PERSISTENCE OF INFLATION IN JAKARTA AND ITS IMPLICATION ON THE REGIONAL INFLATION CONTROL POLICY

Trinil Arimurti, Budi Trisnanto [1]

Abstract

The main objective of this study is to measure the persistence of inflation level in Jakarta. In addition, this study intends to find out the source of inflation persistence and its implication to regional inflation control. The analysis of the regional inflation behavior developed in this paper is explored to commodities level. The empirical result indicates that the level of inflation persistence in Jakarta is relatively high, stemmed from high level of inflation persistence for most of commodities that construct inflation. Using the estimation results of the hybrid NKPC model, it shows that high inflation persistence in Jakarta mainly caused by inflation expectation, which is a combination of forward and backward looking. In this regards, it requires efforts gradually transform the behavior of inflation expectation to be more forward looking.

I. INTRODUCTION

According to the constitution No. 13, 1968 about Bank of Indonesia (Bank Indonesia)as finally amended with law No. 4, 2003, the duty of Bank of Indonesia is to achieve and maintain the stability of Rupiah value toward good and service or inflation stability.Therefore, the monetary policy is directed to achieve and maintain the inflation in the low and stable rate. In this context, the response of monetary policy is not only determined by the inflation rate that wants to be achieved but is also determined by the inflation behavior itself. That will determine the amount and timing of the response of monetary policy that needs to be applied in order to reach the inflation desired. In the side of inflation rate that wants to be achieved, the monetary policy is directed to achieve the inflation target which is stipulated decreasing gradually to the rate that supports the perpetual economy growth. According to the law meant, the inflation target is stipulated by the government after coordinating with Bank of Indonesia which is purposed to increase the credibility of monetary policy. The assessment about the inflation behavior is related to the inflation persistence or the speed of inflation rate back to its equilibrium rate following the shock.

Some researchers have been conducted to see the inflation persistence in Indonesia. The result of Yanuarty study (2007) and Alamsyah (2008), for example, is to conclude that the degree of inflation persistence in Indonesia was generally high however tended to decrease in the crisis aftermath period. While Harmanta (2009) stated that the *backward looking*inflation persistence in the era of ITF decreased, and for the*forward looking*experienced an increase. Nevertheless, the study needs to be supported by the regional study, in term of looking more in regional level. It is also motivated by the understanding that the national inflation is formed from regional inflation. More specifically, the study of inflation persistence in region by considering that each has inflation characteristic that implicates to the inflation controlling policy though generally inflation pressure in region mostly related to the shock in supply

The implementation of *Inflation Targeting Framework* (ITF) in 2005 became the milestone of the change of monetary policy frame done after the economic crisis in Indonesia. Principally the monetary policy frame is in order to adopt the more credible policy frame that accomplish to the use of interest rateas operational target and anticipative policy. ITF is hoped able to change *backward looking expectation*that becomes the source of the high inflation intact, to become*forward looking expectation*. So that, it is hoped that ITF can push the decrease of inflation persistence.

Next, the persistence inflation needs to be supported by analysis about the cause of inflation persistence. As understood in CPI inflation component that its price is influenced by

government policy in the field of price and *administered prices*. The price in this commodity tends to be flat and changes when there is a government policy. Besides that, there is component that its price is influenced by *supply shocks*or is seasonally. For that, assessment is needed to see the fundamental factors more detail. This is purposed so that the response of monetary policy can be carried out more precise regarding monetary policy is for demand management. In other words, the response of monetary policy cannot be overdone if the source of inflation pressure from the non – fundamental factor.

The study of the phenomenon of the inflation persistence that becomes very important to be done in order to support formulating effective monetary policy. This thing because the affectivity of monetary policy can support the perpetual economy growthin order to raise the society prosperity. The high inflation will give negative impact to the economy. Purchasing powerof society will decrease and world business will be covered by the high of uncertainty. The implication from the inflation persistence will also be felt in the level of region so that it needs to be looked after by local government to be able actively act in controlling inflation.

The study is finally needed to formulate the strategy of inflation control. The source of inflation pressure makes the inflation persistence needs to be analyzed more edge so that can be differentiate the fundamental form the temporary source of inflation pressure. The monetary policy cannot be fully used to respond the inflation pressure from the side of supply.Sectoral and regional policies are needed to decrease the inflation pressure from non-fundamental factors. There are some studies of inflation persistence that has previously been done in Indonesia that are more focused on the national scale or range. National inflation constitutes theweighted averagefrom inflation in the region in Indonesia, therefore it needs to study about the behavior of inflation in the region level,including to measure and search for its cause, and also to know its implication toward the control of the region inflation with the focus on Jakarta.

The choosing of Jakarta region is based on to its domination of national inflation rate compared to the other regions in Indonesia. Despite there is the decreasing tendency,inflation rate of Jakartacity is still the biggest among 66 cities that are measured by Living Cost Survey (SBH). In 2007, it showed that the rateof Jakarta reached by 22.49% from national rate(Graphic 1), decreased from 27.66% based on SBH in 2002. The other reason is the movement of the high volume of staple goods distribution in Jakarta.Next, the behavior of Jakarta inflation will be compared with the national and 10 regions panel with the highest contribution of inflation in Indonesia.

To answer the research objectives, the scoop of study span which are the period of January 2000 to May 2008 (Jakarta) and January 2000 to December 2009 (national). This relates to the availability of the data from BPS until the commodity level.

Source: BPS-Statistics Indonesia, processed

Figure 1.
Inflation Rateof the city based on SBH 2007
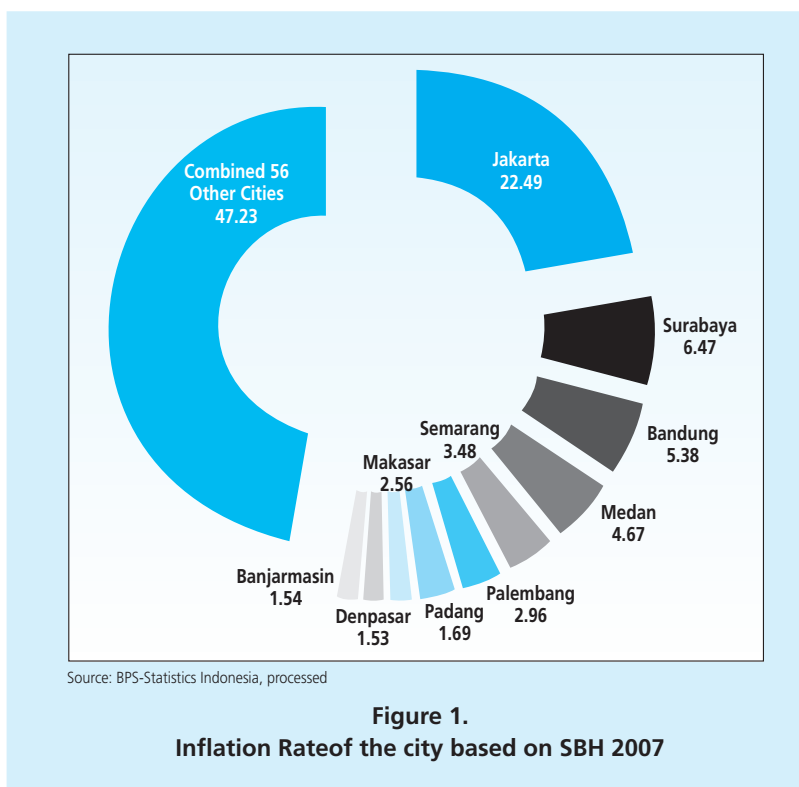
2. THEORY

