



Senior Research

Administered Prices and Inflation Targeting in Thailand

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Abstract

A consistently high proportion of government price control since 2002 is believed to be one major determinant of Thailand inflation process. Among countries that have directly targeted inflation, Thailand has the largest degree of price subsidies with 38% of its CPI basket. This paper aims to provide a comprehensive understanding on how administered price effects monetary policy in Thailand, which recently shifted the policy target toward headline inflation. Our empirical results suggest three major findings. First, the presence of price controls raises question about controllability of monetary policy. Sizable share of price control associated with headline inflation generate higher volatility and are not within direct control of monetary policy. Combining with lead and lag correlation between administered price and free-price sectors in headline inflation, the risk of breaking target rises whereas credibility could be worsen. Secondly, evidence reveals that transmission process of monetary policy in market-determined price sector takes longer time than in aggregate inflation. This implies that policy-makers should even be more forward looking. Lastly, explicit analysis, applying Taylor rule, verified that the central bank exhibits higher degree of response to deviation in free-prices sector than administered prices sector. Without coordination between the Ministry of Commerce and the Bank of Thailand, it is hard for policy maker to anticipate when and how control measures will be altered; hence make inflation forecast more difficult. For the most efficient economic resolution, our results do support the collaboration between two entities as they both share the same goal in stabilizing the price level of the economy.

1 Introduction

“During the decade of inflation targeting (2000-2010), Thailand has recorded an excellent performance in price stability. Not only has core inflation been within the band for almost the whole period, but it also compares favorably with other countries within the region. The Bank of Thailand has put in place an inflation-targeting framework which meets international Best Practice, with high levels of accountability, transparency and external communication.”

Stephen Grenville and Takatoshi Ito
Former deputy governor of the Reserve Bank of Australia
and economics professor at the University of Tokyo
October 2010

Maintaining price stability is always a key objective of Bank of Thailand in conducting monetary policy. After Thailand has adopted inflation targeting as its primary monetary framework in May 2000, inflation level has declined substantially as illustrated in Table 1. The five-year average inflation rate from 2000-2004 is around 1.7 percent compared with the average of 5.1 percent in 1995-1999 prior to inflation targeting periods.¹ The average inflation rate has decreased continuously to only 2.1 percent in the recent year, which is relatively lower than our ASEAN neighbors or other developing nations with average of more than 5 percent. It is one of many countries that have achieved a remarkable record of low inflation and have enjoyed a subtle economic environment over the past decade.

Table 1 Inflation around the World (in percentage)

	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014
World	31.16	9.03	4.23	4.38	4.20
Advanced economies	3.82	2.03	1.98	2.09	1.84
Developing economies	89.56	19.99	7.21	6.71	6.12
ASEAN	8.84	11.93	4.86	6.63	4.67
<i>Thailand</i>	<i>4.82</i>	<i>5.10</i>	<i>1.70</i>	<i>3.21</i>	<i>2.87</i>

Source: World Economic Outlook (2014)

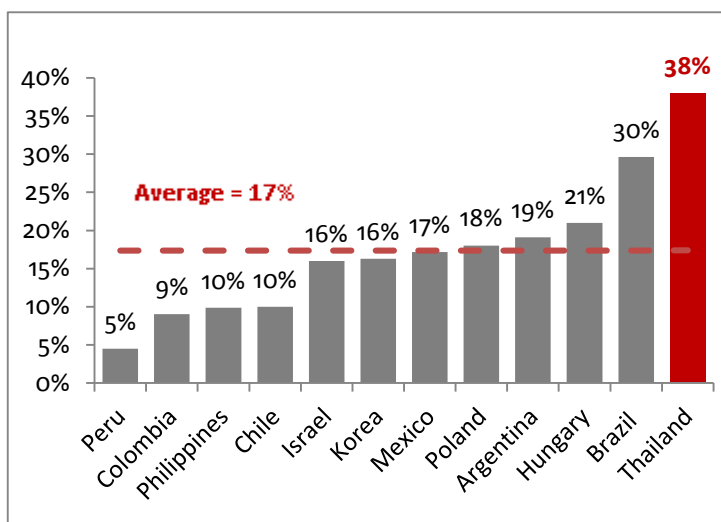
In the beginning of 2015, the central bank decided to shift from quarterly average of core inflation targeting to annual average of headline inflation targeting.² It stirred from a band target of 0.5-3% toward a point target at 2.5% with a tolerance band of $\pm 1.5\%$. As headline inflation is perceived to be a better indicator which accurately reflects the real market price level of an economy, the number becomes more attentive by the general public. Additionally, the core inflation has lost its ability to track underlying inflationary pressure as it has diverged out from headline inflation. (BOT, 2015) The change in framework is therefore believed to improve the ability to communicate with the public as well as to better anchor long-term inflation expectation. Based on IMF statistical data, around 34% of 188 central banks around the world have adopted inflation targeting as their

¹ Based on author computation by using World Economic Outlook data 2014

² On 6 January 2015, the BOT Cabinet approved annual average headline inflation of 2.5 ± 1.5 percent as the monetary policy target for 2015. It became effective after the publication in Royal Gazette.

monetary policy framework. Unfortunately, Thailand is known to be the last country using core inflation as a policy target since all other countries had already changed to headline inflation targeting framework.

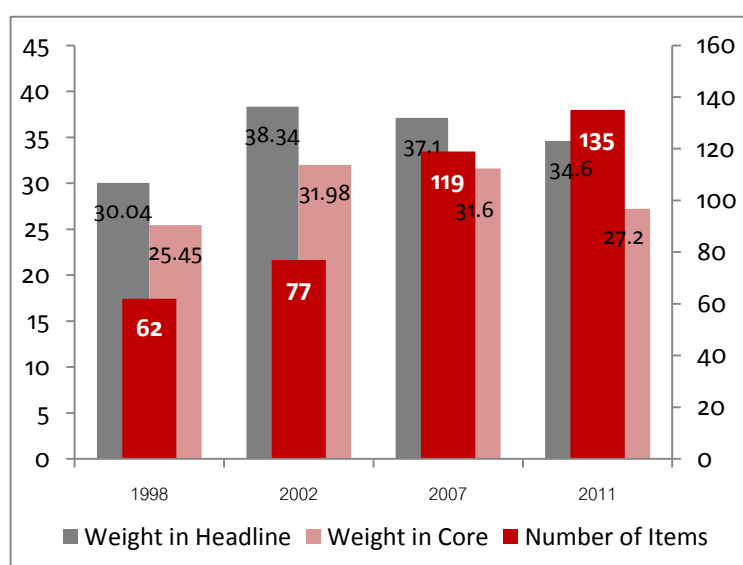
Figure 1: Share of Administered Prices in CPI Basket



Source: IFC (2009)

Although, Buddhari and Chensavardjai (2003) suggested that good macroeconomic management, suitable monetary policy, supportive economics environment have been the major factors nurturing the underlying price movement, large part of the success might be due to the effort of Ministry of Commerce in controlling prices.

Figure 2: Development of Administered Prices in Thailand



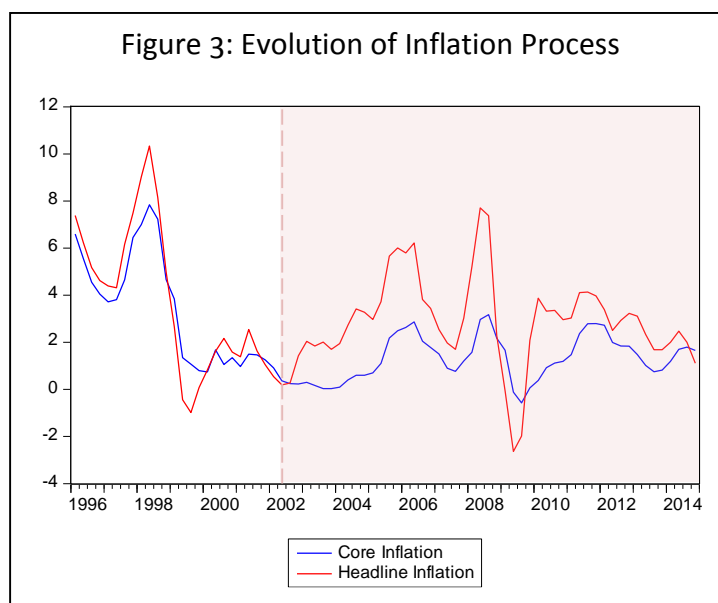
Source: BOT, 2014

As depicted in Figure 1, among 27 economies that have directly targeted inflation³, Thailand is currently ranked the top with highest proportion of price controls. Even though Brazil, where a lot of researches and studies on administered price controls have been made, has a considerably high level of government price subsidies, its relative share of administered prices sector is still substantially lower than Thailand. It seems that the normal appearance of price controls have become very important for inflation

targeting countries as the average proportion of administered items in CPI basket is approximately 17%. With a closer look on Thailand administered prices development, Figure 2 shows that the share of administered prices in the Thai CPI basket has been consistently high with over 30% since 1998 until the present time. Currently, 135 regulated items accounted for 34.6% of the headline basket and 27.2% of core basket.

³ According to "State of the Art of Inflation Targeting" studies by Bank of England (2012).

Ministry of Commerce (MPC) as well as other government entities implements subsidy program and price control as an active tool in maintaining the people cost of living. When there is a negative supply-side shock, producers would likely raise the price in response. But the converse is different. As shock disappears, producers do not lower back their prices. Such an event limiting prices fluctuation may provide a short term relief. Thus, price controls make sense in coping with temporary shock and is proved to be beneficial in the short run when monetary policy cannot accommodate. Yet, as controls are altered, the surprising shock would drive up inflation greatly. For example, after the oil price subsidy was lifted in 2008, inflation sprung up dramatically as seen in Figure 3. Under the circumstance, with the



evolution in administered prices, monetary policy maker encounters with one of the most challenging issues on its ability to control price volatility and attains its inflation target. This uncontrollable factor underlying the behavior of the price indicator must be well understood as it is relevant for monetary policy making.

