EFFECT OF COMMODITY PRICES ON INFLATION PERSISTENCE: PARTIAL ADJUSTMENT APPROACH

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Abstract
The objective of this study is to measure the inflation persistence level in Aceh Province. By using the autoregressive model, the level of persistence counted in general and the level of inflation persistence of commodity groups counted from forming consumer price index (CPI). In addition, this study also explores the source of inflation pressure from these commodity groups by using a partial adjustment model (Partial Adjustment Model). The observation period is the year 2005-2014 using monthly data. The results of this study found that the inflation persistence rate in Aceh Province was relatively low. However, there are several inflation rate variables for CPI commodity groups that exceed the inflation persistence level in common. The source of inflationary pressure discovered also comes from two variables with relatively high persistence levels from other variables, namely foodstuff commodity group variables (BM) and housing, water, electricity, gas, fuel (PERAL) commodity groups. These variables represent the components of inflation of volatile foods and administered price inflation. This study provides recommendations to relevant policymaker in coordinating, preventing, and overcoming the effects of volatile foods and administered prices on inflation by maintaining the supply of goods (supply stock) and regulating prices that are in line with people's purchasing power
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1. Introduction

The study of inflation is one of the most important things to achieve economic stability in a country. In the monetary system, the inflation rate has become the most important indicator in an economy, both to measure economic growth, price stability, and other fundamental variables. The most obvious impact when the inflation rate is high is the decline in people's real income, thereby reducing the amount of public consumption. Unstable inflation will also create uncertainty for economic actors in making decisions. Empirical experience shows that unstable inflation will complicate people's decisions in carrying out consumption, investment and production, which in turn will reduce economic growth.

Economic growth in the economy can be influenced by inflation conditions, Zhang (2011) explains that without any effort determined by the monetary authority to manage inflation expectations, inflation calm in China over the past decade can return to the era of high inflation. Inflation persistence is closely related to the monetary system, Gerlach & Tillmann (2012) in their research revealed that the persistence tends to decline following the adoption of inflation targeting and inflation targeting has been performed well in Asia. However, not only in Asia but also in the Euro Area, the persistence of inflation has significantly decreased (Meller & Nautz, 2012). Developing countries with high inflation persistence need to adjust macroeconomic policies in a way that is significant for price shocks (eg, with a substantial reduction in output) because this shock can affect expectations and inflation for a much longer period (Gaglianone, Guillén, & Figueiredo, 2018).

Bank Indonesia as the authorized holder of the monetary system in Indonesia as mandated in law no.4 of 2003 has the duty to maintain the stability of the rupiah against goods and

services, namely inflation stability. Basically, a low and stable inflation rate is the main objective of monetary policy to achieve sustainable economic growth. According to research conducted by Arimurti and Trisnanto (2011), they explained that the response of monetary policy is not only determined by the level of inflation to be achieved but also by the behavior of inflation itself. This determines the amount and timing of monetary policy responses that need to be applied in order to achieve the desired inflation. The embodiment of inflation behavior has a very close relationship with the persistence of inflation or the length of time the inflation rate to return to the natural level (equilibrium) after the shock or shock.

A high degree of persistence means that the inflation rate will take a long time to return to its natural value after a shock, whereas a low degree of persistence indicates that after a shock in the economy it does not take long for the inflation rate to return to its natural level.

Tabel 1.1 Inflation Target and Real Inflation in Indonesia

Year	Inflation target (%)	Real inflation (%)
2001	4 – 6	12,55
2002	9 – 10	10,03
2003	9 ± 1	5,06
2004	5,5 ± 1	6,40
2005	6 ± 1	17,11
2006	8 ± 1	6,60
2007	6 ± 1	6,59
2008	5 ± 1	11,06
2009	4,5 ± 1	2,78
2010	5 ± 1	6,96
2011	5 ± 1	3,79
2012	4.5 ± 1	4,30
2013	4.5 ± 1	8,38
2014	4.5 ± 1	8,36

Source: Bank Indonesia

In Table 1.1, it can be seen that Indonesia's actual inflation rate from 2001 to 2014 generally missed the inflation target set by Bank Indonesia. Actual inflation in accordance with the inflation target only occurred in 2004, 2006 and 2007 with the remainder, not in accordance with the set targets. Even in 2001, 2005, 2008, 2013 and 2014 the actual inflation rate far missed the inflation target set in those years. This was caused by various effects of shocks in the economy such as the global financial crisis, and increases in prices of basic commodities caused by the increase in fuel prices.

This phenomenon is evidence that the Indonesian economy is very vulnerable to shock or shock to various macroeconomic variables with high inflation persistence. As in the research conducted by Alamsyah (2008), he concluded that the degree of Indonesian inflation persistence, in general, was very high, but it tended to decline in the period after the crisis. Although several studies reveal that Indonesia's inflation persistence rate has declined after the economic crisis, the Indonesian economy is currently still potentially exposed to various effects of the world economic shock because the Indonesian economy is still facing various problems such as a very weak manufacturing structure, limited fiscal space especially for infrastructure spending, weak energy security, limited funding, and various other limitations that make the Indonesian economy very vulnerable to external shock. Therefore Indonesia should have strengthened the resilience of the domestic economy in various ways including formulating new policy instruments.