The inflation persistence according to Marques (2005) is defined by the speed of inflation rate to move back to its equilibrium spot after emergence of the shock. The high speed shows that the low inflation persistence rate and in the way around the high inflation persistence rate that is shown by the time used by inflation rate to move back to its equilibrium spot. The almost same definition is also stated by Willis (2003) who defines the inflation persistence by the time needed by the inflation to move back to its baseline after the shock. While, the alternative definition which is more various is stated by Batini (2002) who discussed three types of inflation persistence, which are (i) "positive serial correlation in inflation"; (ii) "lags between systematic monetary policy actions and their (peak) effect on inflation"; (iii) "lagged responses of inflation to non-systematic policy actions".

The study about inflation persistence is important to increase the ability of inflation forecast, retrieve the clarity of dynamic effect fromexogenous price shocks, gives information/direction and fix the monetary policy, and in order to value whether the other monetary policy regime will produce the different persistence, Stock (2004).

2.1 The Measurement of Inflation Persistence

In order to measure the inflation persistence rate, there are two approaches that can be used,which are the univariate approach and multivariate model approach. The univariate approach is only more stress to the time series data aspect,while the multivariate approach also cover additional information such as real output and central bank interest rate (Dossche and Everaert, 2005). From some studies that have been carried out, the univariate approach by using autoregressive (AR) time series model constitutes the most common in empiric research.

Some scalar measurement methods (univariate)that can be used to calculate the inflation persistence such as (i) the sum of the autoregressive(AR) coefficients; (iii) the largest autoregressive root; (iv) the half-life (Marques, 2005). With AR model, the inflation persistence rate is measured from the range of its lag variable. Meanwhile LAR (*the largestautoregressive root*) is generally explained by Levin and Piger (2004). In this method, inflation persistence is

acquired by finding the biggest square root, the equation of $\lambda^K - \sum_{j=1}^{K} \alpha_j \lambda^{K-j} = 0$. While

thehalf-life method is adopted especially for evaluating deviation persistence frompurchasing power parity equilibrium (Marques 2004). As described by Andrews and Chen (1994), the half-life formula is $\gamma = 1 - \dfrac{n}{T}$, where n is the amount of some inflations above 0.5 when the big disturbance occurred as much as 1 unit and T is the amount of observation period. Despite there are some concepts of different inflation persistence period measurement rate, the estimation result acquired is not far different generally. (Clark, 2003).

The research focus in the inflation process enables the use of univariate model in this paper. However, univariate model cannot be separated from some limitations; one of them is that this model cannot identify the cause source of the observed persistenceof inflationso that there is the probability of inflation process potential trigger to be ignored.

Marques (2004) stated that the AR model is a good inflation persistence measurer, and is also directly related to the coefficient of mean reversion as the alternative of inflation persistence rate measurement. The ARformula AR with order of p can be describedas follows:

$$\pi_t = \mu + \sum_{j=1}^{K} \alpha_j \pi_{t-j} + \varepsilon_t \tag{1}$$

π_t : Monthly inflation rateat the time of t

μ : The constant from the result of estimation process as control toward inflation Average

$\sum_{j=1}^{K} \alpha_j$: The amount of AR Coefficient

ε_t : Random error term or residual from equation regression above

From the result of the equation estimation, the inflation persistence rate is calculated by adding AR coefficient, $\left(\rho \equiv \sum_{j=1}^{K} \alpha_j \right)$.

The way to calculate the coefficient is the best persistence scalar measurement way according to Andrews and Chen (1994). Inflation persistence is high if today inflation rate is influenced by the value of its lag, so that the coefficient is close to 1. In this case, the inflation can be said closed to the unit root process.

To retrieve the result of estimation, in every inflation series needs to be determined the amount of proper lag variable dependent. In its determination, Akaike Information Criterion (AIC) or Schwarz' Bayesian Information Criterion (SBIC) can be used.As stated by Levin and Piger (2004), in measuring the persistence by using AR model, the equivalent equation as follows needs also to be considered:

$$\pi_t = \mu + \rho\pi_{t-1} + \sum_{j=1}^{K-1} \phi_j \Delta\pi_{t-j} + \varepsilon_t \tag{2}$$

Where the dynamic parameter ϕ_j is a simple transformation from AR coefficient from the equation (1) constitutes simple transformation from AR coefficient from equation (1).

Specifically, persistence concept is much related to the Impulse Response Function (IRF) from the process of AR (ρ). Marques (2004) described the weakness and the strength of each

persistence measurement methods. The Cumulative Impulse Response Function (CIRF) concept which is formulated as $CIRF = \dfrac{1}{1-\rho}$ describes the monotonic correlation between CIRF and the AR coefficient (ρ), so that the calculation is very dependent on the AR coefficient. The other weakness of CIRF and ρ in measuring the inflation persistence is if there are 2 (two) of data series, and both of the method cannot tell the different between the series that was highly increased and then followed by the gradual decrease with the series that the increase was low and then followed by the low high decrease in its IRF. Separated fromthe limitation that becomes the weakness of univariate method, this scalar measurement methodmust be seen as the method for estimating the inflation average speed to move back to its equilibrium after the emergence of the shock.This scalar is considered more effective if the speed of inflation series convergence is more uniformed.

Some critics toward the half-lifemethod in inflation persistence rate calculation have been also explained in the previous research. If IRF is oscillating, this method will produce too low inflation process persistence. Besides, if the inflation process is very persistent, the output ofthe half-lifeis very high so it will be difficult to differentiate the change of persistence as the time goes by. However this method is usually preferred because more understanding for its measurement in time unit. Because of the limitation, some writers do the*half-life*calculation directly from IRF. Meanwhile the critic towards the*largest autoregressive root*has ever been stated by (2004). The persistence measurement by using this method is considered not good since its function depends on the other root, not only from the biggest root. However the advantage of this method is the easiness in calculating asymptotically valid confidence intervals for its estimation result.