The introduction of an administered price could potentially leads to a limitation on the effectiveness of monetary policy and likely becomes major challenge on central bank inflation controllability. While experiencing a fairly low inflation, a close inspection of the inflation pattern appears to show larger variations. (see Figure4) Additionally, core inflation and headline inflation started to diverge out from each other since 2002 and these particularly generated skepticism about the effects from price controls implementation. (Mallikamas, 2005) Accordingly, understanding the impact of price control is crucial for monetary policy designing. Central bank should utilize all information in order to make the most optimal policy response.

The aim of this research paper is to analyze the impact of administered prices on monetary policy under inflation targeting framework and hope to provide useful implications for monetary policy operation. The study attempts to investigate and examine the inflation dynamics, monetary policy response, and transmission mechanism under Thai economy context, where there is high proportion of government price controls.

2 Literature Reviews

Price control is usually seen as an instrument in preserving the cost of living. The aim of the government in controlling the prices of goods and services is basically to optimize the social welfare, in order to protect the domestic consumers' purchasing power from the exogenous price volatility. In the short run, costs of production are subjected to controls and are apparently stable. Hence, overall price level remains subtle. In addition, with prices constraints, the demand within the country remains unaffected by exogenous shocks. This perhaps results in a declining trend of inflation worldwide after the 1990s.

Nevertheless, the international experience has shown that this government intervention do not offer long term relief from inflation and do inflict costs on the economy by distorting the pricing system. (Daniel, 1975) In other word, this policy turns out to obstruct monetary policy operation. After certain period of time, if a control is lifted combined with a large variability from external factors, the prices are expected to sharply rise. In consequence, overall price level or inflation level would predictably ascend. To prevent the rapid rise in price level, central bank has to design a monetary policy responding this price adjustment.

The empirical results of Masson et al. (1998) and Debelle (2001) show that price controls in emerging economies, account for large part of the market basket of goods used to calculate consumer price index, have substantial impact on inflation volatility in the short term. The researches emphasized that proper inflation forecast should include the effect of price controls into the calculation and central banks should be cautious in handling the rapid rise in price of goods that are exempted from controls. Furthermore, the paper of Safouane and Rebei (2012), found that sizable controls in majority of the countries have exceeded their optimal thresholds share of subsidized goods for most favorable inflation targeting policy that they have calculated.⁴ The paper proposed policy recommendations to reduce the extent of government intervention as they find welfare losses in responding to large market distortions.

Much of the empirical literature related to the field of administered prices and monetary policy are founded in Brazil, one of the countries with highest degree of prices controls. In one of the studies by Freitas (2005), the author created a simulation model, a small open economy dynamic New-Keynesian general equilibrium model, including sector of free-goods and administered-goods to evaluate the impact on the performance of the Brazilian monetary policy. The results suggest that the rigidity of the administered pricing is important to explain the movement of unregulated-goods prices or what we called free prices. Majority of the controlled goods and services are commodity products necessary for consumption as well as are typical production factors. Therefore, administered prices put pressure on overall market, leading to a corresponding price adjustment in the free prices sector. As a result, conducting monetary policy can be more complicated. More importantly, the research supports the use of headline inflation as the target, as the welfare loss associated presents to be statistically low.

⁴For model derivation details refer to Safouane and Rebei (2012)

Even though, it is certain that understanding the impact of price controls is very important, very little researches on this area are rarely founded in Thailand. In reviewing existing inflation targeting literatures, low level of inflation in Thailand is partly attributable to administered price. Inflation has been falling from 5-8% prior to year 2000 to less than 1 percent in the recent year. In Buddhari and Chensavardjai(2003) literature described three main reasons which favor the miraculous inflation performance in Thailand: the appreciation of baht, changing pattern in housing market with falling rental cost, and finally the increase of administered price measures. In the similar way, Mallikamas (2005) highlighted that although Central Bank has managed to achieve price stability over the period; price controls of goods and services do have substantial impact to the inflation level of Thailand and thus, the inflation targeting regime.

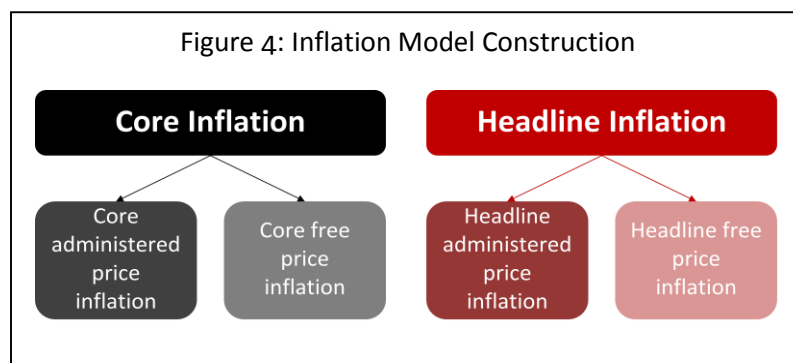
While there is a steady decline in price, larger volatility in the inflation dynamics can be seen clearly in addition to the divergence of core and headline inflation which raised concern to central bank of the consequential risks. The research of Mallikamas (2005) of the Bank of Thailand suggests that administered prices policy of the government was one of the major factors that affects the inflation adjustment mechanism as reflected in a divergence pattern of the core inflation and headline inflation since the year 2002. This can be clearly seen in Figure 3. Correspondingly, the analyses of Chantanahom et al. (2004), which explored the causation of the divergence between headline CPI and PPI, also proved that the rise in proportion of controlled goods in the baskets of consumer price index has preserved the prices volatility of wide range of commodity products leading to the divergence between the two indices. It is seen that most papers have similarly proposed convincing implications that administered prices have significant impact on inflation level.

Considering the impact of administered price on inflation and monetary policy operation therefore become an interesting issue. As can inferred from the information above, previous work has been primarily illustrated the importance of price controls on inflation level, but details on how price controls effect inflation targeting framework are limited. One of the literatures by Sriumpolchan (2006), concluded that government price controls do not affect long run comprehensiveness. While it may improve clarity of price signal in tracking underlying inflation, administered prices increase the variation of inflation and hamper monetary policy process. However, this research was done after Thailand has adopted inflation targeting for only 4 years and it was silent about the concerns of shifting from core inflation targeting toward headline inflation targeting in the recent year.

In the present paper, we try to understand how does the government price control complements or distorts the inflation targeting regime by examining (i) inflation dynamics including; (ii) monetary policy response, (iii) monetary transmission mechanism. In understanding inflation process development and trends, method used in Buddhari and Chensavardjai(2003) and Chantanahom et. al.(2004) are revisited. The research extends further study following the lead of previous literatures specifically on the impact of administered prices and inflation.

3 Data

For this study, we mainly use the existing time-series data of the macroeconomic indicators and pricing data of the goods and services. The research captured the dataset for 21 years horizon since the beginning of 1994 until 2014, which covers the period before and



after inflation targeting has been fully adopted in Thailand. This should shed light on the role of administered prices in explaining inflation dynamics more explicitly. These sets of data are upon request from the Bureau of Trade and Economic Indices, Ministry of

Commerce database, Bank of Thailand, World Economic Outlook, IMF and past research papers are also useful sources of information. The necessary variables include headline inflation, core inflation, free price inflation, administered price inflation, oil price, and 1-day repurchase rate. Based on BoT processed data series, we then constructed disaggregate model of administered prices index and market-determined index for our analysis (Figure 4), in which the calculation method is further demonstrated in section 3.1.

3.1 Consumer Price Index Construction

Consumer Price Index is regarded as the major price indicator that can be easily understood and has become the best available measure of the consumers' cost of living. In order to fully understand the evolution of inflation, it is important to be aware of the measurement of Thai CPI and its nature. CPI is typically constructed by summing the products of the weighted average and price of items in basket of goods and services, which then later used for inflation computation. Weight of goods and services reflects the relative importance of each item in household consumption in base period. (IFC, 2006) In which, these weights are based on consumer expenditure surveys conducted every four years by the National Statistical Office of Thailand (NSO). This in other word means that items and weighted are reviewed every four years term. Examples of base year are 2002, 2007, 2011 and 2015.

Collecting data by surveying is done separately in five different regions including Bangkok metropolitan, Central, Northeastern, Southern, and Northern areas. According to the NSO, sample households that qualify for survey must meet certain criteria: (1) residing in one of these five regions, (2) having 2-6 family members, (3) earning income between 6,000 to 43,000 baht per month and (4) receiving benefits and subsidies of no more than 30 percent of total income. (Buddhari, 2003) After obtaining every regional CPI indices, MOC then takes the weight average of all areas based on population to construct the national CPI number for example Bangkok metropolitan received the highest weight due to its largest

population.⁵ Currently, CPI basket comprises of 450 items of goods and services. The changes in prices are monthly tracked by the Bureau of Trade and Economic Indices (BTEI). This CPI is regularly reported and publicized which enhances its transparency and usefulness for monetary purpose. BTEI adopted the Laspeyres formula, as a procedure in constructing the CPI index according to the international standard.

$$I_t = \left[\frac{\sum \frac{P_t}{P_{t-1}} \times P_{t-1} \times Q_0}{\sum P_{t-1} \times Q_0} \right] \times I_{t-1}$$

$$\pi_{i,t} = \left[\frac{I_{i,t} - I_{i,t-1}}{I_{i,t-1}} \right] \times 100$$

I_t : CPI Index at time t

I_{t-1} : CPI index at time $t-1$

P_t : Price level at time t

P_{t-1} : Price level at time $t-1$

Q_0 : Weighted average in base year

$\pi_{i,t}$: Inflation rate in month i year t

Measurement Bias and Limitations

CPI may be the best representative index reflecting the overall price level; nevertheless, it contains some errors and has certain limitations for usage. First of all, new products are not taken into account and therefore the index cannot fully reflect these additional values. Secondly, the relative weight of goods and services is fixed in each period, but in reality, quality of product may often change. Thirdly, due to substitution bias, people may shift from expensive good to cheaper one or switch to discount outlet. As a result, prices cannot be accurately measured. As indicated by MOC authority, tracking prices is also one of the difficulties for CPI construction and several assumptions are applied often time. As mentioned earlier, consumer expenditures survey is conducted for household with income between 6,000 to 43,000 baht, this implies that CPI does not fully capture the whole population range and may not reflect the real cost of living especially for those on the very top and very bottom percentile of the country.

