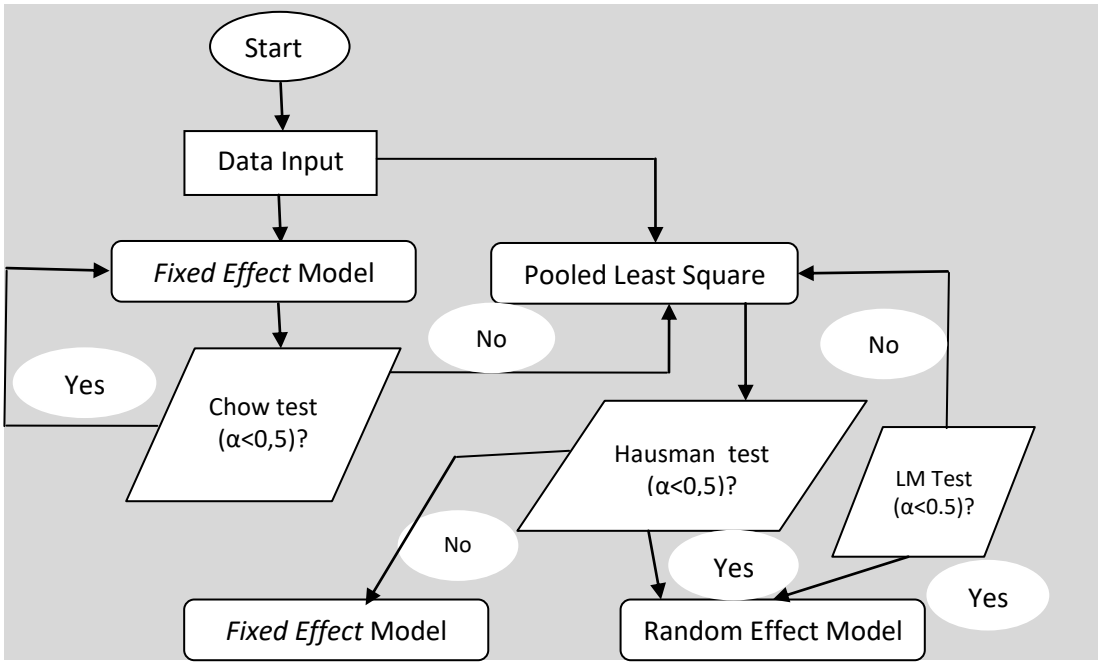


**Figure 4 Research Design**

This study uses the Chow Test to determine which are the more appropriate model between Fixed Effect and Common Effect in estimating a panel data (Gujarati, 2003). Next, the Hausman test is used to compare the Fixed Effect model with a random effect (Widaryono, 2009). And finally, the Lagrange Multiplier test is used to compare the Random Effect and Common Effect models as the best to used to estimate panel data. Furthermore, the statistical test was carried out with the F test to test the significance of the model and the t-test to test the significance of the influence between the independent and dependent variables. However, before a regression analysis is conducted, this study first tests the classical assumptions to ensure that the data used meets the statistical rules of thumbs to be analyzed (Gujarati, 2003)

**Results and Discussion**

**Test of Assumption**

The result of classical assumption test in table 1 show that all coefficients of the independent variables are significant, then it can be concluded that there is no violation of the heteroscedasticity assumption. Then, the result of multicollinearity test shows that $R_1^2$ = 0.999345 > $R_2^2$ = 0.903510; $R_3^2$ = 0.903720; $R_4^2$ = 0.442361; $R_5^2$ = 0.083571, thus the fixed effect model does not contain multicollinearity.

**Table 1 The Result of Heteroscedasticity test**

Dependent Variable: LOG(ABS(RESID?))
Method: Pooled Least Squares
Date: 10/05/19 Time: 00:36
Sample: 2007 2017
Included observations: 11
Cross-sections included: 4
Total pool (balanced) observations: 44