One of Bank Indonesia's policies in safeguarding financial stability and inflation is to produce macroprudential policy packages, namely policies that map and monitor risks to continue to the stage of selecting the necessary policy instruments. To perfect the macroprudential policy framework in macroeconomic monitoring, in 2008 Bank Indonesia formed the Regional Inflation Control Team (TPID) as a coordination forum to maintain

inflation stability at the regional level whose duty is to monitor prices, and maintain supply stock and accelerate the implementation of the national inflation control roadmap. This shows that the inflation rate in each region has a contribution that must be monitored towards the formation of inflation at the national level, and each region also has inflationary behavior and the characteristics of different problems. Based on POKJANAS TPID data in 2014, national inflation is formed by regional inflation of 81 percent outside DKI Jakarta.

The province of Aceh as a province that has specialization in regulating government including regulating fiscal policy (UUPA No. 11 of 2006) is also inseparable from the problem of high inflation rates. Based on the index results released by the Aceh Central Statistics Agency (BPS) in 2014, the dominance of the causes of the inflation rate in Aceh Province is the component of commodities whose prices are regulated by the government, which is 18.68 percent, followed by volatile components of 11.52 percent and only 4,43 percent of inflation due to the core inflation component. This means that in an effort to stabilize the inflation rate in Aceh Province it will be more effectively implemented through a fiscal policy approach.

The average inflation rate of Aceh Province is still relatively higher compared to the national inflation rate. Empirically, the behavior of inflation in the province of Aceh is also very susceptible to shock caused by various things, both due to government-regulated price increases and disruption of supply distribution. The source of inflation pressure which causes inflation persistence in Aceh province needs to be analyzed more deeply so that the sources of fundamental inflationary pressure can be distinguished or sources of inflationary pressure that are only temporary (temporary). Monetary policy cannot be used fully to respond to inflationary pressure from shock on the supply side. Sectoral and regional policies are needed to reduce inflationary pressure from non-fundamental factors.

Figure 1.1 Fluctuation of Commodity Prices in Aceh (Monthly 2014)
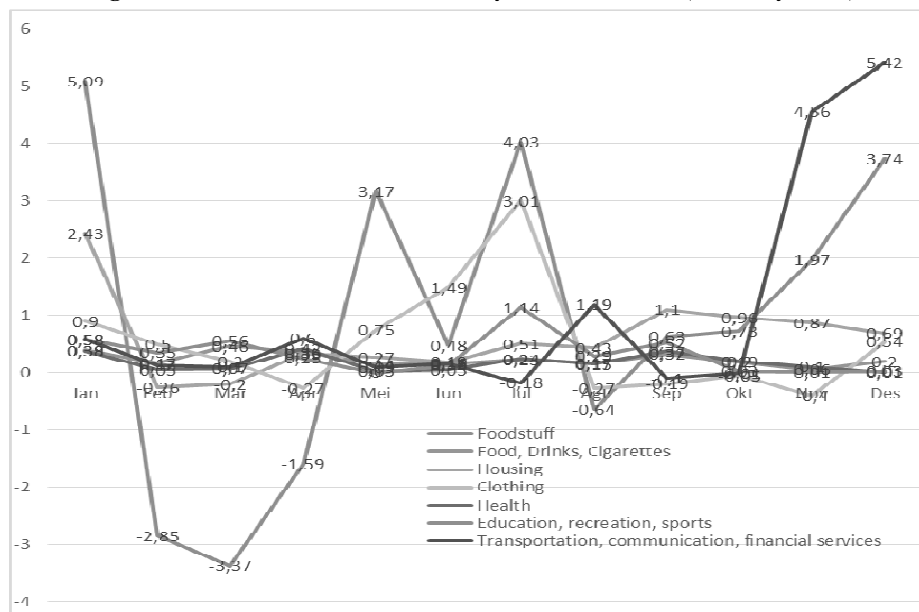

Figure 1.1 shows the condition of the monthly inflation rate of seven commodity groups in the province of Aceh in 2014. In general, the most volatile inflation rate in 2014 was the inflation rate in the foodstuffs group. The foodstuffs group at the beginning of 2014 had the highest inflation compared to other commodity groups at 5.09 percent. Furthermore, in March it experienced the highest deflation of 3.37 percent, then again inflation in May also reached 3.37 percent. The inflation rate fluctuations in the foodstuffs group continued until December and got the highest inflation rate among other commodity groups with an inflation rate of 3.74 percent.

From the 2014 data sample, it can be concluded that the foodstuffs group is the commodity group most vulnerable to shock. However, it cannot yet be ascertained whether the shock that causes inflation is persistent and continues to affect future prices or not because there has not been a specific study of how the inflation persistence rate in Aceh Province, especially inflation from the side of commodity groups forming the CPI. A high level of persistence

indicates that the monetary policy framework in implementing the ITF (Inflation Targeting Framework) has not been fully successful. The application of the ITF in Aceh Province is very necessary to determine the behavior of inflation itself through the calculation of the degree of persistence so that it can know the time needed for each component of inflation to return to its natural level. Thus, policymaker can adjust the amount and timing of responses that need to be applied in order to achieve the desired inflation.

This research will examine how the behavior of inflation by measuring the inflation persistence level in Aceh province. Consequently, The event of a shock can become information for policymaker and can produce appropriate and targeted policy formulations in overcoming the problem of inflation in the economy in Aceh Province.

2. Literature Review

In simple terms, inflation can be explained as a tendency to increase prices in general and continuously. The price level in the definition of inflation conceptually is the level of the weighted average price of goods and services in the economy. In practice, the price level is measured by the price index, both the consumer price index (CPI) and the producer price index (PPI). The opposite of inflation is deflation, which is a decrease in the general price level (Samuelson and Nordhaus: 1997).