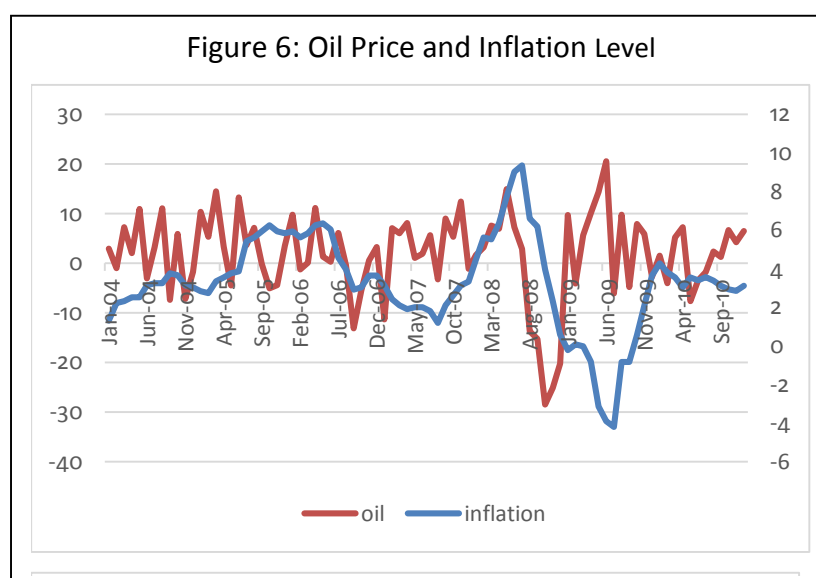
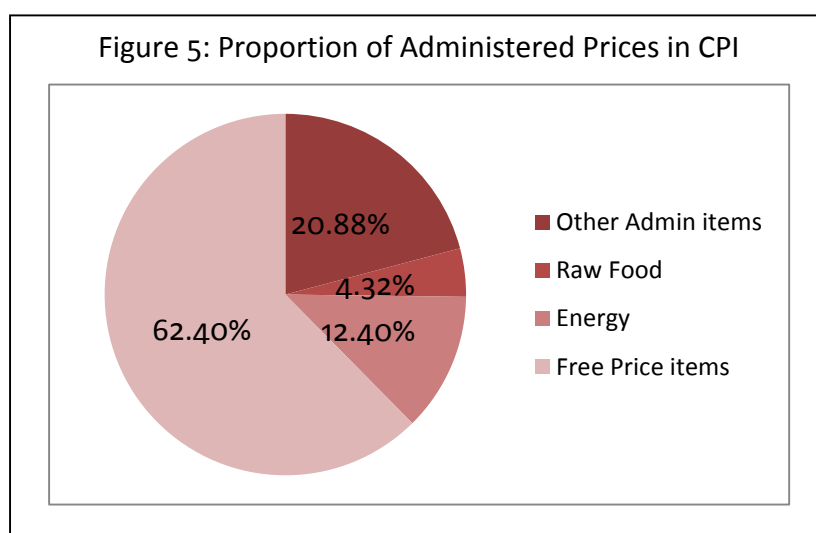
Sectors (% Weights in CPI)	2002	2007	2011
1 Food and Beverages	36.06	33.01	33.48
2 Clothing and footwear	3.40	2.96	3.06
3 Housing	23.86	23.47	24.14
4 Personal and medical care	6.03	6.87	6.54
5 Transportation and communication	21.98	26.80	25.54
6 Recreation and education	5.82	5.21	6.03
7 Tobacco and alcoholic beverages	2.82	1.66	1.20

⁵ The process of BTEI operation written in this paper was gathered from informational interview with the director of the entity.

Although weight of goods and services is reviewed once every four years, CPI basket compositions have remain in the same shape with partial changes between periods. The number of items continuously increased from only 232 items in 1962 up to 450 items today. Based on Table 2, food and beverage sector has always had the highest weight proportion following by transportation and communication sector. The choice of products and spending patterns adjusted the most in IT sector as technology is advancing at a very face pace. For example, floppy disk was included in 1997 basket, but no longer existed in 2002 module.

3.2 Administered Prices Operation

In 2011 base year, there are 143 administered price items accounted for around 35% of the basket.⁶ Approximately 15.6% is controlled by DTF, Ministry of Commerce and 19.3% from other government entities. Regulated prices are highly influenced by public policies



which are not driven by market mechanism. Share of administered items is significantly large and appear in various sectors. Exclusively, most of these items are concentrated in transportation and communication sector for example, oil, gas, public transportation. Referring to Figure 5, within administered price items, 12.40% are in energy, 4.32% in raw food, and the rest 20.88% in diverse sectors. While the controls are rigid and generally consistent over the time, observations reveal that oil and fuel prices induce inflation fluctuation significantly. An explicit example shown in Figure 6 is the period of oil crisis around 2008. After the oil subsidy program was altered, surprising price shock brought up the

⁶Thanks to the BOT research department for the processed data.

whole CPI index noticeably.

Measures of controlling and monitoring prices of goods and services by the Department of Internal Trade, Ministry of Commerce

Prices of goods and services act, B.E. 2542 (1999)

The cabinet authorized Central Commission on Prices of Goods and Services⁷the power to investigate, revise, and specify the list of administered goods and services. The controlling period shall not exceed a period of one year, unless new announcement has been made. The commission shall have the power to prescribe the purchase price or the selling price of administered goods and services as well as to regulate standard measures and conditions of production, distribution process, supply storing and other characteristics of the controlled goods and services in order to prevent speculation hoarding. Producers are prohibited to stop or refuse to perform normal services without reasonable grounds. Any person who refuses to comply with the rule shall be liable to punishments.

Department of Internal Trade, Ministry of Commerce direct and monitor consumption goods on standard, price, size, volume, as well as quality in order to optimize the social welfare and ensure fairness for consumers. Upon the Prices of goods and services act, B.E.2542, goods and services monitoring is divided into 3 following cases:

1. In a normal circumstance, when major costs of production are fairly low meaning the aggregate increase does not exceed 5 percent, and supply of goods sufficiently meet the growing demand, Ministry of Commerce shall have powers and duties as follows:
 - Carry out study, analysis, and research with respect to goods or services, prices and business operations to make sure they comply with true costs of production, to ensure supply is suffice with demand and is adequately distributed to all consumers.
 - Monitor movements in the prices and business operation, to prevent from unfair conditions or trade practices, including inspection of producers at the sources of production, fresh-food markets, and other distributing areas to assure they follow the rule strictly or would be penalized. The commission shall have the right of enforcement according to section 29 and section 30 of the Prices of goods and services act, B.E.2542.
 - Regulate selling prices by asking for producers' cooperation to notify any price adjustment and the reason before it is put on the market.
 - Maintain empowerment of administered goods and services, preserving the 18 items as prescribed in the Prices of goods and services act, B.E.2542 as well as strictly direct control on administered price items as described in section 25 and section 26.
2. In an unusual circumstance, when major costs of production increase at a rate of 5-20 percent, and supply of goods is adequately provided in the market, Ministry of Commerce shall have powers and duties as follows:

⁷Consisting of the Minister of Commerce as Chairman, Permanent Secretary for Commerce and Secretary-General of the Central Commission on Prices of Goods and Services as Vice Chairman, and not less than four but not more than eight qualified persons appointed by the Council of Ministers 3 at least one-half of whom should be appointed from qualified persons in the private sector as members

- Prescribe additional list of administered goods and services as necessary regarding the economic environment as well as the situation of each individual goods. Exercise measures such as determining selling price, determine the maximum rate of profit per unit or determine the proportional difference between the purchase price and sale price of controlled goods or services in each trading period in order to minimize consumer risk of burden high price variation.
 - Direct a business operator to improve the efficiency of production, purchase, distribution as well as other production factors.
 - Prevent the stockpiling of goods under section 25. Additionally, require producers, distributors to declare quantity, storing area, production and operation plan; or prescribe the amount of storing reserve of goods.
 - Link a retailer directly to a producer in order to reduce cost of production as well as consumers can purchase at a cheaper price.
3. In a critical circumstance, when costs of production increase over 20 percent, and a shortage of goods occur, Ministry of Commerce shall have powers and duties as follows:
- Prescribe additional list of administered goods and services that are necessary consumption goods and essential production factors.
 - Strictly regulate selling price by determining appropriate price or prohibiting operator from selling above the setting price.
 - Control usage, distribution or transformation of goods as well as manage transportation system to ensure fair allocation and distribution of goods and services.
 - Arrange for the rationing of purchase and distribution of goods including prescribing rules and procedures for such rationing.
 - Procure necessary consumption goods, manage distribution system to meet people demand in order to live their lives.