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.028130 | 8.095813 | -0.126995 | +0.8997 |
| LOG(Population?) | -0.258780 | 1.201291 | -0.215419 | +0.8307 |
| LOG(MRW?) | -0.200005 | 1.913376 | -0.104530 | +0.9173 |
| LOG(Rice?) | 1.433619 | 1.185116 | 1.209686 | +0.2343 |
| LOG(EG?) | -0.196393 | 0.252973 | -0.776338 | +0.4426 |
| Fixed Effects (Cross) | | | | |
| _SIANTAR—C | -1.060845 | | | |
| _SIBOLGA—C | -0.482652 | | | |
| _MEDAN—C | 0.555824 | | | |
| _SIDEMPUAN--C | 0.987673 | | | |
| | Effects Specification | | | |
| Cross-section fixed (dummy variables) | | | | |
| R-squared | 0.487357 | Mean dependent var | | -4.247235 |
| Adjusted R-squared | 0.387676 | S.D. dependent var | | 1.146541 |
| S.E. of regression | 0.897182 | Akaike info criterion | | 2.783849 |
| Sum squared resid | 28.97765 | Schwarz criterion | | 3.108247 |
| Log likelihood | -53.24467 | Hannan-Quinn criter. | | 2.904151 |
| F-statistic | *4.889181 | Durbin-Watson stat | | 1.960503 |
| Prob(F-statistic) | 0.000594 | | | |

*Source: Result of data analysis using EViews 8.1*

**The Model of Inflation**

**Chow-test**

The result of the chow test, in table 2, shows that the value of Prob. cross-section F equal to 0.000001 which means that the value obtained is <0.05, then it can be concluded that the Fixed Effect model is more appropriate than the Common Effect model.

**The Estimation of Panel Data Regression with Fixed Effect Model**

Researchers using the Eviews 8.1 software to estimate the model. This research deals with the individual behavior of districts/cities that are systemically revised (multi-equation). In this estimator, the estimated equation consists of 4 cities with an annual observation of time during 2010-2017. Table 3 presents the results of data processing using the Fixed Effect method. From the estimation results of the model, researchers will further analyze the statistical significance test and the a priori economic test analysis (direction and meaningfulness). A priori economic test explains how the independent variable influences the dependent variable by observing the probability of the t-statistic value to investigate the significance level and also the direction of the regression coefficient of each independent variable.

**Table 2 Chow Test Results**

Redundant Fixed Effects Tests
Pool: DATAPANEL
Test period fixed effects

| Effects Test | | Statistic | d.f. | Prob. |
|---|---|---|---|---|
| Period F | | 0.768442 | (10,29) | 0.6572 |
| Period fixed effects test equation: | | | | |
| Dependent Variable: LOG(I?) | | | | |
| Method: Panel EGLS (Period weights) | | | | |
| Date: 10/05/19 Time: 00:17 | | | | |
| Sample: 2007 2017 | | | | |
| Included observations: 11 | | | | |
| Cross-sections included: 4 | | | | |
| Total pool (balanced) observations: 44 | | | | |
| Use pre-specified GLS weights | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C | -11.42864 | 8.157158 | -1.401057 | 0.1691 |
| LOG(Population?) | 4.348638 | 0.966127 | 4.501104 | 0.0001 |
| LOG(MRW?) | -5.087282 | 1.570173 | -3.239950 | 0.0024 |
| LOG(Rice?) | 5.219694 | 1.033354 | 5.051218 | 0.0000 |
| LOG(EG?) | -0.153531 | 0.248995 | -0.616603 | 0.5411 |
| | Weighted Statistics | | | |
| R-squared | 0.572553 | Mean dependent var | | 14.77056 |
| Adjusted R-squared | 0.528712 | S.D. dependent var | | 5.826445 |
| S.E. of regression | 1.028581 | Sum squared resid | | 41.26118 |
| F-statistic | 13.05984 | Durbin-Watson stat | | 0.463019 |
| Prob(F-statistic) | 0.000001 | | | |
| | Unweighted Statistics | | | |
| R-squared | 0.233837 | Mean dependent var | | 12.64401 |
| Sum squared resid | 47.20107 | Durbin-Watson stat | | 0.510817 |

*Source: Result of data analysis using EViews 8.1*

Table 3 presents the result of the analysis of Panel Data Regression. We can formulate the Inflation Equation Model in North Sumatra as follows:

LOG (Inflation) = -91.76667 + 8.429256 LOG (Population) - 2,302758 LOG (UMR) + 4,738640 LOG (Rice Prices) -1,045921 LOG (PE).