The calculation result of inflation persistence degree by using AR model estimated by using OLS can be compared with the bootstrap estimation result. This is also useful to anticipate of the probability of invalid measurement if the persistence degree closes to the number of 1, so that the robustness check is important to be carried out. This procedure has been used in some previous research, such as: O'Reilly and Whelan (2004) and Alamsyah (2008).

In order to complete the observation toward inflation behavior change, *rolling regression method can be used to see whether the inflation process is changing as the time goes by*, by seeing the evolution from the AR coefficient. This method has been done also in some previous research such as:Pivetta & Reis (2006), Debelle and Wilkinson (2002), O'Reilly and Whelan (2004) and Alamsyah (2008). It is generally can be summarized that the estimation result of

inflation persistence degree by using the method showed the change of inflation process in countries that became sample of object occurred. Nevertheless, this method has also the weakness because not accurately showed the change of inflation persistence rate, so that the factors influences such as monetary policy cannot be caught clearly.

In doing analysis toward inflation persistence degree, it is also need to be considered the existence of structural breaks. Some literatures stated that the estimation of inflation persistence rate will be exaggeratedif the existence of the inflation average value of structural break is not calculated. Some techniques such as Andrew and Quandt test or Chow test can be carried out to do the test toward the existence of structural break.

In order to measure of how long does the inflation take to absorb 50% of *shock*occurred before moving back to its average value, formula can be used (Gujarati, 2003) with simple formula $h = \dfrac{\rho}{1-\rho}$.   Where h is the time needed by inflation to absorb the 50% of shock occurred before moving back to its average value and ρ is the estimation result of inflation persistence degree.

Some studies related to the inflation persistence have been done in Indonesia, such as by Alamsyah (2008), Yanuarti (2007), Bank Indonesia inflation team (2006). Whole the research were more stressed on the national inflation persistence and limited to general inflation persistence and commodity group. Generally it is found that the inflation persistence degree in Indonesia is relatively high in the observation period, though there is decreasing tendency in the crisis aftermath period in 1997/1998. Nevertheless, there has not been a study about the inflation persistence in regional level and covers until commodity level.

The study that has been done by Alamsyah (2008) is for seeing the inflation behavior change in Indonesia at the time of before and after crisis, and also for seeing the cause sourceof inflation persistence especially from the micro businessmen approached by using NKPC hybrid model. By using univariate approach which is *the sum of autoregressive coefficient* (AR (1)) it is found that the persistence degree in Indonesia is relatively high at the observation period of 1985-2007. Nevertheless, the persistence degree tends to be decreasing at the time of after economic crisis.It is also founded that the inflation in Indonesia constitutes the combination of backward and forward lookingbehavior. Therefore, the effort to stabilize the inflation expectationto the target set by central bank, needs to control the inflation and increase the monetary policy credibility in Indonesia.

Meanwhile, the study by Yanuarti (2007) was purposed to measure the inflation persistence degree in Indonesia and also to research whether there is the change of inflation persistence

degree change in span of 1990-2006. By using gull sample, it is found that the inflation persistence degree in Indonesia is very high; however tends to decrease at the time of after crisis. Thesefindings are in line with Alamsyah findings (2008).

2.2 The Cause of Inflation Persistence

Inflation pressure source can be seen through the equation of New Keynesian Philips Curve (NKPC), where the cause of inflation persistence can be seen by the inflation forward looking) and (backward looking)behavior. This approach is the innovation of the inflation initial model that describes the inflation dynamic as written in NKPC:

$$\pi_t = \kappa y_t + \beta E_t \pi_{t+1}$$

Next, according to Gali and Gertler (1999), beside forward looking oriented, inflation has also backward lookingbehavior both of the behaviors described from the NKPC Hybrid model that catch the inflation persistence characteristic.

The inflation structural equation that is usually called as New Keynesian Phillips Curvehybrid consisted in this equation below (Angeloni et. al, 2004):

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E_t(\pi_{t+1}) - \lambda \hat{\mu}_t + \xi_t$$

Where π_t is inflation at the time of t; $E_t(\pi_{t+1})$ is the inflation expectation at the time of $t+1$ with informal condition at the time of t, μ_t is output gap and ξ_t is exogenous shock substance.

By seeing the right side of the equation, it can be estimated that the four of inflation sources : (i) extrinsic persistence that relates to the persistence of marginal cost or output gap.; (ii) intrinsic persistence that relates to the inflation dependency toward the previous period inflation (backward looking expectation); (iii) expectations-based persistence that relates to the inflation expectation form that is based on to the forward looking; (iv) error term persistence because of the inflation shock occurred.

III. METHODOLOGY

3.1 Estimation Technique

Inflation persistence estimation is done by seeing *univariate autoregressive (AR) time series model process as* Marques (2004) stated since the AR model is the measurer of good inflation persistenceand also directly related to the *mean reversion as alternative of inflation persistence rate measurement.* AR formula with the order p can be broken down as follows:

$$\pi_t = \mu + \sum_{j=1}^{K} \alpha_j \pi_{t-j} + \varepsilon_t \tag{3}$$

π_t : Monthly inflation rate at the time of *t*

μ : The constant of estimation result, as control of average inflation

$\sum_{j=1}^{K} \alpha_j$: The total of AR coefficient

ε_t : Random error term or residual from equation regression above

The inflation persistence rate is calculated by adding AR coefficient $\left(\rho \equiv \sum_{j=1}^{K} \alpha_j \right)$. The inflation persistence can be said high if today inflation rate is very influenced by its lag persistence, so that the coefficient is close to 1.in this case, inflation can be said close to the *unit root process.*

For, estimation, the determination of the amount of dependent variable lagwhich is according to the*Akaike Information Criterion* (AIC) and or *Schwarz' Bayesian Information Criterion* (SBIC). In order to see the result of robustness obtained, and also bootstrap and rolling regression procedure is conducted. *Structural break test is carried out by applying the technic such as Quandt* (1960) and Chow test to do the test toward known and unknown break to measure of how long does the inflation take to absorb 50% of *shock that is occurred before moving to its average value, the formula is*:

$$h = \frac{\rho}{1-\rho}$$

In this paper, the cause of inflation persistence can be seen based on the inflation behavior *forward looking*and backward *looking* of the inflation behavior as follows:

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E_t(\pi_{t+1}) - \lambda \hat{\mu}_t + \xi_t$$

Where π_t is the inflation at the time of t; $E_t(\pi_{t+1})$ is an inflation expectation at the time of $t+1$ with information condition at the time of t, μ_t is the output gap and ξ_t is a exogenous shock substance. The significant variable and has big coefficient is the variable that becomes the main source of inflation pressure. Embarking from the analysis about the source of the inflation pressure, and in order to see the inflation persistence source, more analysis is done.