Department of Internal Trade, Ministry of Commerce has classified the importance of goods and services into 3 main categories as followings:

<p><u>1. Sensitive List</u></p>	<p>Goods or services that are highly volatile. The commission closely tracks the price movement and condition of these items both domestically and internationally on day to day basis. Moreover, authorities are sent out to examine the market price in Bangkok Metropolitan area. In a critical case, commission shall prescribe additional measures as follows:</p> <ul style="list-style-type: none"> i. Prescribe additional administered price of goods and services ii. Determine the purchase prices or distribution prices iii. Arrange of the rationing of purchase of goods and services iv. Supply and distribute goods necessary for living and ensure it is suffice with the demand.
<p><u>2. Priority Watch List</u></p>	<p>This category is inferior to the one above as goods and services in this group are followed up twice a week with a close inspection on their prices. In a critical case, commission shall prescribe additional measures as follows:</p> <ul style="list-style-type: none"> i. Links distributors directly to producers

	<ul style="list-style-type: none"> ii. Direct a business operator to improve the efficiency of production, purchase, distribution as well as other production factors iii. Prescribe measures to prevent the stockpiling
<u>3. Watch List</u>	<p>A least sensitive set of items, which the prices are highly stable. In a normal situation, commission shall prescribe measures as follows:</p> <ul style="list-style-type: none"> i. Monitor price of goods and services every two weeks as well as inspect for any act of unfair trade practices ii. Open a 24-hour Hotline 1569 to receive consumer complaints of unfair conditions

4 Research Methodology

To assess the impact of price subsidies on inflation targeting regime, multiple models are applied. In order to capture the effects of administered prices, we reasonably use quarterly data of CPI index with decompositions of each core and headline inflation into administered price inflation and free price inflation. Based on MOC data of CPI index from year 1994-2015, we break the model construction into administered prices index and free prices index. Administered prices index only includes subsidized items for example sugar, oil, student uniform, etc. In the similar way, free prices index was created from index of market-determined items. Our variables comprise headline inflation (h_{inf}), headline administered prices inflation (h_{adinf}), headline free prices inflation (h_{finf}), core inflation (c_{inf}), core administered prices inflation (c_{adinf}), core free prices inflation (c_{finf}). With these components, tests and models can be estimated more resiliently. The disaggregate indices would allow us to clearly distinguish the effects between variables and perform econometric analyses. Our analyses are divided into 3 main sections: (i) inflation dynamics, (ii) monetary policy response, and (iii) monetary transmission mechanism.

4.1 Inflation Dynamics

In order to understand the evolving process of inflation in Thailand as well as its nature, we perform 5 types of investigation:

a. Disaggregate sectors regression

The regression analysis of disaggregate sector of CPI basket on overall inflation allow us to trace the importance of inflation determinants over time and to see which category of goods and services is the most dominant indicator. Also, this explores the degree of influential power each individual component has in prescribing inflation level. In other word, it reveals the impact each component has on inflation as described in the equation below:

$$\log(\text{Headline}) = -0.074 + \gamma_1 \text{Cloth_Footwear} + \gamma_2 \text{Food_Bev} + \gamma_3 \text{Housing} + \gamma_4 \text{Personal_Medical} + \gamma_5 \text{Recrea_Educ} + \gamma_6 \text{Tobac_Alch} + \gamma_7 \text{Trans_Comm} + \gamma_8 \text{Others} + \varepsilon_t$$

b. Correlation Coefficient

The parameter represents the co-movement of variables in the short run as well as specifies how strong the relationships between variables are. A coefficient that is close to 1 can be interpreted as a very tight relationship of between two variables.

In this specific case, the associations between different variables can be perceived through the estimation of correlation. The formula of correlation coefficient is

$$r = \frac{cov(x, y)}{\sqrt{s_x^2 \times s_y^2}}$$

Where $cov(x, y)$ is a covariance of x and y defined as

$$cov(x, y) = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{n-1}$$

s_x^2 and s_y^2 denote sample variances of x and y measuring variability around its mean value,

$$s_x^2 = \frac{\sum(x_i - \bar{x})^2}{n-1} \quad \text{and} \quad s_y^2 = \frac{\sum(y_i - \bar{y})^2}{n-1}$$

c. Cross Correlation (Lead and Lag effect)

We next investigate the lead and lag correlations between variables. Cross correlation is one statistical measurement that determines the timing movement between any two series as a function of the lag of one another⁸ or in other word; it measures similarity between two series of data at two different time-lag position. By observing correlogram, we will be able to clearly seen when do variables have the maximum correlation. For instance, when does administered price inflation has the strongest correlation with the headline inflation. This can point out the signal of administered price pattern on the overall price. Thus the highest coefficient is associated to the period with the highest correlation.

d. Johansen Co-Integration Test

To identify the long-term nature of connection of two time-series, we applied Johansen Co-Integration Test. Correlation coefficient may be able specify the short run relationship between two variables; however, it cannot adequately indicate any long run association. Co-integrating relationship describe the long-run equilibrium relationship of the co-integrated pairs. Although each path individually can be unpredictable, two variables could possibly move in the same direction overtime. Consistently, given the location of one series, we can fairly estimate position of another as well as the distance between them.

e. Persistency of Inflation

Reviewing existing literatures, general findings from Batani (2002), Levin and Piger (2004), and O'Reilly and Whelan (2005) all suggest that inflation in many countries tends to be highly persistent. In contrast, research by Chantanahom et al. (2004) which employed similar AR(1) and AR(12) analyses for Thailand case with data from 1995 to 2004, concluded that degree of inflation persistence in Thailand was fairly low. Persistence parameter was found to be less than 0.5 for headline inflation.⁹

We adopt the similar autoregressive model AR(1) as in Khemangkorn (2008) as our measures of inflation persistence. Autoregressive help us to be aware of how persistent or

⁸ Method of calculation is similar to equation 3, as correlation coefficient model.

⁹ Estimation method by Chantanahom et. al (2004) integrate break point in their model.

how sticky inflation is. Persistency intuitively means that once hit by a shock, how adaptive inflation would be. The regression model provides evidence of degree of inflation persistence as well as reveals how inflation expectation play role in explaining inflation dynamics. High persistency does not favor monetary policy because this means inflation is not likely to response to shock instantly. This quantitative analysis therefore offers important implications for monetary policy in shaping price setting behavior.

The model for AR(1):

$$\pi_t = \mu + \rho\pi_{t-1} + \varepsilon_t$$

where μ is the constant term, π_t is the quarter-on-quarter inflation rate at time t, π_{t-1} is the quarter-on-quarter inflation rate of the previous period, and ε_t is an exogenous shock or external noise.

4.2. Monetary Policy Response

a. Taylor Rule

Following the literature of Freitas (2005), we adopt the Taylor-type equation of this form:

$$i_t = \alpha_1 i_{t-1} + \alpha_2 (\pi^{admin} - \pi^*) + \alpha_3 (\pi^{free} - \pi^*) + \varepsilon_t$$

i_t : policy rate (1day repo rate)

i_{t-1} : 1 period lag of policy rate

π^{admin} : administered price inflation

π^{free} : free price inflation

π^* : target rate (core = 1.75%, headline = 3%)

ε_t : error term

In this section, we try to investigate how much Bank of Thailand adjusts its interest rate when inflation component deviates from its target and to justify how appropriate it is. The Taylor equation demonstrates central bank choice for optimal policy in responding to changes. We then modified normal Taylor model to incorporate the response on administered price. This implies how policy maker reacts to the deviation of administered price as well as free price sector.

4.3 Monetary Transmission Mechanism

In understanding the transmission mechanism of monetary policy, we develop a Vector Autoregressive model (VAR). Considering the equation below, the model describes progress of a set of k endogenous variables including GDP, inflation, and policy rate over the period t, \dots, T as linear function of their past value. In our model, y_{t-1} denotes 1-period lag of y_t , A_i is $k \times k$ matrix, c is a constant term, and e_t is a vector of error term. Extending from normal autoregressive model, VAR captures the linear interdependencies among multiple time series variables with more than one evolving variable. The estimated also report the response of one variable to exogenous impulses. Applying this model, we would be able to observe how long it takes for monetary policy to become fully effective.

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t$$

5 Empirical Results

5.1 Inflation Dynamics

The inflation development in Thailand was largely driven by price subsidies. To protect people from higher cost of living and avoid the rises in domestic inflation, government entities have implemented certain aid program in keeping price artificially low. We then proceed to look at the impact of administered price on the recent development in different aspects.

We first provide an analysis of descriptive statistics. The declining fluctuation in inflation movement since 2000 has been the result of the adoption of Thailand primary monetary framework toward inflation targeting. Although central bank has successfully managed to achieve price stability over the past decade, controlling core inflation within a range of 0.5-3%, price control of goods and services seems to have substantial impact to the overall volatility of inflation. This direct government intervention can be clearly seen after the year 2002 when there was a large increase in administered price items. (Figure 7) Core and headline inflations diverge out from each other significantly. Moreover, the spikes in price level are mostly related to administered inflation.