The policy in maintaining the stability of the inflation rate is carried out by the establishment of an expansionary monetary policy (Monetary Expansive policy) which is often referred to as loose monetary policy or Monetary contractive policy or tight monetary policy. Both policies are implemented with various instruments which are the authority of Bank Indonesia. According to Moreno and Villar (2008), the tight and looser monetary policy is based on the degree of inflation persistence or inflation behavior itself.

Sbordone (2007) defines inflation persistence as the length of time needed for the disappearance of inflation shock or the return of inflation to natural levels, as well as Gadzinski and Orlandi (2004) who interpret inflation persistence as slow inflation to return to the target value set by the central bank when there is a change in the achievement of these objectives or because of other shocks. Batini (2002) explains that there are three types of inflation persistence, namely: First, the serial correlation is positive on inflation. Second, there is a lag between the actions of systematic monetary policy and their effect on inflation. Third, the lag of response from inflation to unsystematic monetary policy. Thus, inflation persistence can not only increase but also decrease from its natural value. If the inflation persistence position is at its natural value, then the inflation persistence value will be positive, whereas if the persistence position is below its natural value, the persistence value will be negative. In the various existing literature, the discussion of inflation persistence mostly focuses on the increase alone, where the studies aim to find out how quickly or slowly the decline in inflation can return to its natural value.

Marques (2004) states that inflation persistence is usually assessed in two approaches. The first study defines and evaluates inflation persistence in the context of simple univariate time-series representations while the second uses structural econometric models that aim to explain the behavior of inflation. Several previous studies have explained the behavior of inflation in Indonesia, both backward looking and forward looking. Research conducted by Harmanta (2009) found that the persistence of backward-looking inflation in the ITF era decreased, while those that were forward-looking had increased. However, the study needs to be supported by regional studies, in the sense of looking deeper into regional inflation persistence. This is also motivated by the understanding that national inflation is formed from regional inflation.

The determinant of inflation can be seen from two sides, namely Core Inflation and non-core inflation. Core inflation is inflation which is influenced by fundamental factors such as demand-supply interactions, external environments such as exchange rates, international commodity prices, inflation of trading partners and inflation expectations from traders and consumers. Whereas non-core inflation is inflation which is influenced by other than fundamental factors. Like Volatile Food Inflation. (Shocks-influenced inflation in foodstuffs such as crops, natural disturbances, disease disorders) and Administered Prices Inflation (inflation affected by shocks in the form of Government price policies, such as fuel prices, electricity tariffs, transportation fares, etc). In this study, persistence and the source of

inflation are focused on inflation originating from the supply side, namely the inflation rate caused by changes in the prices of goods and services of the Consumer Price Index (CPI) constituent component.

3.   Method of Analysis

3.1. Data Stationarity Test

In econometrics, the data to be used must be stationary especially for time series data. Test of stationary data is needed to see whether over time the data or variable will tend to return to a fixed long-term trend. In this study the stationarity test of data using the Augmented Dickey Fuller-Test (ADF-Test) and the Phillips-Peron test. The optimal length of lag in the ADF test is determined based on the minimum AIC (Akaike Information Criterion) value and the maximum value of   (Harris, 1995). Stationarity tests on all variables are carried out starting with a constant (drift) and trend, with a constant (drift) and a random walk equation.

3.2. Autoregressive (AR)

In this study, the measurement of persistence degrees uses a univariate approach by emphasizing aspects of time series data. The model that will be used is the Autoregressive (AR) time series model. With the AR model, the inflation persistence rate is measured from the sum of the lag coefficients of the dependent variable. The method of summing the coefficients is the best way of persistence scalar measurement according to Andrews and Chen (1994) AR formula with order ρ can be described as follows:

$$\pi_t = \mu + \sum_{j=1}^{k} \alpha_j \mu_{t-j} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

For estimation ρ, determine the number of lags of the corresponding K dependent variable using the Akaike Information Criterion (AIC) and or Schwarz 'Bayesian Information Criterion (SBIC). The inflation persistence rate is calculated by summing the AR coefficients ($\rho = \sum_{j=1}^{k} \alpha_j$). Inflation persistence is said to be high if the current inflation rate is strongly influenced by its lag value, so the coefficient is close to 1. In this case, inflation is said to approach the unit root process. Measuring the level of inflation persistence with a univariate approach in some previous literature assumes that the natural inflation rate, in the long run, is constant (Vasilika, 2011). The natural inflation rate is the inflation rate in equilibrium conditions

To measure how long the inflation persistence (inflation returns to the natural level after a shock) can use the Koyck Model by calculating the Mean Lag. Mean Lag value is the magnitude of the average value of Lag influence (different times) on the dependent variable which can be expressed in the formula as follows:

$h = \dfrac{\rho}{1-\rho}$ where p is the coefficient of AR (Gujarati, 2003).

3.3. Partial Adjustment Model (PAM)

The causes of the source of inflation pressure can be known by using Partial Adjustment Model (PAM), also known as Stock Adjustment Model, basically, this model is a form of rationalization of the Koyck Model developed by Mark Nerlove in 1958. The Koyck model is a simple method used in estimating the relationship of dependent variables with independent variables which in the equation accommodate lags (Gujarati, 1995).