In the analysis of the source of inflation persistence, the inflation is only focused on o the 5 commodities that has the highest of inflation persistence degree. The five commodities are the most important commodities in controlling inflation. In order to analyze the source of inflation persistence,*anecdotal information*and*analysis* are used and also the study that has been done related to the commodities. The information collected such as about the market structure and the commodity inflation characteristic.

3.2 Data

The data that will be used in this inflation persistence analysis are:

1. Monthly inflation (*year-on-year*), measured by using Consumer Price Index of the total of all city in Indonesia (National inflation) and IHK of Jakarta city, also IHK 9 of other regions that have the biggest rate toward national inflation. While the date used the year base 2002. The IHK can be explained in detail in to 7 (seven) commodity groups : (i) Foodstuff, (ii) Food, Baverages and Tobaccos, (iii) Estate, (iv) Clothes, (v) Health, (vi) Education, Recreation and Sports, and (vii)Transportation and Communication.The sample span was started since January 2000 - May 2008 (December 2009 for national). The source of CPI data is retrieved from the Statistic Center Bureau and *International Financial Statistics* (IFS).
2. The annual inflation target(source: Bank Indonesia)

The use of the year on year inflation data especially is because some reasons as stated by Babecky (2008) as follows:

1. The use of *month-to-month* (m-t-m) inflation data or *quarter-to-quarter* (q-t-q) is very related to the seasonal factor so that it is worried that it does not represent the real inflation persistence
2. The both of inflation size m-t-m and q-t-q size are not monitored by certain economic agent.

3. Central bank in determining the inflation target is more based on the annual inflation change *(y-o-y).*

## 4. RESULT AND ANALYSIS

4.1 The development of Jakarta Inflation

Jakarta Inflation has the almost same pattern with the national inflation. In a span of the last 25 years, the average of Jakarta inflation rate has not been changing significantly. Either in the before and after economic crisis period occurred in1997/1998,the average of inflation tend to be staying at 8% (outside crisis period).While, compared with the region countries such as Malaysia, Thailand and Philippines at that period, Indonesia inflation is relatively high (Alamsyah, 2008). The tendency of the resistance inflation rate in the high level needs to further observationin order to determine the right pace in controlling it.

Source: BPS-Statistics Indonesia, processed

**Figure 2. The development of National Inflation and
Jakarta and National**
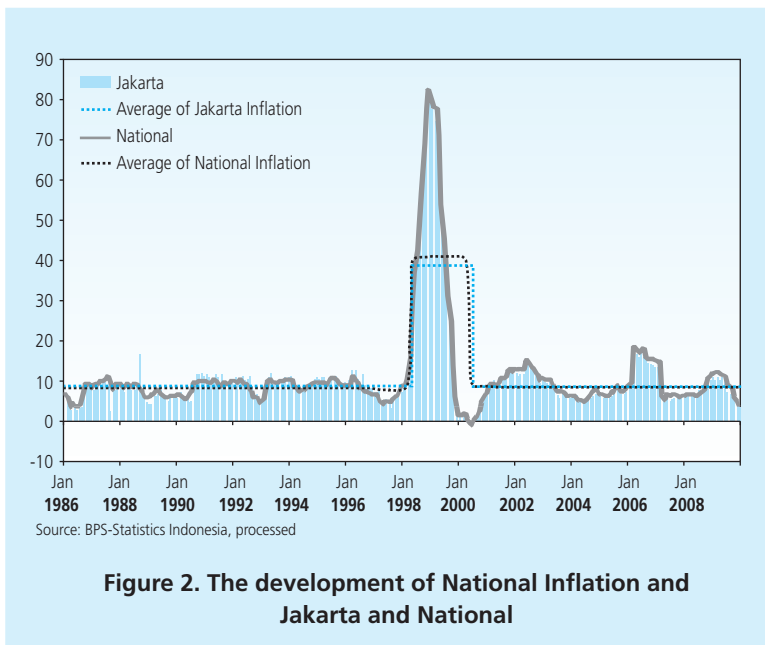
The high tendency in Jakarta can be still seen after applying the ITF in Indonesia. Formally, ITF began being applied inJuly 2005 by setting inflation target periodically and transparently. Figure 2 describes that the inflation realization either in Jakarta of National d not still sometimes reach the target applied. This thing describes of the lateness of proses of inflation decline in Indonesia.

The lowest rate of year by yearinflation until 2008 that could be reached was still above 5%. If it is compared with the inflation average of the country that adopts ITF, the inflation rate in Indonesia is still classified as high.

Figure 3.
Target and inflation Realization
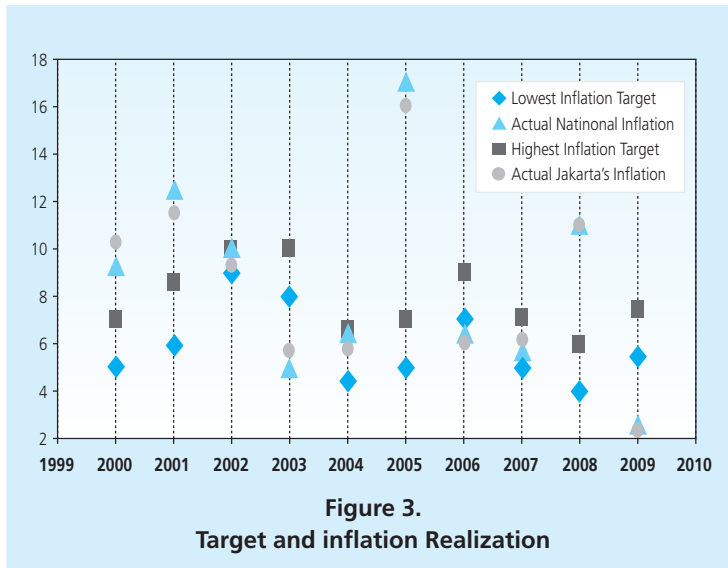
The development of Jakarta inflation also shows the almost same pattern with the other region in Indonesia. The inflation development of some big cities in Indonesia visually described in the Figure 4.