Table 3 Descriptive Statistics

Sample: 1996Q1 2014Q4

	Core Inflation	Core Admin Inflation	Core Free Inflation	Headline Inflation	Headline Admin Inflation	Headline Free Inflation
Mean	1.976	1.829	2.012	3.129	3.140	3.081
Median	1.477	1.166	1.284	2.828	2.634	2.448
Maximum	7.840	8.152	8.152	10.335	12.235	10.513
Minimum	-0.570	-5.223	-0.183	-2.638	-12.968	-0.974
Std. Dev.	1.839	2.480	2.010	2.425	4.227	2.292
Skewness	1.465	0.113	1.314	0.540	-1.026	0.975
Kurtosis	4.718	4.210	3.941	3.599	6.173	3.984
Jarque-Bera Probability	36.561	4.805	24.689	4.836	45.246	15.119
	0.000	0.090	0.000	0.089	0.000	0.000

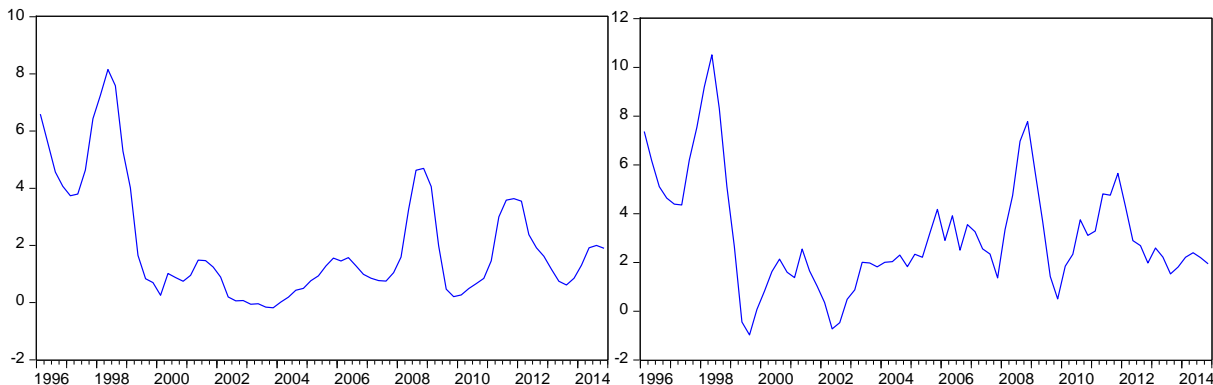
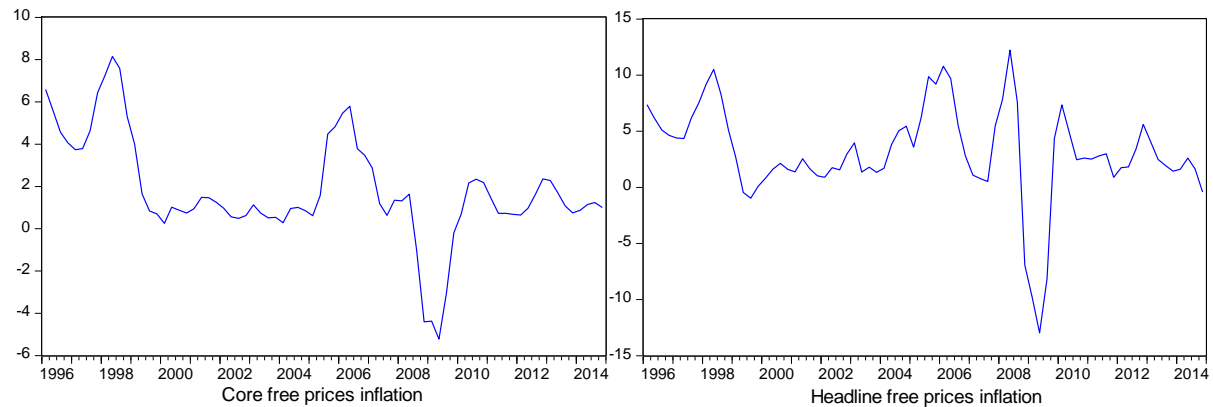
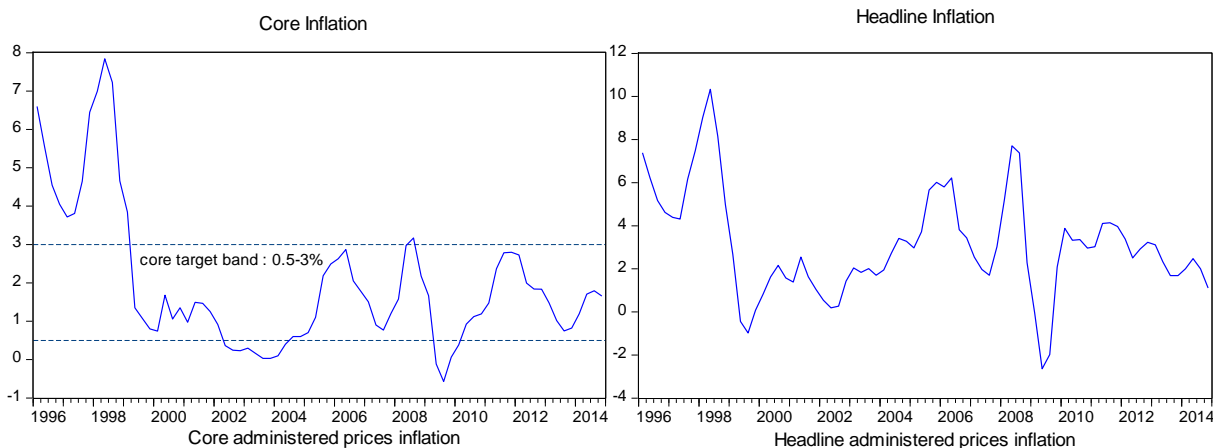
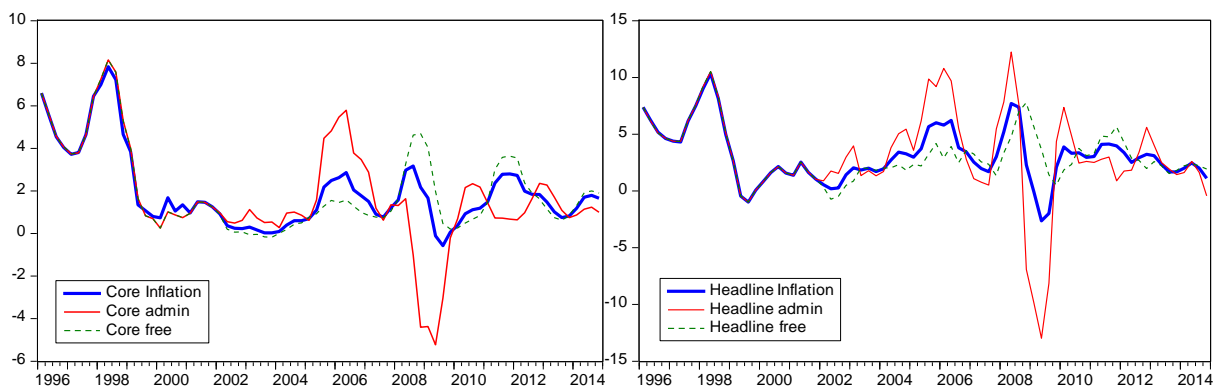
Subsample: 2000Q3 2014Q4

	Core Inflation	Core Admin Inflation	Core Free Inflation	Headline Inflation	Headline Admin Inflation	Headline Free Inflation
Mean	1.286	1.083	1.323	2.686	2.690	2.612
Std. Dev.	0.894	1.957	1.185	1.884	4.383	1.593

Headline inflation maybe a better indicator to explain the true cost of living with its high comprehensiveness, but it also contains high transitory noise. This strong seasonal and temporary effect do not impact underlying inflation trend. Additionally, administered price started to play an important role in explaining Thailand inflation dynamics recently as can be observed from Table above. Among all variables, administered prices inflation is the most

volatile sector with an average of 3.14 and a standard deviation of 4.22. Since administered price items accounted for 38% of the total CPI basket, this suggests that the movement of this price certainly influence the general headline figure.

Figure 7: Development of Inflation Process in Thailand



The restrictions of prices may help to maintain price stability of goods and services as well as protect welfare of consumers in the short run; however, the rapid price rises after the period of control drives up inflation greatly. As a result, headline inflation turns up to have a lot larger mean and standard deviation relative to core inflation. (Table 3) On the other hand, the low rate of core inflation and relatively low volatility can be explained by the exclusion of energy and raw food from the composite of inflation. Removing large portion of administered items allows core inflation to move freely, driven by market mechanism; nevertheless, price pressure signaled by the indicator might not reflect the true underlying price level.

Disaggregate Sectors Regression

In this section, we take a closer look at the relationship between inflation and disaggregate components. The total CPI is broken down into eight different sectors conforming to the categories proposed by the Bureau of Trade and Economic Indices.

Table 4 Disaggregate CPI Components Regression – Headline Inflation

	Variable	Coefficient	Std. Error	Prob.
1	<i>Food and Beverages</i>	0.405	0.004	0.000
2	<i>Transportation and Communication</i>	0.139	0.022	0.000
3	Clothing and Footwear	-0.129	0.024	0.000
4	Recreational and Education	0.074	0.009	0.000
5	Tobacco and Alcoholic Beverages	0.029	0.003	0.000
6	Personal and Medical care	0.002	0.021	0.091
7	Housing	0.132	0.023	0.000
8	Others	0.236	0.058	0.000

From analysis above, using monthly data from 2003 to present, food and beverage sector has the highest impact on headline inflation as it has the strongest coefficient with 0.405. Given that the majority of items in this category are necessity consumption goods as well as inputs for other goods, a change in headline inflation process is largely influenced by the movement of this sectoral index. Correspondingly, transportation and communication which heavily composed of oil and fuels, is also an important determinant of headline volatility. A change in these prices would produce a pass-through effect or passing cost over on other items. Despite a generally high degree of correlation, evidences from Mallikamas (2004) demonstrate that pass-through effect or second-round effect has diminished. “The change in the degree of pass-through is most likely a result of lower inflation expectation, intense competition in retail sector, and price administration by the government.”(Mallikamas, 2004)

Table 5 Disaggregate CPI Components Regression – Core Inflation

	Variable	Coefficient	Std. Error	Prob.
1	Food and Beverages	0.257	0.018	0.000
2	Transportation and Communication	-0.024	0.090	0.784
3	<i>Clothing and Footwear</i>	0.485	0.097	0.000
4	Recreational and Education	-0.025	0.039	0.516
5	Tobacco and Alcoholic Beverages	0.076	0.015	0.000

6	Personal and Medical care	0.201	0.084	0.019
7	Housing	0.084	0.095	0.381
8	Others	0.123	0.233	0.596

The results yet show different story under core inflation model, coefficient of food and beverages as well as transportation and communication sector are substantially lower than what we saw in the previous case. In contrast to headline inflation, the exclusion of raw food and energy items made these categories less dominant in explaining inflation dynamic. At the same time, core inflation has more service proportion in its measure; hence, core CPI basket is vastly driven by movement in service prices. The evidence of 12-years regression analysis illustrates that clothing and footwear has become the major determinant of core inflation process.