Partial Adjustment Model (PAM) is also an Autoregressive model. The criteria that must be fulfilled from the PAM model are the lagged coefficient of the dependent variable

(dependent variable) located $0 < \beta < 1$ and β must be statistically significant with the

coefficient sign positive (Insukindro, 2006). This model assumes that the Y non-free variable expected in period t is written (Yt *) cannot be observed directly. The Yt * variable will depend on the current Xi free variable. The general forms of PAM models are as follows (Gujarati, 2003):

$$Yt = \gamma\beta_0 + \gamma\beta_0 X_t + (1-\gamma) Y_{t-1} + vt \quad \text{where } v_t = \delta et \quad \ldots\ldots\ldots\ldots (2)$$

To form a PAM model that will be used in this study the first step that must be done is to form a functional relationship between the independent variable and the dependent variable. The decline in the PAM model in this study is as follows:

$$\pi = f(\text{BM, MMR, PERAL, SDG, KSH, PRO, TKK}) \quad \ldots\ldots\ldots\ldots (3)$$

Where π shows the inflation rate, BM is food ingredients, MMR is food, drinks, cigarettes, then PERAL is Housing, water, electricity, gas, SDG fuel is Clothing and KSH are Health, PRO is Education, recreation, sports, and TKK is transportation, communication, financial services. In the PAM model, equation (3) can be explained through the following equation:

$$\pi_t^* = \beta_0 + \beta_1 \text{BM}_t + \beta_2 \text{MMR}_t + \beta_3 \text{PERAL}_t + \beta_4 \text{SDG}_t + \beta_5 \text{KSH}_t + \beta_6 \text{PRO}_t + \beta_7 \text{TKK}_t + e_{1t} \quad \ldots\ldots\ldots\ldots (4)$$

π_t^* is an unobservable variable, to eliminate the variable equation (4) is derived into the following equation:

$$\pi_t - \pi_{t-1} = \delta(\pi_t^* - \pi_{t-1}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\pi_t = \delta(\pi_t^* - \pi_{t-1}) + \pi_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$\pi_t = \delta\pi_t^* + (1-\delta)\pi_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where:
$\pi_t - \pi_{t-1}$ is Actual change in the inflation rate, $\pi_t^* - \pi_{t-1}$ is Change in inflation rate

according to the desired time, and δ is the adjustment coefficient $(0 < \delta \leq 1)$.

By substituting equation (7) into equation (4), the equation can be used for estimation as follows:

$$\pi_t = \delta\beta_0 + \delta\beta_1 BM_t + \delta\beta_2 MMR_t + \delta\beta_3 PERAL_t + \delta\beta_4 SDG_t + \delta\beta_5 KSH_t + \delta\beta_6 PRO_t$$

$$+ \delta\beta_7 TKK_t + \delta e_{1t} + (1-\delta)\pi_{t-1} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (8)$$

Because:

$$\gamma_0 = \delta\beta_0, \; \gamma_1 = \delta\beta_1, \; \gamma_2 = \delta\beta_2, \; \gamma_3 = \delta\beta_3, \; \gamma_4 = \delta\beta_4, \gamma_5 = \delta\beta_5, \gamma_6 = \delta\beta_6, \gamma_7 \delta\beta_7,$$
$$\text{and } v_t = e_{1t}$$

So in general equation (8) can be written as equation (9) below:

$$\pi_t = \gamma_0 + \gamma_1 BM_t + \gamma_2 MMR_t + \gamma_3 PERAL_t + \gamma_4 SDG_t + \gamma_5 KSH_t + \gamma_6 PRO_t + \gamma_7 TKK_t +$$

$$(1-\delta)\pi_{t-1} + v_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (9)$$

The operational definitions in this study are as follows: Inflation rate (π) is the dependent variable measured by the index of a consumer price index (CPI). Foodstuff (BM) is an independent variable obtained by measuring the inflation rate by using the component index of the prices of goods included in the food ingredients. Fast food, drinks, cigarettes (MMR) is an independent variable obtained by measuring the inflation rate by using the component index of prices of goods included in food, drinks, and cigarettes.

Housing, water, electricity, gas, fuel (PERAL) is an independent variable obtained by measuring the inflation rate by using the component index of prices of goods included in Housing, water, electricity, gas, and fuel Clothing (SDG) is an independent variable obtained by measuring the inflation rate by using the component index of prices of goods included in clothing items Health (KSH) is an independent variable obtained by measuring the inflation rate by using the component index of the prices of goods and services included in health goods and services. Education, recreation, sports (PRO) is an independent variable obtained by measuring the inflation rate by using a component index of prices of goods and services included in goods and services of education, recreation, and sports. Transportation, communication, financial services (TKK) are independent variables obtained by measuring the inflation rate by using a component index of prices of goods and services included in goods and services of transportation, communication, and finance.

4. Results and Discussion

The economic structure that continues to evolve and continues to change makes economic fluctuations increasingly difficult to assess. Not surprisingly, in the measurement of various economic indicators or variables continue to experience changes and developments in accordance with ongoing economic conditions. The inflation rate as one of the indicators to determine changes in prices in general also continues to develop in the calculation process. Measuring the level of inflation is done by using a price index of a group of goods and services that are general needs and can represent the price level as a whole. Therefore to calculate the price index, goods, and services whose prices are used to calculate the index also change as well as the base year of price changes.