Source: BPS-Statistics Indonesia, processed

Figure 4.
Inflation of Some Big Cities in Indonesia
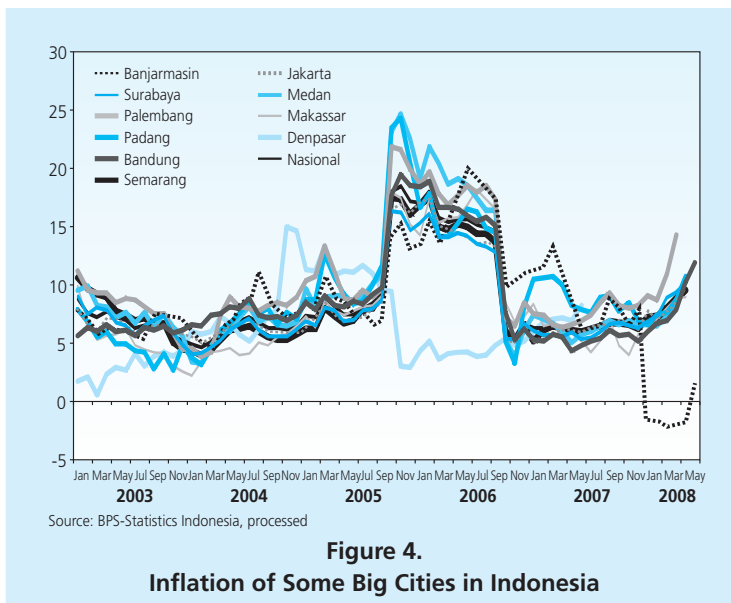
Descriptively, the comparison of Jakarta inflation behavior based on central tendency measurement such as mean,trimmed mean and median also data dispersion which is inflation standard deviation, are shown in Table 1.Fromthese measurements, the Jakarta inflation behavior is not far different with national inflation shown in the Table 2.

No	Group of Commodities	Full Sampel				Pre - ITF				Post - ITF			
		Mean	Trimmed mean	Median	SD	Mean	Trimmed mean	Median	SD	Mean	Trimmed mean	Median	SD
	General	8.48	8.44	7.13	3.75	7.89	7.98	7.05	3.29	9.59	9.51	7.65	4.32
	Group of Commodities												
1	Foodstuff	8.66	8.61	9.75	5.16	6.19	6.08	5.79	4.27	13.31	13.36	12.83	3.06
2	Food, beverages, cigarettes & tobacco	8.69	8.54	8.53	4.32	8.92	8.83	8.21	4.50	8.25	8.20	8.88	3.96
3	Housing	8.80	8.79	8.84	2.38	9.13	9.12	9.30	1.77	8.19	8.15	7.89	3.18
4	Clothing	6.58	6.51	6.63	2.86	5.96	5.89	6.18	2.80	7.74	7.71	7.81	2.63
5	Health	6.07	5.69	4.46	3.64	6.32	5.97	4.37	4.28	5.59	5.57	5.43	1.91
6	Education, recreation & sport	9.17	8.63	7.96	6.41	10.41	10.04	8.38	7.51	6.84	6.82	6.47	2.07
7	Transportation and Communication	11.23	10.26	9.44	10.22	10.38	10.17	10.28	5.58	12.83	12.38	1.41	15.60

**Table 1. Descriptive Statistic of Jakarta Commodity Group Inflation
Data period: January 2000-May 2008**

Source: BPS-Statistics Indonesia, processed

In the full sample observation period, the averages of inflation either in Jakarta or national are in the rate of 8%. And so is if it is spitted in the commodity group level, it is shown that the average is still close to the rate, the inflation average either generally of commodity group in the period of before and after ITF does not show significant difference. This thing shows that inflation in Indonesia is still showing the persistence tendency.Besides that, inflation volatility in

No	Group of Commodities	Full Sample				Pre - ITF				Post - ITF			
		Mean	Trimmed mean	Median	SD	Mean	Trimmed mean	Median	SD	Mean	Trimmed mean	Median	SD
	General	8.36	8.31	7.40	4.06	7.80	7.91	7.36	3.49	9.04	8.94	7.45	4.61
	Group of Commodities												
1	Foodstuff	8.34	8.64	8.61	6.58	4.80	5.02	6.25	5.78	12.67	12.71	12.38	4.65
2	Food. beverages. cigarettes & tobacco	8.98	8.94	8.79	3.29	8.76	8.68	8.79	3.86	9.25	9.19	8.78	2.44
3	Housing	8.94	8.98	8.66	5.12	9.89	9.91	9.83	2.96	7.78	7.72	6.61	6.76
4	Clothing	7.06	6.98	6.16	2.62	6.74	6.63	5.61	2.87	7.46	7.43	7.16	2.24
5	Health	6.10	5.94	5.76	2.01	6.57	6.44	6.21	2.40	5.52	5.51	5.35	1.19
6	Education. recreation & sport	8.88	8.91	8.71	2.74	10.33	10.41	10.27	2.32	7.11	7.12	7.99	2.09
7	Transportation and Communication	9.85	8.97	6.18	11.11	9.96	9.73	9.39	5.67	9.71	8.98	1.42	15.42

**Table 2. Descriptive Statistic of National Commodity Inflation Groups
Data period: January 2000-December 2009**

Source: BPS-Statistics Indonesia, processed

both of the periods is not changing significantly. The existence of the shock in the Transportation and Communication group which was triggered by the raise of natural gas in 2005 became one of the sources of the high of inflation standard deviation in the groups.

4.2 The Measurement of Jakarta Inflation Persistence Degree[2]

The commodity choice is determined based on the average of the biggest inflation contribution toward Jakarta CPI inflation within the last 5 year. From about 774 commodities (including commodity groups/sub groups) Jakarta IHK bracket former, was chosen 28 types of commodity that represented 66,35% from the average of Jakarta inflation in that period. Rice, Gasoline, city public transportation, house leasing, House rental, water/PAM fares and kerosene are the biggest commodities for its contribution compared with the other commodities. The amount of inflation contribution of each commodity is written in Table 3.

No	Commodity Jakarta	Contribution	No	Commodity Jakarta	Contribution
**Table 3.**
**The Contribution of the Chosen Jakarta Inflation Trigger**
	General/Total	**8.12**			
1	Rice	0.65	15	LPG	0.09
2	Broiler chicken	0.07	16	Kerosene	0.31
3	Meat	0.04	17	Water	0.33
4	Tempe	0.05	18	Electricity	0.21
5	Chilli	0.03	19	House keeper	0.11
6	Fried Oil	0.07	20	Gold	0.16
7	Fried Chicken	0.08	21	Health	0.03
8	Noodle	0.09	22	ElementarySchool	0.09
9	Sugar	0.07	23	Yunior High School	0.08
10	Cigarette	0.06	24	Senior High School	0.08
11	Filtered Cigarette	0.09	25	Higher education	0.12
12	House Contract	0.83	26	Transport between cities	0.07
13	House rental	0.23	27	Transport within cities	0.72
14	Non foreman worker	0.16	28	Gasoline	0.48

Source: BPS-Statistics Indonesia, processed

2　The time of ITF implementation in Indonesia was officialy started since July of 2005 (Bank Indonesia website: www.bi.go.id). In other research by Harmanta (2009), the period until June of 2005 was mentioned as the Lite-ITF and since July 2005 as Full-ITF.