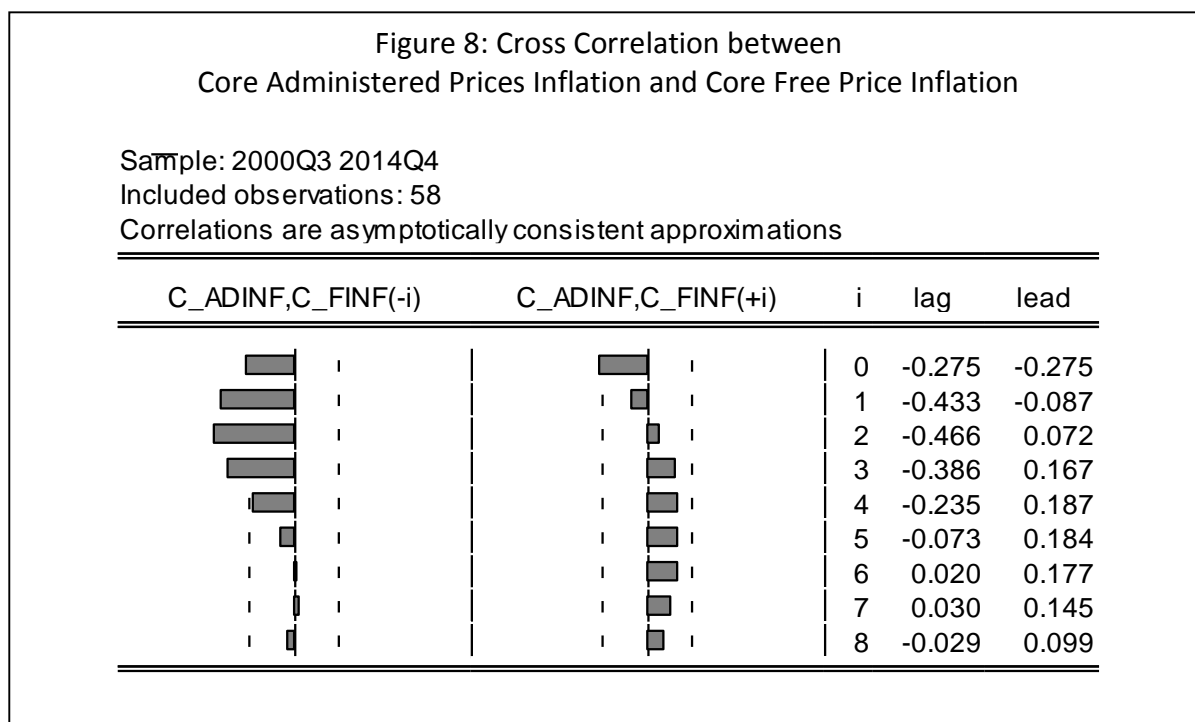
Coefficient Correlation

Table 6 Correlation of key price measures between 1994 and 2014

	Core Inflation	Core Admin Inflation	Core Free Inflation	Headline Inflation	Headline Admin Inflation	Headline Free Inflation
C_INF	1.000	0.762	0.946	0.812	0.503	0.842
C_ADINF	0.762	1.000	0.524	0.769	0.782	0.457
C_FINF	0.946	0.524	1.000	0.694	0.276	0.891
H_INF	0.812	0.769	0.694	1.000	0.831	0.784
H_ADINF	0.503	0.782	0.276	0.831	1.000	0.307
H_FINF	0.842	0.457	0.891	0.784	0.307	1.000

The table above provides some simple statistics on core inflation, headline inflation in more dimensions with both administered price and free price inflation. According to Mallikamas (2005), the correlation of headline and core inflation has fallen sharply after 2002. One of the factors contributing this decline is administered price. This proposes a criticism of the use of core inflation as monetary target. In contrast to Mallikamas's view, the results of above suggest that shifting to headline inflation targeting can be more challenging. The large share of administered items in CPI basket is eventually concentrated in transportation and communication sector, which are necessity goods and services for daily consumption. Hence, correlation coefficient of administered price inflation and headline inflation is the highest with 0.831. While the correlation coefficient of free price inflation and headline inflation is 0.784. On the other hand, with the exclusion of energy and raw food, free price inflation has relatively higher correlation with core inflation than the administered price inflation. As Central Bank has moved toward headline inflation targeting, this fact implies that it might burden great risk of breaking the target since monetary policy does not have the ability to control administered price inflation, which largely described headline inflation.

Cross correlation

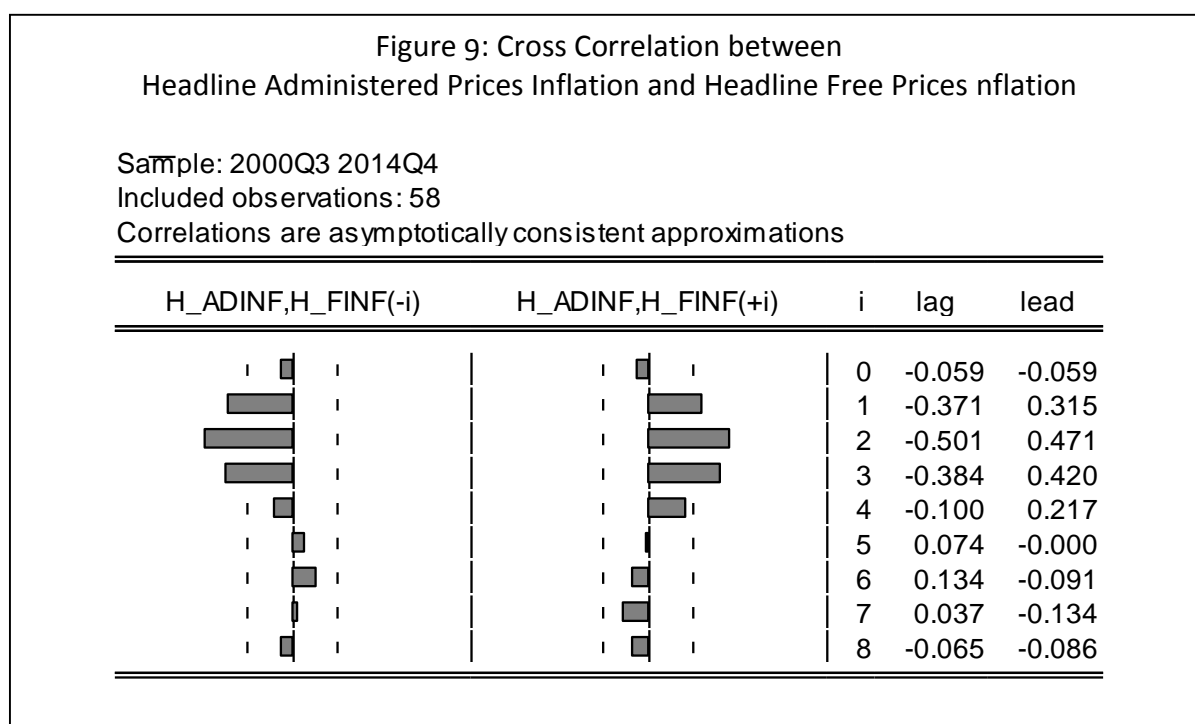


Core inflation barely contains administered price items as it dropped out raw food and energy sectors from its calculation. Therefore, changes in administered price inflation shows little following impact to the core inflation. In contrast, the core inflation process is largely governed by free price inflation. The negative correlation between the lag period of free price and administered price reveals the process of government in regulation price control. Because of the little relationship administered price and free price had in the core inflation, the price controls implemented by government did not have significant effect on free price inflation.

As administered price items accounted for large share in headline CPI basket, the movement of administered price inflation played a prevailing role in determining overall headline inflation. We discovered that strong correlation is exhibited in the instant period between the two. The estimation on free price inflation depicts tighter correlation to headline inflation with its leading period. This perhaps explains pass-through effect of headline inflation on free price. Finally, the most interesting finding is, on the last diagram of Table 8, administered price and free price inflation had both solid lag and lead correlations. The probable explanation is that as price of goods and services increase, government authorities are likely to limit this price changes by suppressing the prices of administered items. However, after a certain period of time, when control is altered, the inflationary shock would pass through to free price inflation in the later periods. The results consistently confirm that headline inflation is largely influenced by the price administration, which cannot be managed by the central bank. As in the early of 2015, cabinet approved annual average headline inflation at 2.5 ± 1.5 percent tolerance zone as primary policy target. As a result, our findings address that achieving the target may apparently become difficult.

Cointegration Test

Johansen Co-integration test is performed to derive the long-run coefficient of the relationship between administered price and overall inflation. Based on empirical results above, Johansen co-integration hypothesis between the two variables are rejected at 0.05 level for both core and headline inflation. The rejection suggests that administered prices do not have significant effect on comprehensiveness and does not reflect the underlying cost of living in the long term. In other word, because the restriction period is temporary, administered price inflation has no long run integration with both core and headline inflation. Even though in the short run administered price directly determine the dynamics of free price and overall inflation, there is no significant co-integrating relationship in the long run.



Autoregression

Another crucial factor for policy-making analyses is the persistence of inflation. Higher inflation persistence amplifies output and inflation effects of monetary policy shock. (Angeloni, Coenen, and Mets 2003). Thus, inflation persistence could be costly for monetary policy when inflation is highly interacted with expectation. This means that any shock can produce prolong effects and could potentially cause spiral inflation.

In testing inflation persistence with autoregressive model AR(1) to AR(4) as in Khamangkorn (2008), we find that administered price inflation is reasonably less persistence than free price inflation for core inflation case whereas in headline inflation is shown to be insignificant.¹⁰ Although, there are lower frequencies of price adjustment due to the stickiness in price of a large number of administered price components, once they are allowed to adjust, prices are likely to rise significantly. The time-frame of price control is also considered temporary; making administered price inflation became relatively less persistence.