In this study, of course, it will not discuss the mechanism of these calculations, but it should be noted that in the Aceh Province the inflation rate which is currently a reference for economic agents is also not immune from changes. The inflation rate in Aceh Province released by the Central Bureau of Statistics has undergone two years of basic measurement of price indexes during the data period of this study, namely in 2009 with the base year 2007 and in 2014 with the base year 2012. Changes to this base year have several reasons important as the presence of new goods whose prices are feasible to be included in the index scales. In general, inflation and fluctuations of commodities price in Aceh Province from 2005 to 2014 can be seen in the following figure:

Figure 4.1 Inflation and Fluctuations of Commodities Price in Aceh Province From 2005 To 2014
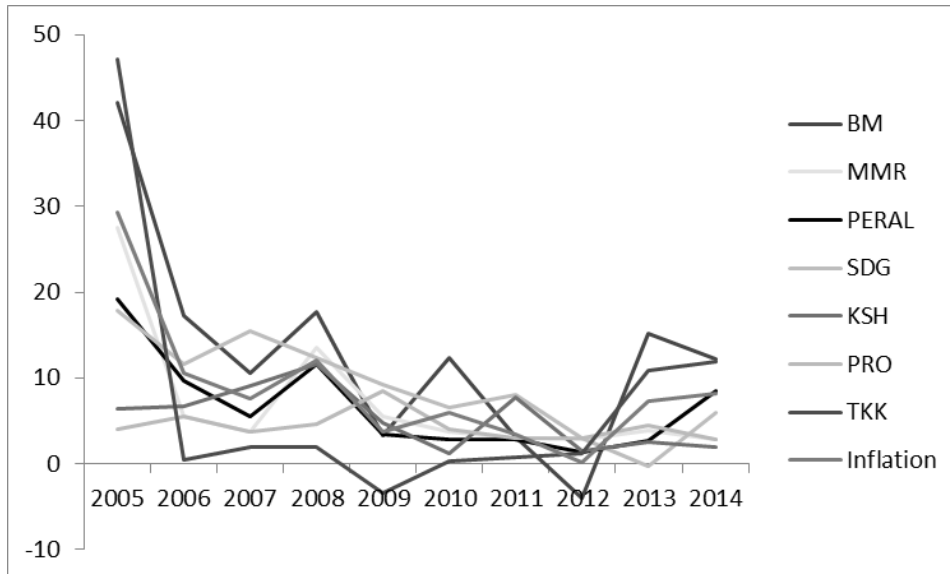
The description of the inflation rate fluctuations seen in Figure 4.1 shows the highest average inflation rate occurred in 2005. The price changes that occurred in 2005 experienced a significant increase from the previous year. Based on the results of the release of the Central Bureau of Statistics, the earthquake and tsunami disaster in Aceh Province on December 26, 2004, greatly affected the price increase in 2005.

While the lowest average inflation rate occurred in 2012. This is because the economic condition of Aceh Province in 2012 was quite good supported by improved infrastructure, and the distribution of goods and services that were increasingly smooth.

4.1. Stationarity Test Results

In conducting data stationarity tests, the thing that must be considered is the probability value. If the probability value is below $\alpha = 1$ percent, $\alpha = 5$ percent, or $\alpha = 10$ percent, then there is no unit root. Conversely, if the probability value above is $\alpha = 1$ percent, $\alpha = 5$ percent, or $\alpha = 10$ percent, then the result indicates a unit root occurs. In addition to knowing the stationarity of data can also be done by comparing the value of t-statistics and critical values to determine whether there is a null hypothesis that can be rejected or not (Rachman Hakim et al, 2012). Unit root testing in this study is based on Augmented Dickey-Fuller (ADF) test at the level and first difference.

From the results of the stationarity test, it was found that the data to be used in this study is not stationary at the level which is proven by the probability value of several variables greater than α. This means that the variables in this study are not stationary at $\alpha = 1$ percent, $\alpha = 5$ percent, and $\alpha = 10$ percent. The results of the comparison between the t-statistics and critical values show the same thing. The t-statistic value is not smaller than the critical value both at $\alpha = 1$ percent, $\alpha = 5$ percent, or $\alpha = 10$ percent. That is, the null hypothesis that the root unit is accepted. The test results can be seen in Table 4.1 below:

Table 4.1 Stationarity Test

Variables	ADF Statistic	critical value of Mc Kinnon			Prob*	ADF Statistic	critical value of Mc Kinnon			Prob*
		1%	5%	10%			1%	5%	10%	
π	-3,0384	-3,4937	-2,8892	-2,5816	0,0346	-8,8768	-3,4937	-2,8892	-2,5816	0
BM	-3,2575	-3,4931	-2,8889	-2,5815	0,0194	-8,7277	-3,4931	-2,8889	-2,5815	0
MMR	-1,2616	-3,5007	-2,8922	-2,5832	0,6447	-8,1157	-3,4931	-2,8889	-2,5815	0
PERAL	- 1,3783	-3,5007	-2,8922	-2,5832	0,5898	-8,8575	-3,4931	-2,8889	-2,5815	0
SDG	-1,0468	-3,5007	-2,8922	-2,5832	0,7337	-9,8247	-3,4931	-2,8889	-2,5815	0
KSH	-1,4124	-3,4925	-2,8887	-2,5813	0,5737	-9,6244	-3,4931	-2,8889	-2,5815	0

Variables	ADF Statistic	critical value of Mc Kinnon			Prob*	ADF Statistic	critical value of Mc Kinnon			Prob*
		1%	5%	10%			1%	5%	10%	
PRO	-2,3666	-3,5007	-2,8922	-2,5832	0,1539	-3,6540	-3,5007	-2,8922	-2,5832	0,0064
TKK	-4,6869	-3,4931	-2,8889	-2,5815	0,0002	-9,0043	-3,4931	-2,8889	-2,5815	0

The data is not stationary at the level, it needs to be differencing, namely first difference and the determination of the number of lags of dependent variables using the Schwarz Bayesian Information Criterion (SBIC) because the number of lags is required to remember the data that is not long enough. At first difference, all variables are stationary both seen from the probability value that is smaller than the value of α and the t-statistical value smaller than the critical value at α = 1%, α = 5%, and α = 10%. That is, the null hypothesis of unit root is rejected.