The intercept value of the regression model is -91.7. It means that if the independent variables, that is Population, Regional Minimum Wage, Rice Prices, and Economic Growth are assumed to be null, then the level of Inflation in the Province of North Sumatra will decrease by 91.7%.

According to table 3, it can be seen that Population Number and Rice Prices have a significant effect on Inflation at $\alpha$ = 5%, while Minimum Regional Wage (MRW) and Economic Growth (EG) has no significant effect on inflation at $\alpha$ = 5%. Interestingly, Table 3 also shows that the Prob (F-statistic) value is 0.00072 (<0,05) which means that the independent variables simultaneously have a significant impact on inflation rate. Furthermore, Table 3 also presents the value of $R^2$ equal to 0.662092. It indicates that the variation of inflation

can be explained simultaneously by the independent variables of 66.21% while the other 33.79% is explained by other factors not included in the model.

**Table 3 Panel Data Equation Model Estimation Results (*Fixed Effect Model*)**

Dependent Variable: LOG(I?)
Method: Pooled EGLS (Period weights)
Date: 10/04/19 Time: 22:22
Sample: 2007 2017
Included observations: 11
Cross-sections included: 4
Total pool (balanced) observations: 44
Linear estimation after one-step weighting matrix

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -91.76667 | 43.31051 | -2.118808 | 0.0428 |
| LOG(Population?) | 8.429256 | 2.539722 | 3.318968 | 0.0024 |
| LOG(MRW?) | -2.302758 | 2.412742 | -0.954415 | 0.3478 |
| LOG(Rice?) | 4.738640 | 1.415063 | 3.348713 | 0.0023 |
| LOG(EG?) | -1.045921 | 0.794842 | -1.315884 | 0.1985 |
| Fixed Effects (Period) | | | | |
| 2007—C | 2.812586 | | | |
| 2008—C | 3.782814 | | | |
| 2009—C | 1.300654 | | | |
| 2010—C | 2.070427 | | | |
| 2011—C | 0.612189 | | | |
| 2012—C | -0.190642 | | | |
| 2013—C | 0.073648 | | | |
| 2014—C | -1.357918 | | | |
| 2015—C | -2.672346 | | | |
| 2016—C | -2.674637 | | | |
| 2017—C | -3.756776 | | | |
| | Effects Specification | | | |
| Period fixed (dummy variables) | | | | |
| | Weighted Statistics | | | |
| R-squared | 0.662092 | Mean dependent var | | 14.77056 |
| Adjusted R-squared | 0.498964 | S.D. dependent var | | 5.826445 |
| S.E. of regression | 1.060547 | Sum squared resid | | 32.61805 |
| F-statistic | 4.058723 | Durbin-Watson stat | | 0.316876 |
| Prob(F-statistic) | 0.000702 | | | |
| | Unweighted Statistics | | | |
| R-squared | 0.377409 | Mean dependent var | | 12.64401 |
| Sum squared resid | 38.35601 | Durbin-Watson stat | | 0.360231 |

*Source: Result of data analysis using EViews 8.1*

## Discussion

The estimation model produces a positive coefficient for the Population variable equal to 8.429256 with a probability value of 0.0024 (<0.05). This indicates that the population has a positive and significant effect on the inflation rate in North Sumatra. The higher the population, the higher the inflation rate in North Sumatra. An increase in public consumption can cause it. The commodities consumed are not only goods but also services. This condition can actually bring benefits if appropriately responded. Because this phenomenon is an opportunity for the real sector to add goods to be produced. At the same time, there will also be a need to

increase the amount of labor employed, which has implications for reducing unemployment. But if an increase does not match an increase in consumption due to an increase in population in production, it will cause a Demand-Pull Inflation (inflation push demand). Likewise, the consumption variable itself has a very small effect and has been getting smaller until the last period. In the short term, the shock to consumption will only have an impact on inflation of 4.042408 percent. In the medium to long term, the blow to consumption is no more than 3 percent (Dwijawaty, 2015).