Besides, free price inflation variation can be better explained by Talor's model or limited information models. Regarding Taylor's model, the effect of shock on price level is persisted if the length of contract is long and price cannot be changed instantaneously. Similarly, with limited information, process of setting price and extracting the signal of price changes are slow. As administered price items are strictly regulated by government entities, price do not freely driven by market mechanism. Price can therefore adjust more swiftly than market-determined items. Consequently, with lower persistence, administered price inflation can accommodate to shock faster than free price inflation.

	ρ coefficient	Prob.
Core Inflation	0.490	0.001
Core Admin Inflation	0.523	0.000
Core Free Inflation	0.771	0.000
Headline Inflation	0.297	0.021
Headline Admin Inflation	0.352	0.006
Headline Free Inflation	0.041	0.767

Another important finding can be drawn from Table 9 is that the persistence parameter (ρ coefficient) of inflation process for headline inflation is proportionately less than core inflation. This result is consistent with what we discussed earlier. Given that administered prices have low persistency, headline inflation, which contains high proportion of price controls, is therefore less persistent. It can be seen from column 2 that the estimated degree of persistence for headline inflation is somewhat lower in every inflation series and model specifications.

$$\pi_t = \pi^e + aX_t + v_t$$

$$\pi_{t-1} \rightarrow \textit{Backward Looking}$$

¹⁰ In this section, we employed quarter-on-quarter dataset on autoregression analysis as it better explain persistency of inflation.

$$E_t(\pi_{t+1}) \rightarrow \text{Forward Looking}$$

$$\pi_t = (1 - \gamma)\pi_{t-1} + \gamma E_t(\pi_{t+1}) + v_t$$

Referring to New Keynesian Phillips Curve, the model implies that current inflation is determined by inflation expectation and output gap. Given the low persistence in headline inflation, we can infer from the equation above that when $(1 - \gamma)$ is low γ will then be assumably high as they are alternatives. One essential point can be derived from the results is that by shifting to headline targeting framework, central bank noticeably has higher ability to anchor inflation expectation.

5.2. Monetary Policy Response

Taylor Rule

Headline inflation reaction function:

$$i_t = 0.917i_{t-1} + 0.023(\pi^{admin} - 3\%) + 0.094(\pi^{free} - 3\%) + 0.434$$

(0.000) (0.052) (0.013) (0.005)

Core inflation reaction function:

$$i_t = 0.890i_{t-1} + 0.109(\pi^{admin} - 1.75\%) + 0.229(\pi^{free} - 1.75\%) + 0.689$$

(0.000) (0.0523) (0.0131) (0.0053)

*Note: quarter on quarter data from 2000q1-2014q4

According to Taylor rule, we proceed to empirically assess how Bank of Thailand response to deviations in each of the variables. After performing econometric tests, we find convincing evidence that coefficients of administered price on both core and headline inflation are lower than free price in which this make sense because BOT does not have controllability over administered items and should not response to variables that are not in its control.

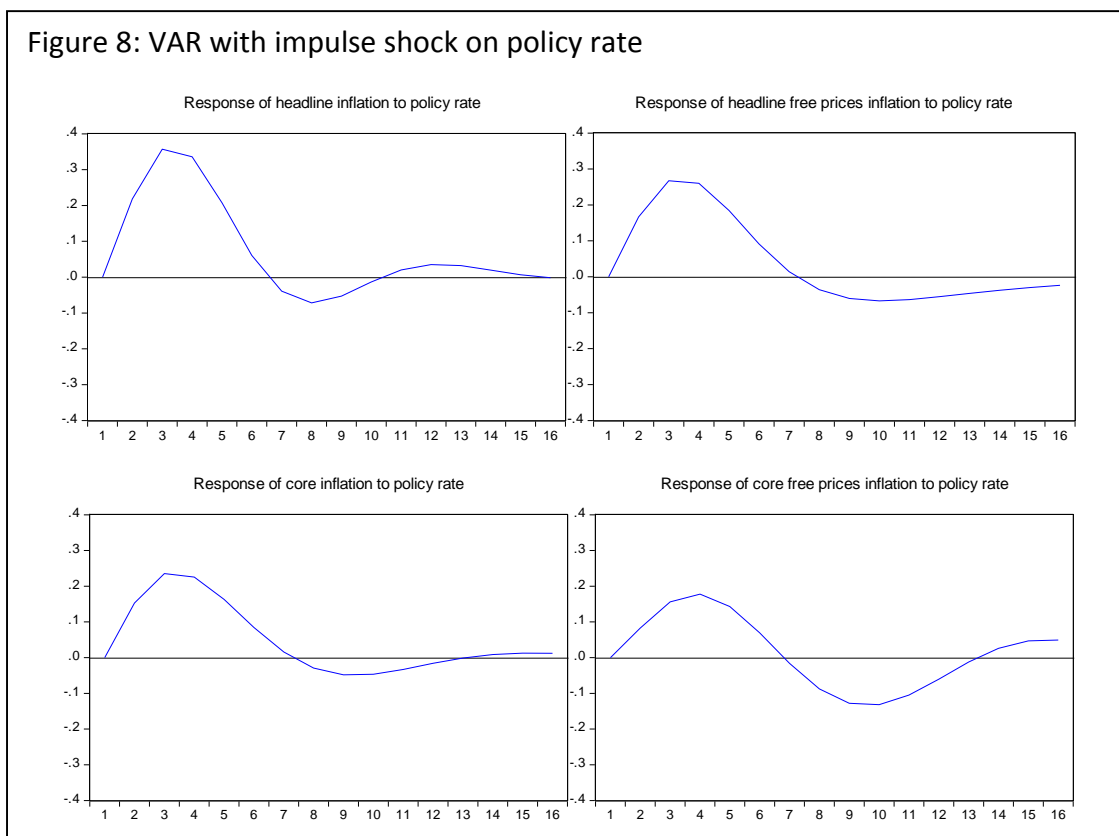
One important finding emerged from this study. Price administration may complement monetary policy operation when there is a temporary shock. Administered price helps protect the domestic consumers from the exogenous price volatility. This therefore supports the monetary framework in achieving inflation stability as price control mitigates the risk of sudden price changes. Also, central bank does not have to implement monetary policy to deal with the instant volatility. But, if shock persists, price control may suppress the real underlying inflation. This causes a distortion in conducting monetary policy as inflation does not reflect the real underlying pressure.

5.3 Monetary Transmission Mechanism

Vector Autoregressive model

In the last section, we then take investigation on the effectiveness of monetary policy. Through testing length of transmission mechanism of monetary policy, we discovered that free prices inflation response slower to interest rate changes relative than overall inflation. As in Figure 8, given impulse shock on policy rate, headline inflation as well as core inflation tend to adjust faster to interest rate shock than the market-determined price inflation does. The VAR charts above demonstrate that for headline inflation, it takes

Figure 8: VAR with impulse shock on policy rate



approximately 8 quarters for monetary to have full impact, whereas it takes almost 10 quarters for free price. This is consistent with core inflation where monetary policy becomes effective in 9 quarters and 10 quarters on free price.

This suggests that the transmission process of monetary policy of take more than 2 years for it to have full effect on the inflation. More importantly, because free prices sector, which central bank has direct control and should strongly focus on, response significantly lower. The implies that Bank of Thailand should even be more forward looking as monetary policy likely takes longer horizon than expect. Due to price stickiness, free prices inflation require certain amount of time to completely adjust. It is noteworthy that we have already taken into account of exogenous oil price, price puzzle still exist. Explicit analysis indicates that normal framework of VAR might not be suitable as VAR model in general is symmetric. Hence, a modified model of VAR, extending the conventional analysis to capture the asymmetric response is necessary required for further study.

6 Conclusion

To the most recent period, inevitably, Thailand inflation process has largely been influenced by the price aiding programs of the government. The low level of inflation in the past decades is partly attributable to the price administrations. However, it has also been responsible for the divergence between core and headline inflation. The issue regarding the effect of administered price on inflation targeting brought us motivation in conducting this research study. On the one side, arguments suggest that price controls, maintaining people cost of living, complement the price stability goal and hence support monetary policy with inflation targeting framework. In contrast, the opposite side views that the price restrictions rather distort market mechanism and do not provide long term alleviation of price pressure. Instead, performing monetary policy becomes more complicated and its effectiveness is hindered.

We analyze the impact of administered price on inflation process covering three different dimensions (i) inflation dynamics; (ii) monetary policy reaction; (iii) monetary transmission mechanism of monetary policy. The empirical results conclude 3 main findings. First, price controls regulated by the government raise concern on controllability of monetary policy. Headline inflation is highly volatile with relatively larger standard deviation than core inflation. This implies that central bank burdens great risk of breaking the target as well as losing its controllability. In addition, the magnitude of correlation between headline inflation and administered prices sector is significantly high. With more than one third of the CPI basket consisting of administered items, these variations are difficult to be managed and are not within direct control of monetary policy. On the contrary, core inflation is not subject to exogenous factors as it removes raw food and energy components from the CPI basket. By investigating cross correlation between inflation sequences, complicated lead and lag relationship of headline administered price and free price inflation emerged. Price adjustment and administration are undertaken in response to free sector fluctuation. Government authority would strictly regulate administered items, which are crucial inputs to other goods and services such as oil, or raw food. The impulse responses would later neutralize relative price changes. After certain time, when control is altered, drastic price rises generate inflationary shock to overall basket. The rigidity of administered price obstructs the real underlying price pressure. Therefore, conducting monetary policy becomes more complex.

the study does not argue that the framework adjustment toward headline targeting is incompetent. Even though administered price may propose certain difficulties for monetary policy operation and play important role in explaining inflation dynamics, price controls do not have any long-run relationship with inflation development. More importantly, using the former econometric test, autoregression model with disaggregate components, we found that headline inflation was relatively less persistent than core inflation. Inpersistence of inflation implies that once it gets hit by a shock, inflation tend to adjust back instantaneously. This can be inferred that the central bank has higher ability to anchor inflation expectation and increases monetary policy effectiveness.