4.2. Persistence of Inflation in Aceh Province

After ensuring that all variables are stationary, then the estimation process can be done. Because the estimation used is the autoregressive model, the measure of inflation persistence is the value of the autoregressive coefficient. The estimation results show that the inflation persistence of Aceh Province is very low with an AR coefficient of 0.095. This result shows that the inflation rate of Aceh Province is almost not influenced by its lag value and only requires a short time to return to its natural value (equilibrium).

Table 4.2 Inflation persistence in Aceh Province (2005-2014)

| Variable	Coefficient	Std. Error	t-Statistic
C	-0.1552	0.1641	-0.9454
DINF(-1)	0.0954	0.0969	0.9850

This result is certainly not as expected (Table 4.2). Although inflation in Aceh Province is very prone to shock, the inflation rate that is generated is not persistent and the shock that occurs is absorbed quickly towards returning to the average value of inflation during the research period from 2005 to 2014. These results provide information that price changes the prices of commodities forming CPI in Aceh Province, in general, do not follow the magnitude of past price changes.

The magnitude of the price change (inflation) in Aceh Province is more influenced by various factors formed in the current period. In other words, the behavior of inflation in Aceh Province is more influenced by other things that are seasonal or temporary because in each period in the study the inflation rate in Aceh Province has a different pattern and very little influence from the previous period on inflation formation in the next period. Empirically, the shock of prices of goods and services in Aceh Province is often caused by the large demand for goods and services in certain seasons, such as *maulid* celebrations, *Ramadhan* month, and other holidays which are identical to the social conditions in Aceh Province. This also greatly influences the changing patterns of inflation in the Province. This situation is theoretically called Demand-Pull Inflation, which is inflation caused by an increase in the amount of demand for goods but not offset by an increase in output produced, generally, prices will rise.

Because of the increase in the demand for goods and services in certain seasons often prices that have generally risen will return to decline (correction) after reaching the highest price in the season even though in the long run prices continue to increase. Perhaps this is what causes the inflation persistence rate in Aceh Province to be low because of the often corrected price level to return to the previous price. The relatively low level of inflation persistence in Aceh Province, which is different from the inflation persistence rate in other provinces, can also be caused by the most influential source of inflation pressure in Aceh Province. However, to draw conclusions like this, more in-depth research is needed, including in observing price behavior.

In line with the opinion of Marques (2004) which states that there is a tradeoff between the level of inflation persistence and the flexibility of the natural inflation rate. If the natural inflation rate is constant, it will produce a high level of inflation persistence and vice versa if the natural inflation rate is more flexible and changing, the inflation persistence level will tend to be low. Aceh Province with a low inflation persistence rate has an average inflation value that is quite varied during the study period as shown in Figure 4.2 below:

Figure 4.2 Inflation rate and moving average
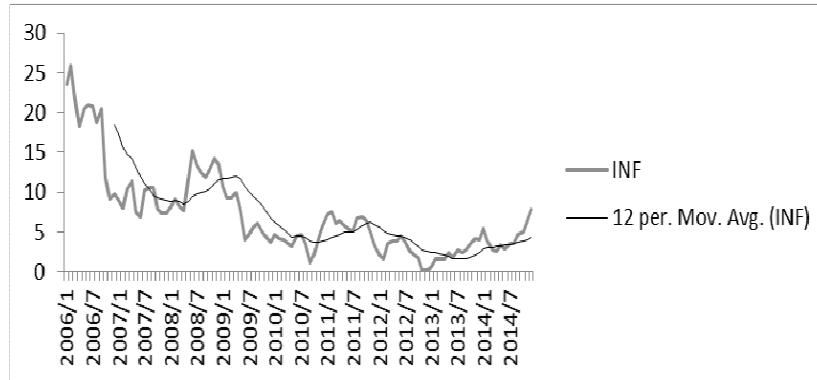
In Figure 4.2, it can be seen in each year that the inflation rate cuts several times the balance point. In other words, the inflation rate in Aceh Province is very fast returning to the average value. If the length of time needed for the inflation rate of Aceh Province is calculated to return to its natural level by calculating the Mean Lag value the results are as follows:

$$h = \frac{0,095}{1-0,095} = 0,104$$

The average length of time required for the general inflation rate to return to its natural level in Aceh Province is 0.104 years (the length of time in the study period is 12 months) which is about 1.2 months. This can be said to be a relatively short time to return to the average value of inflation after the shock.

Aceh Province which has economic relations that are quite close to the province certainly has the same inflationary behavior. So that the results of inflation persistence in the relatively low province of Aceh could be influenced by a very active trade flow, both imports, and exports, especially agricultural commodities between these two provinces. The low inflation persistence level of the Province of Aceh means that in general the current value of inflation is very little influenced by the value of its past so that the effect of shocks or shock on inflation will return to its natural level in a relatively short time. This was reinforced by Gaglianone, Guillén, & Figueiredo (2018) who explained that the shock that occurs when inflation is higher, has a greater dissipation time than the shock that occurs when inflation is lower.

4.3. Persistence of inflation in the form of CPI commodities

Inflation persistence in general in Aceh Province has a relatively low degree. Nevertheless, this study also tries to calculate the inflation persistence of each CPI-forming commodity group, namely seven other variables mentioned earlier. This calculation is also considered very important because inflation, in general, is a calculation of the average value of seven commodity groups forming the Consumer Price Index (CPI) so that the results of this calculation can provide a more detailed explanation of how the inflation persistence rate in Aceh Province in each price group. The results of estimating the degree of inflation persistence in Aceh Province based on the group of CPI-forming commodities are presented in the following table.