No	Commodity	Persistence Degree of Jakarta's Inflation*		
		OLS	Bootstrap	Rolling Regression
	General	0.94	0.79	0.90
	Group of Commodity			
1	Foodstuff	0.98	0.84	0.86
2	Food, beverages, cigarettes & tobacco	0.92	0.83	0.92
3	Housing	0.84	0.61	0.80
4	Clothing	0.88	0.73	0.87
5	Health	0.93	0.87	0.89
6	Education, recreation & sport	0.90	0.73	0.77
7	Transportation and Communication	0.90	0.74	0.86
	Commodity			
1	Rice	0.94	0.88	0.93
2	Chicken	0.68	0.35	0.49
3	Meat	0.93	0.82	0.91
4	Tempe	0.61	0.86	0.81
5	Chilli	0.72	0.37	0.68
6	Fried Oil	0.94	0.78	0.85
7	Fried Chicken	0.80	0.67	0.65
8	Noodle	0.69	0.40	0.64
9	Sugar	0.90	0.78	0.88
10	Cigarette	0.78	0.87	0.83
11	Filtered Cigarette	0.61	0.72	0.84
12	House contract	0.90	0.73	0.86
13	House rental	0.92	0.80	0.85
14	Non foreman worker	0.84	0.51	0.70
15	LPG	0.78	0.50	0.93
16	Kerosene	0.76	0.78	0.89
17	Water	0.87	0.51	0.73
18	Electricity	0.82	n/a	n/a
19	House keeper	0.97	0.77	0.80
20	Gold	0.90	0.61	0.82
21	Health	0.80	0.69	0.73
22	Elementary School	0.73	0.59	0.80
23	Yunior High School	0.80	0.61	0.82
24	Senior High School	0.90	0.74	0.70
25	Higher education	0.88	0.90	0.89
26	Transport between cities	0.84	0.63	0.86
27	Transport within cities	0.88	0.55	0.67
28	Gasoline	0.74	0.78	0.86

Table 4. Inflation Persistence Degree of Jakarta Commodity Groups and Chosen Commodity (Before accommodating the structural break)
Observation period: January 2000 – May 2008
Observation total: 101

*) Optimum lag is based on SBIC, AIC and HGIC criteria

Source: BPS-Statistics Indonesia, processed

Beside the measurement of inflation persistence degree for major inflation contributor commoditiesin Jakarta, we also conduct the measurement of CPI inflation persistence rate based on to its disaggregation, which is broken into core inflation, volatile food inflation and administered price inflation.

The estimation result of inflation persistence degree in Jakarta across commodity group and commodityis provided in the Table 4. The inflation persistence degree is obtained by adding the entire AR coefficient according to the inflation optimum lag of each commodity, or commodity group. The determination of optimum lag is done by using the AIC/HQIC/SBIC criteria.The Jakarta inflation persistence degree measurement by using 3 different techniques that shows similar result, even though the OLS with rolling regression techniques shows closer estimation result than the OLS with bootstrap.

By using the full sample, the result of Jakarta persistence degree estimation generally shows that the Jakarta CPI inflation is still very persistent.This isin line with the national inflation persistence in the same observation period which also showsthe high persistent degree[3]. From 7 commodity groups, almost all of them show the high inflation persistence degree. Only housing/Estate group has lower inflation persistence rate than other group.

The estimation result also shows that the inflation persistence of Foodstuff, which is greatly influenced by the supply and the distribution shock, is still high. While, the commodity group with the biggest inflation persistence and consistent across the three approaches in the Table 4 are processed processed food - drinks - cigarettes and tobacco, and Health group. Across commodity level, Rice, Beef, Cooking Oil, Sugar, House contract and House rental are commodities with the highest inflation persistence among others.

The high of the inflation persistence degree is probably related to the shock that greatly influence the inflation in Indonesia. Therefore, it is necessary to conduct a test to see whether there is *structural break*in inflation data. *Quandt-Andrews test*is carried out on inflation series to see whether there is *structural break*along observation period.Based on the test, there is *structural break* in general inflation and in some commodities (House group, education group, recreation & sport, and Transportation and Communication group) and also commodity of (tempe, cigarette, cigarette filter, LPG/liquid gas, kerosene and SLTA), see Table 5.

After adjusting for the structural break on Jakarta inflation data, the inflation persistence degree shows a little different. Some commodities showa decrease of inflation persistence,

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3 As shown in the result of national inflation persistence degree measurement which is provided in Table 4.

however other commodity shows an increase. Therefore, we consider that for Jakarta, the existence of *structural break*does not cause over inflation persistence measurement.

No	Commodity	Jakarta Inflation Persistence Degree	
		without SB	with SB
1	General	0,94	0,93
2	Housing/Estate	0,84	0,83
3	Education, Recreation & Sport	0,90	0,87
4	Transportation and Communication	0,90	0,92
5	Tempe	0,61	0,92
6	Cigarette	0,78	0,86
7	Filtered cigarette	0,61	0,60
8	Liquid gas/LPG	0,78	0,86
9	Kerosene	0,76	0,96
10	Yunior high school	0,90	0,86

Table 5. The Inflation Persistence Degree of Commodity Groups and Chosen Commodity – With and Without Structural Break – Jakarta
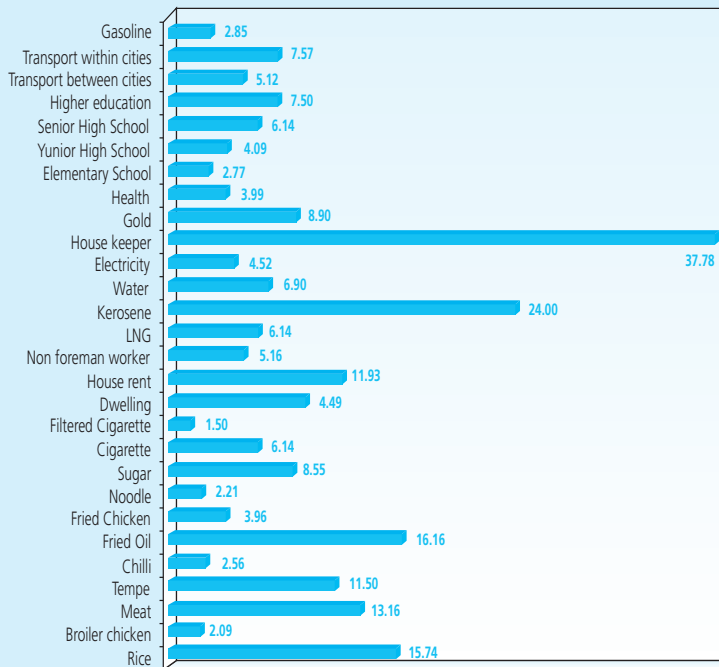
Source: BPS-Statistics Indonesia, processed

The high degree of inflation persistence in Jakarta is also reflected by the length of period for the inflation to absorb 50% *shock*, before return to its average value. By looking atthe OLS estimation result, the time that it takes by commodity groups reaches 5 until 13 months. The commodity with the highest inflation persistence degree is processed food group, Baverage and Tobacco and transport and communication group that need about 12 months before moving back to its average value. While the Healthy group needs around 13 months. These three groups are the commodity with the highest inflation persistence degree and are consistent across the 3 techniques of measurement used. Despite the OLS estimation described on the Figure 5 produces very high inflation persistence degree for Foodstuff groups; the result is not supported by 2 other techniques.