Then on the effect of the regional minimum wage on inflation, the estimation results produce a regional minimum wage coefficient of -2.302758 with a probability value of 0.03478 (<0.05). It indicates that the regional minimum wage has a significant negative effect on the inflation rate in North Sumatra. The higher the number of regional minimum wages, the lower the inflation rate in North Sumatra. An increase in the number of the minimum wage in the North Sumatra area will cause a decrease in inflation, this indeed seems unusual because generally, an increase in the minimum wage will result in increased consumption. But this situation can occur because of primary goods or goods with the same characteristics are too much circulating in the market so that the inflation rate is held back by the number of goods.

Rice prices have a positive coefficient of 4.738640, with a probability of 0.0023 (<0.05). It can be interpreted that the price of rice has a significant positive effect on the level of inflation in North Sumatra. The higher the price of rice will further increase the inflation rate in North Sumatra. Rice is a staple food in North Sumatra. So it is considered reasonable if a significant increase in the price of rice will cause an increase in other staples in North Sumatra, mainly if a processed product contains rice. The dependence of the people of North Sumatra is also due to the culture of the people who make rice as the primary carbohydrate fulfillment. This finding is in line with BPS findings revealed by the head of the Jakarta BPS, Suhariyanto, that foodstuff groups such as the price of shallots and rice prices contributed to the increase in inflation. The price of rice rose slightly has raised inflation by 0.03% (SiHarapanku, 2018). In addition, Fitrawaty (2018) has also found that, in the long run, certain expenditure groups such as processed foods, beverages, cigarettes and tobacco; housing, water, electricity, gas and fuel; clothing, and health, have a significant effect on inflation in Medan while the other groups do not (Fitrawaty, 2018). Rice, as a staple used in processed food products, will undoubtedly have many implications for derivative products so that they have a high contribution to inflation in general.

Furthermore, economic growth has a negative coefficient of -1.045921 with a probability value of 0.1985 (<0.05). It can be interpreted that economic growth does not have a significant effect on the inflation rate in North Sumatra. Even though it has a negative coefficient, the significance number indicates that the coefficient value has no meaningful influence. The results of this study suggest that the price of rice more influences inflation fluctuations as a staple food and the population in North Sumatra. Fundamental factors, such as the interaction between demand and supply, are more influential on inflation. It also allegedly made Bank Indonesia the authority for inflation targeting also did not make economic growth the basis for decision making.

The above findings are in line with the Bank Indonesia (2019) findings, which revealed that North Sumatra Inflation in the first quarter of 2019 declined compared to the previous period. The realization of inflation in the first quarter of 2019 was 1.05% (YoY). The Foodstuffs group contributed to the annual deflation in the first quarter of 2019. Entering April, inflationary pressures increased again well above the historical average. Furthermore, inflation in the second quarter of 2019 is expected to increase compared to the previous quarter, in line with the entry of Ramadan and Eid Al-Fitr. The economy of the Province of North Sumatra in the third quarter of 2019 is expected to grow moderately amid the development of inflation, which has increased again compared to the previous quarter. Economic moderation stems from the normal return of household consumption demand after the Ramadhan and Eid Al-Fitr periods, amidst stable investment and improving net exports. Meanwhile, the pace of changes in prices, in general, is still rising, which is contributed by increased inflationary pressures for spices, clothing and transportation, communication, and financial services (Bank of Indonesia, 2019). In this case, a general picture of fluctuations in inflation in North Sumatra,

in the period 2010-2017, is more influenced by fundamental aspects, such as household consumption and availability of staple foods and other short-term things, while economic growth will affect inflation in the long run.

## Conclusions

The conclution of this research are, (1) Inflation in North Sumatra is a type of inflation that causes by fundamental factors, such as the interaction of demand and supply, then to overcome its condition, the availability of staple commodities, such as rice must be considered carefully, (2) Policies and regulations regarding population control, as has been done by the National Population and Family Planning Board, should continue to disseminate to the public community, (3) The dissemination of information and counseling regarding the organizing of cropping patterns, cropping technology, and effective fertilizing, in particular on the basic commodities, is essential for farmers in order to controlling the sustainability and stability of production, (4) The public should pay attention to their consumption patterns, by prioritizing the needs rather than the lifestyle, so that they have no consumption beyond their ability.

## Acknowledgments

This study was funded by Unimed's internal research grant on the Scheme of Lecturer Group of Expertise (in Bahasa: KDBK). Researchers are grateful for the funding and support that has been given.

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