Table 4.3 Inflation persistence for commodities group

| No	Groups	Degree of Persistence
1	Foodstuff	0,161356
2	food, drinks, cigarettes	0,305003
3	housing, water, electricity, gas, fuel	0,138980
4	Clothing	0,037643
5	Health	0,06569
6	Education, recreation, sports	0,071837
7	Transportation, communication, financial services	0,109759

The results of the calculation of the inflation persistence level of the CPI composing commodity groups in Aceh Province are attached in Table 4.3. The commodity group with the highest persistence level is the group of processed food, drinks, cigarettes (MMR) with a persistence value of 0.30, followed by the foodstuff commodity group (BM) with a value of 0.16, the next highest commodity group is housing, water, electricity, gas, fuel (PERAL) with a value of 0.13, then a group of commodities for transportation, communication and financial services (TKK) with a value of 0.1. While the three other commodity groups are the clothing group (SDG), the health group (KSH), and the education, recreation, and sports groups (PRO) which have persistence levels below 0.1.

When viewed to the level of the commodity group, the biggest contributor to the persistence of inflation is the processed food, beverages, and cigarettes group. This gives the view that in Aceh Province in controlling the inflation rate must be careful with the type of inflation that comes from outside the Aceh region or often referred to as imported inflation, because commodity groups with the highest persistence level are processed food, beverage and cigarette commodities almost certainly comes from outside Aceh (not Aceh products).

Foodstuff commodity group (BM) occupied the second position of the highest inflation persistence rate. Prices of foodstuffs that continue to increase and very often experience limited supply, perhaps the cause of this commodity group tend to be a high level of persistence from several other commodity groups. Inevitably the crisis of food stock in Aceh Province often has to be covered by importing from outside the region to meet demand, plus the amount of food demand in certain seasons makes prices of these commodity groups continue to soar as during the day celebrations. Islamic big day.

The next commodity group that was felt to be quite influential in contributing to the inflation persistence level in Aceh Province was the housing, water, electricity, gas, fuel commodity group (PERAL). To overcome the problem of inflation caused by this commodity group is a little more difficult than the two previous commodity groups. Because most of the commodity prices incorporated in this group are determined by policies at the central government level and very few commodities can be intervened in price formation at the regional level.

For some other commodity groups, namely clothing (SDG), health (KSH), education, recreation, sports (PRO), and transportation, communication, financial services (TKK), during the study period, the results of persistence levels were relatively very low. In general, commodity groups with a low persistence level mean that changes in prices do not occur continuously for changes in prices in the past (the effect of small lags). However, a low persistence level does not become a barrier for these commodity groups to contribute to the inflation rate in each period. Discussion of the source of the influence of inflation will be discussed in the next sub-heading. For more details, the following is explained by the calculation of the length of time the inflation rate to return to its average value after a shock in the overall inflation rate of the commodity group above.

Figure 4.3 Inflation persistence level to natural level (monthly)
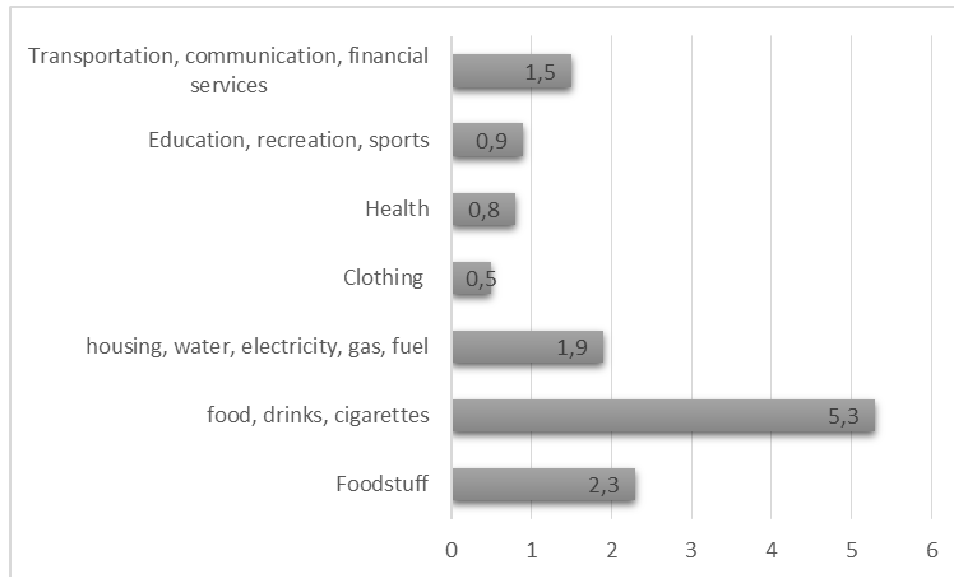
Overall the results shown in Figure 4.3 show the time needed by the inflation rate to return to relatively fast average values as a result of the calculation of the general inflation persistence level discussed earlier. The length of time ranges from 0.5 to 5.3 months. The commodity group that most quickly absorbs shock is the clothing group, which only takes 0.5 months. In other languages, the average inflation rate of commodities joined in this group only takes about 15 days to absorb shocks that occur in commodities in this group.