As seen from inflation commodity basket, the commodity with the highest persistence are Rice, Beef, Cooking Oil, Sugar, House contract and House rental. Meanwhile the commodity that shows the lowest persistence is mostly from Foodstuff such asbroiler chicken meat and Chili.Besides that, noodle that is included to the Foodstuff shows the lowest persistence rate compared with other chosen commodity. The time which is needed by commodity inflation to return to its average also supports the persistence degree measurement result (Figure 6).
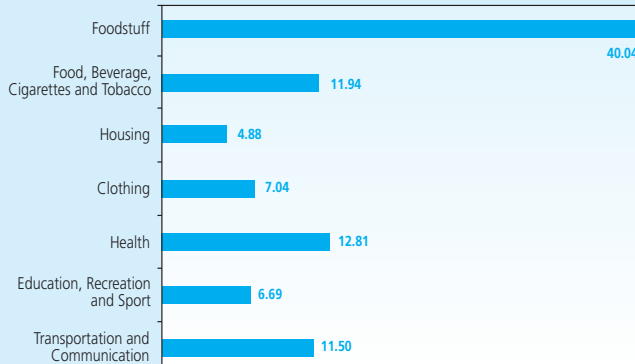
Source: BPS-Statistics Indonesia, processed

**Figure 5. The Time Needed by Commodity Group Inflation to
move back to the average value (Month) – Jakarta**
(After accommodating structural break)

Source: BPS-Statistics Indonesia, processed

**Figure 6. The Time Needed by Commodity Inflation
to move back to the average value (Month) – Jakarta**
(After accommodating structural break)

No	Commodities	Persistence Degree of Jakarta's Inflation*		
		OLS	Bootstrap	Rolling Regression
1	CPI Inflation	0.89	0.74	0.91
2	Core Inflation	0.88	0.69	0.89
3	Administered Prices Inflation	0.89	0.72	0.89
4	Volatile Food Inflation	0.92	0.81	0.86

Table 6. Inflation Persistence Degree Based on Inflation Disaggregation – Jakarta
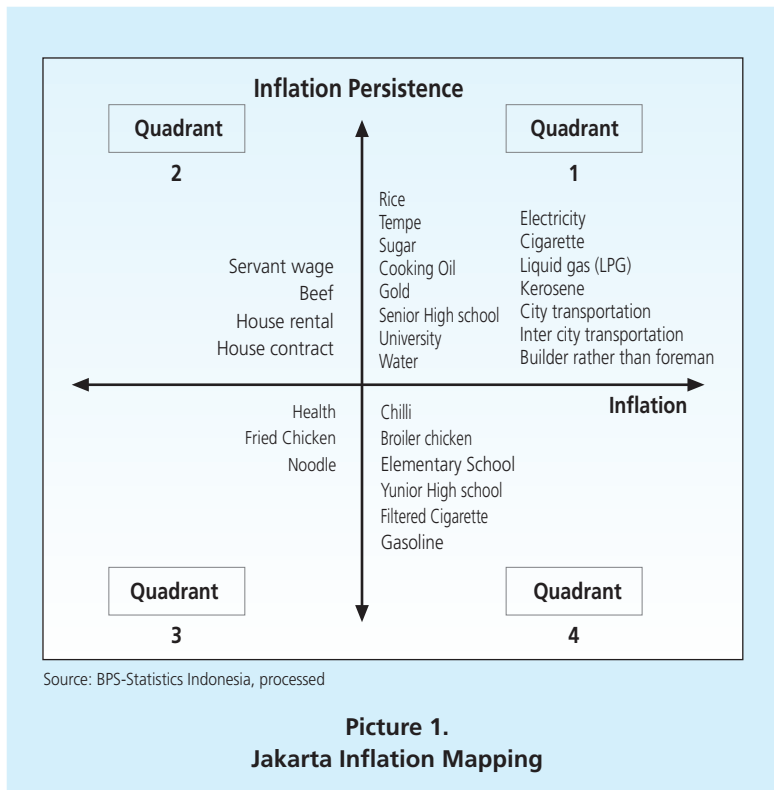Monthly inflation (y-o-y) in the period of Jan 2003 - Mar 2008

*) Optimum lag is based on SBIC, AIC and HGIC criteria
Source: BPS-Statistics Indonesia, processed

As seen based on the disaggregation, Jakarta inflation is broken into core inflation, administered price, and volatile food inflation. Table 6 writes the estimation result of Jakarta inflation persistence degree by using 3 techniques; those are OLS, *bootstrap* and *rolling regression*. The three inflations types are still very persistent in the observation period, as seen from inflation persistence degree that is still high (0.88 - 0.92), so that in order to return to its average will require between 7-12 months (Figure 7).

Source: BPS-Statistics Indonesia, processed

Figure 7.
The time to move back to the average (month)
– Jakarta Inflation
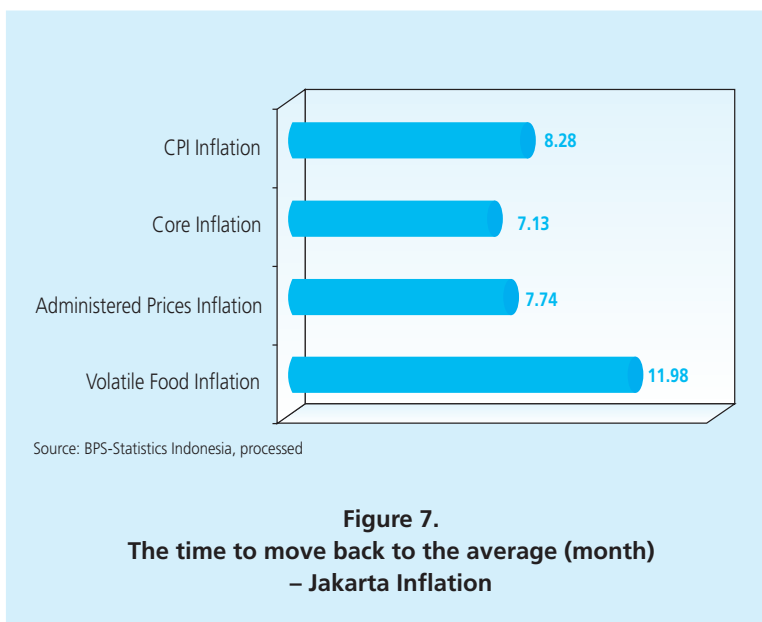
The mapping of the inflation persistence degree estimation across commodity is shown on the Picture 1.

Inflation Persistence

Quadrant 2	Quadrant 1

Rice
Tempe
Sugar
Cooking Oil
Gold
Senior High school
University
Water

Servant wage
Beef
House rental
House contract

Electricity
Cigarette
Liquid gas (LPG)
Kerosene
City transportation
Inter city transportation
Builder rather than foreman

Inflation

Health
Fried Chicken
Noodle

Chilli
Broiler chicken
Elementary School
Yunior High school
Filtered Cigarette
Gasoline

Quadrant 3	Quadrant 4

Source: BPS-Statistics Indonesia, processed

Picture 1.
Jakarta Inflation Mapping

Quadrant 1 is the commodity with high inflation persistence and high inflation rate, Quadrant 2 is the commodity with high inflation persistence and low inflation rate, Quadrant 3 is the commodity with low inflation persistence and low inflation rate, and Quadrant 4 is the commodity with low inflation persistence and high inflation rate. The classification to each Quadrant is based on the followings; high inflation category if inflation rate> 10% and high inflation persistence if > 0, 80. Based on the mapping, we will focus more on Quadrant 1. Nevertheless, some of the commodities in this quadrant constitutes administered price, meaning their price is influenced by the government policy, such as electricity fares, PAM/water fares, cigarette, LPG/liquid gas, kerosene, public transportation, intercity transportation. This implies the needs for better coordination between government and the central bank in order to control the regional inflation .

4.3 The Determinant of Jakarta Inflation Persistence

The other approach to see the determinant of inflation persistence is by using Hybrid New Keynesian Philips Curve model, following some previous research such as, Alamsyah (2008) and Mehrotra et al (2007).Using this method, the inflation persistence cause can be seen based on the *forward looking* and*backward looking inflation behavior*. Both of them are described from the Hybrid NKPCmodel that catchesinflation persistence characteristic as follows:

$$\pi_t = \kappa y_t + \beta E_t \pi_{t+1} + \mu \pi_{t-1} + \varepsilon_t$$

Table 7.
The Result of Hybrid NKPC Estimation

NKPC
2SLS Regression
Sample   : 2000Q1 - 2009Q4
Number of Observation   : 37
Dependent Variable   : Inflation

Variable Independent	Parameter Coeficient
L1.Inflation	0.46***
	(0.08)
F.Inflation	0.54***
	(0.08)
Outputgap	0.18
	0.22
Constant	0.07
	(0.25)

R-squared   0.79

Instrument Variables :
   L2.Inflation
   Growth of Oil Prices

Hybrid NKPC model estimation is conducted by using 2SLS (*Two Stages Least Squares*) technique, by adding a restriction on inflation parameter to be 1. The estimation result provided in Table 7 shows that Jakarta's inflation isdetermined by forward and backward *looking* expectation. This is shown by similar magnitude of both parameters, indicating equal influence of forward and backward looking expectation. Besides, the test using *Wald test* also shows that there is no significant difference between *forward* and *backward looking* coefficient of Jakarta inflation. The condition shows that the need of more intensive effort to change the inflation expectation behavior to forward *looking*.

Meanwhile, output gap data is obtained by using HP filter technique. The estimation showsthe output gap parameter is not significant to influence the inflation.In other word, the output gap influence toward inflation has not been concluded yet.

The high inflation causes negative impact toward the economy. The high inflation will give the uncertainty for economic agent in making decision beside influence the purchasing power of society especially those with constant expectation. The economy management will be more difficult if the inflation rate is persistent. By definition, the flow of inflation will take more time before return to the its initial rate prior the shock. In addition, the inflation will also require longer time to converge. These will amplify the effort needed to decrease the inflation rate. Since Jakarta has the biggest weight in forming national inflation, then the high inflation persistence in Jakarta implicates high effort to decrease national inflation.

Based on these assessment, the high inflation persistence degree in Jakarta is because of the *volatile food* and *administered price groups.* This imply the need of stronger coordination between the government and Bank Indonesia to control the inflation. While for the *administered price* group is higly depends on the government effort to arrange the timing and the magnitude of the price (and income) policy so that its impact toward inflation is minimum.

The high volatile food and *administered price inflation* will influence the influence expectation, hence complicates the regional inflation control. Good coordination through the existing coordination forums such as Bank Indonesia Governor council coordination meeting with the government, inflation target stipulation forum, also forward looking inflation controlling team, needs to be more optimized. Regarding to the Team for Monitoring and Controlling the Regional Inflation / *Tim Pemantauan dan Pengendalian Inflasi Daerah* (TPID), its target to cover all region in Indonesia (66 cities) needs to be monitored, considering its importance to reach low and stable national inflation.

Beside that the TPID role can be optimized if it involve inter-regional coordination, especially between the region with high economic linkage. In addition, TPID should realize its role to provide information system (*database*) in monitoring the biggest inflation contributor commodity, which is useful in determining price policy in regional level.

The effort to control inflation in region is subsequently can give positive impact toward faster inflation convergence across region, hence the regional inflation can be easier to controlled. The inflation control through monetary policy in national level, then is expected to be more effective. The issue of convergence and coordination across region especially Jakarta and other region should be interesting topic for next paper[4].

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4 Arimurti and Trisnanto, "Inter regional inflation convergence in Indonesia", forthcoming paper.

The inflation pressure sourced mainly from inflation expectation especially backward looking one implies a more intensive dissemination of information and central bank policy to direct the economic agent expectation to be forward looking, in order to achieve the low and stable inflation. These attempts are also related to the credibility of policy maker that needs to be strengthened and maintained.

5. SUMMARY

This research gives several important conclusions, *first*, the empirical test shows the CPI inflation in Jakarta is persistent. Similar result is shown in a more disaggregated group, where the administered price inflation, and volatile food inflation in Jakarta is classified to be very persistent .Comodity groups with highest degree of persistence are Processed Foods, Beverages and Tobaccos and Health. On commodity level, Rice, Beef, Cooking Oil, Sugar, and Dwelling. In Jakarta, the comodity group mostly need 5-12 months to return to its average prior the shock, while for the mostly commodity needs between 3-12 months. *Second*, in accordance with the hybrid NKPC model result, it is found that the Jakarta's inflation is a combination between forward and backward looking behavior, This is in line with the result of national inflation behavior (Alamsyah, 2008). *Third*, the cause of high inflation persistence degree in Jakarta are because of the high of inflation persistence degree of volatile food and administered price groups. This volatile food and administered price inflation affect the inflation expectation, hence will complicate the inter regional inflation control.

This findings has several policy implications; first,the needsto intensify the dissemination of information and policy in order to direct inflation expectation to be more on forward looking. Second, the need to optimizethe coordination between the government and the Central Bank through the existing coordination forums such as Bank Indonesia governor council coordination meeting with government, inflation target stipulation forum, and also inflation controlling team.

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