While the longest time needed to return to the average value is the inflation rate in the processed food, beverage and cigarette commodity groups, which is for 5.3 months or reaches a quarterly one. By knowing the length of the persistent inflation rate in each group of commodities, in terms of taking policy stakeholders need to pay attention to the right timing in taking the policy so that it can achieve the desired inflation target.

4.4. Sources of Inflation Pressure in Aceh Province

As stated in the previous discussion, to calculate the effect of each variable (CPI commodity group) will be calculated using a partial adjustment model (PAM). This model includes a dynamic model that accommodates the lag value of the dependent variable. The following estimation results using the partial adjustment model.

Table 4.4 The Source of the Causes of Inflation

Variables	Coefficient	Std. Error	t-Statistic
C	-0.053980	0.083498	-0.646480
DBM	0.235836	0.018230	12.93646
DKSH	0.075560	0.075966	0.994663
DMMR	0.086570	0.086999	0.995074
DPRO	0.028357	0.070951	0.399666
DTKK	0.132023	0.024887	5.304795
DSDG	0.072993	0.044370	1.645111
DPERAL	0.330454	0.069447	4.758394
DINF(-1)	0.023650	0.042489	0.556616

From the results of the estimation of the PAM model, the source of the causes of inflation from the supply side is shown in Table 4.4. To see the effect of the independent variables on the dependent variable is to look at the coefficients of each independent variable. The variables that have the biggest to the smallest influence on the inflation rate in Aceh Province if sorted are as follows: (1) housing, water, electricity, gas, fuel group with a coefficient of

0.330454, (2) foodstuff with a coefficient of 0.235836 , (3) transportation, communication, financial services groups with a coefficient of 0.132023, (4) processed foods, beverages, cigarettes with a coefficient of 0.086570 (5) health groups with a coefficient of 0.075560, (6) clothing and value groups coefficient of 0.072993, (7) education, recreation, sports group with a coefficient of 0.028357. The results provide information that variables with a low persistence level can contribute greatly to the magnitude of the inflation rate in Aceh Province. As attached to the following table:

Table 4.5 Level of Persistence and the Effect to Inflation

Ordering	Variables	Persistence	Ordering	Variables	The effect on inflation
1	MMR	0,305003	1	PERAL	0,330454
2	BM	0,161356	2	BM	0,235836
3	PERAL	0,138980	3	TKK	0,132023
4	TKK	0,109759	4	MMR	0,086570
5	PRO	0,071837	5	KSH	0,075560
6	KSH	0,06569	6	SDG	0,072993
7	SDG	0,037643	7	PRO	0,028357

Table 4.5 shows that the commodity groups that occupy the top three ranks with the highest persistence level and the magnitude of the influence on the inflation rate, namely food commodity groups and housing, water, electricity, gas, fuel commodity groups. Therefore, the two commodity groups are recommended to be the focus of policymaker in controlling the inflation rate in Aceh Province, by anticipating the possibility of inflation in this commodity group and also overcoming the impact of inflation caused by this commodity group.

Each of these variables represents the volatile foods component and administered price component. The BM variable represents the volatile foods component because this variable is the inflation rate of food ingredients such as rice, meat, beans, fruits and others that are prone to shocks such as natural disasters and crop failures. Whereas the PERAL variable represents the administered price component because this group is more dominated by needs whose prices are determined by the government, such as the basic electricity, fuel, and water rates.

5. Conclusion

The results of this study get some conclusions that can be a reference for controlling inflation in Aceh Province. In general, the inflation persistence level in Aceh Province is relatively low in contrast to some previous studies in various other regions even in Indonesia in general which have a high inflation persistence rate. In Aceh Province, it took a long time for the general inflation rate to return to an average (natural) value after the shock of only 1,2 months. Furthermore, the inflation persistence level of the commodity group of the Consumer Price Index (CPI) has a time span in absorbing shock from 0,5 months to 5,3 months. The three groups of commodities with the highest persistence in inflation are processed food, beverages, cigarettes, foodstuffs, and housing, water, electricity, gas, and fuel groups.

With reference to the estimation of the PAM model, it was found that the three groups of commodities with the greatest influence on the inflation rate were housing, water, electricity, gas, fuel, foodstuffs, and transportation, communication and financial services. When viewed from the disaggregation, this result provides information that in terms of controlling inflation in Aceh Province, it must have a main focus in preventing and reducing the impact of volatile foods inflation and administered price inflation represented by foodstuffs and housing groups, water, electricity, gas, fuel. To reduce the impact of price increases on volatile foods, the government must maintain the supply of goods (supply stock) in various ways. Among them by opening new agricultural land, encouraging people to be more productive in producing agricultural products, plantations, and other food ingredients. Such a policy certainly must also be followed by revamping agricultural infrastructures such as irrigation, dams, and other infrastructure that can facilitate the community or producers to optimize their production. The

government can also strive to provide subsidies for raw materials for the production of foodstuffs such as fertilizers, agricultural seeds, livestock breeds, and so forth.

Meanwhile, the impact of inflation caused by the administered price component, the government must immediately find a solution to the energy crisis problem. The solution is to find other energy sources that are renewable and cheaper and more efficient for use by the community because the inflation rate in these components is strongly influenced by energy-related prices. If this is difficult, the government can strive to reduce the impact of inflation on this component by providing public facilities that can reduce the amount of energy consumption by the community such as public transportation, closer access roads, and other policies that can reduce energy needs. Therefore, to achieve the inflation target desired by the government as a stakeholder, it must strengthen coordination and synergize with all relevant parties so that the inflation rate in Aceh Province continues to be stable and on target.

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