Secondly, our research suggests that Bank of Thailand should be even more forward looking in designing monetary policy. In exploring the transmission mechanism of monetary policy by using VAR method, free prices sector apparently has slower transmission process than the overall headline inflation with over 2 years. Since free prices inflation is what the central bank has direct control over, it should be cautious in evaluating time horizon of

transmission mechanism. Wage rigidity and price setting behavior is one possible explanation describing price adjustment process. Nevertheless, it is noteworthy that the samples in the test already take into account of exogenous oil price, but price puzzle remains. Additionally, VAR is generally symmetric, and hence may not be suitable for asymmetric response.

Lastly, we inspect the reaction function of the central bank in setting optimal policy rate. Considering Taylor rule equation, we have seen that the Bank of Thailand is more responsive to variation in free prices sector than in regulated prices sector. The results allow us to get more insights that in somehow the central bank has utilized this information in making its policy-decisions.

Important policy implication emerged from this research study is that monetary authority should cautiously evaluate the underlying price movement in the market and utilize all information in making decision. Most importantly, more coordination between Bank of Thailand and Ministry of Commerce is necessary required. Since both organizations have the same objective in preserving social welfare and people cost of living, collaboration would eventually allow them to achieve their goal more effectively rather than interfering each other work. Without communication, it is very difficult for the central bank to know when and how control measures will be changed. As a result, BoT cannot anticipate this information into its inflation forecast. Regarding the high volatility of headline inflation due to the large variation in administered prices, government should therefore carefully reconsider the regulated items by performing cost and benefit analyses. Reduction in controls of insignificant goods and services is essentially encouraged. Communication about when to alter the controlling items would also become helpful for the central bank in designing monetary policy as policy maker can incorporate the following information into its forecast. Finally, information sharing is also a relevant factor that built up clearer economics prospect as well as to understand real underlying price movement.

It also should be noted here that there were some limitation in the present study. Obtaining raw data from government entity was really troublesome. The inconvenient bureaucratic process is one of the biggest barriers in conducting this research. Disaggregate CPI models are constructed based on assumption that items are the same throughout the periods, while in reality controlled list change every month. Also, there are certain indirect subsidies programs which had not been considered. Another caveat is that certain administered items in CPI basket and the one in MOC publication are defined differently.

Further extensions of this study could incorporate the welfare analysis determining the most optimal threshold for administered prices for the economy. The evidences of our paper may conclude certain difficulties arises from price subsidies program and does suggest several important findings on inflation development. However, the analyses do not capture economical aspect on how price controls effect economic growth.

References:

- Batini N. (2002). Euro Area Inflation Persistence. *European Central Bank, Working Paper, No.201*.
- Buddhari A. and Chansavasdijai V. (2003). Inflation Dynamics and Its Implication for Monetary Policy. Bank of Thailand Discussion Paper DP/09/2003.
- Chantanahom P., Poonpatpibul C. and Vongsinsirikul P. (2004). Exploring Inflation in Thailand Through Sectoral Price Setting Behavior and Underlying Trend. Bank of Thailand Annual Symposium.
- Cufer U., Mahadera L. and Steme G. (2000) Specifying Inflation Target. The case of administered price and other candidates for exclusion. *Monetary Policy Framework in a Global Context*, 557-584. London: Routledge, Bank of England.
- Daniel J. and Mitchell B. (1975). Wage-Price Controls and Inflation. *The Academy of Political Science*, Vol.31, No.4, 114-126.
- Debelle G. (2001). The Case for Inflation Targeting in East Asian Countries. Paper presented at Future Directions for Monetary Policies in East Asia, Conference Reserve Bank of Australia.
- Freitas P. S. (2005). A Study on Administered Prices and Optimal Monetary Policy: The Brazillian Case. *Business School, Fucape*.
- Khemangkorn V., Mallikamas R.P. and P. Sutthasri (2008). Inflation Dynamics and Implications on Monetary Policy. Bank of Thailand Symposium 2008.
- Levin A. T. and Jeremy M.P. (2014) Is Inflation Persistence Intrinsic in Industrial Economies? *European Central Bank, Working Paper, No.354*.
- Mallikamas R. and Ponsaparn R. (2005). Evolving Inflation Process: The Thai Experience. Bank of Thailand Discussion Paper DP/13/2005.
- Masson P., Savastano M. and Sharma S. (1998). Can Inflation Targeting be a Framework for Monetary Policy in Developing Countries? *Finance and development*, Vol.35, No.1, 34-37. Washington DC: IMF Publication.
- Mishkin S. F. (2000). Inflation Targeting in Emerging Market Countries. *National Bureau of Economic Research, Working Paper, No.7618*.
- O'Reily G. and Karl W. (2005). Has Euro-Area Inflation Persistence Changed Over Time? *Review of Economics and Statistics*, Vol.84, No.4, 709-720.
- Safouance M. and Nooman R. (2012). Price Subsidies and the Conduct of Monetary Policy. *Journal of Macroeconomics*, Vol.34, 769-787. Washington DC: IMF Publication.

Sriumpolchan K. (2006). Impact of Government Price Control on Monetary Policy. Thesis for Degree of Master of Economics Program in Economics, Chulalongkorn University.

Appendix A

Sample (adjusted): 1996Q4 2014Q4
Core inflation and Core administered inflation
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Summary
None *	0.207384	25.84109	15.49471	0.0010	Not cointegrated
At most 1 *	0.114472	8.874717	3.841466	0.0029	Not cointegrated

Headline inflation and Headline administered inflation
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Summary
None *	0.223578	30.80466	15.49471	0.0001	Not cointegrated
At most 1 *	0.155425	12.33130	3.841466	0.0004	Not cointegrated

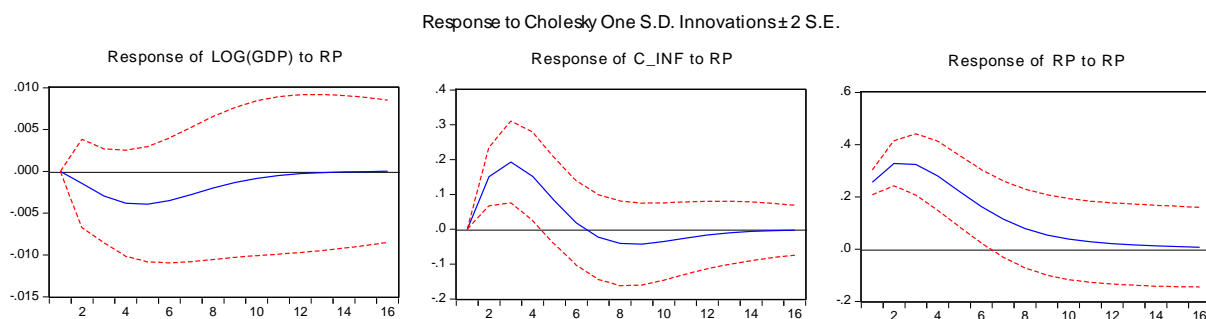
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

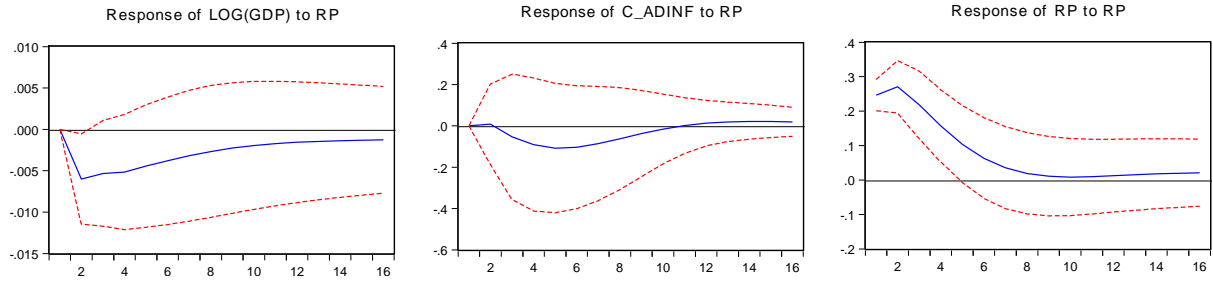
Appendix B

Core Inflation



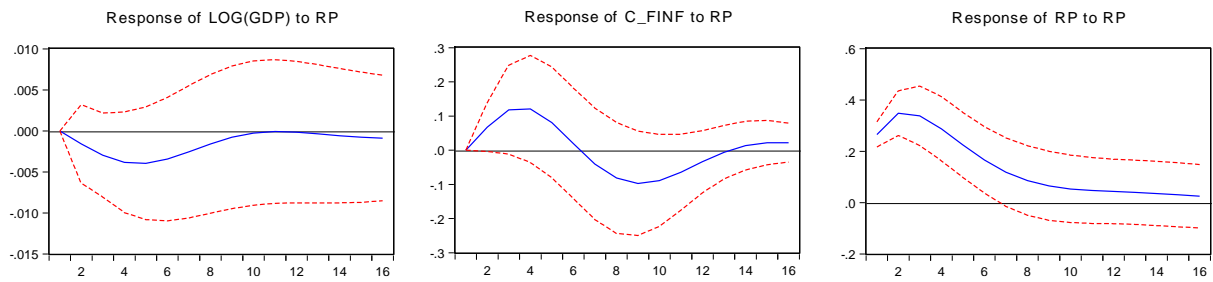
Core Administered Price Inflation

Response to Cholesky One S.D. Innovations ± 2 S.E.



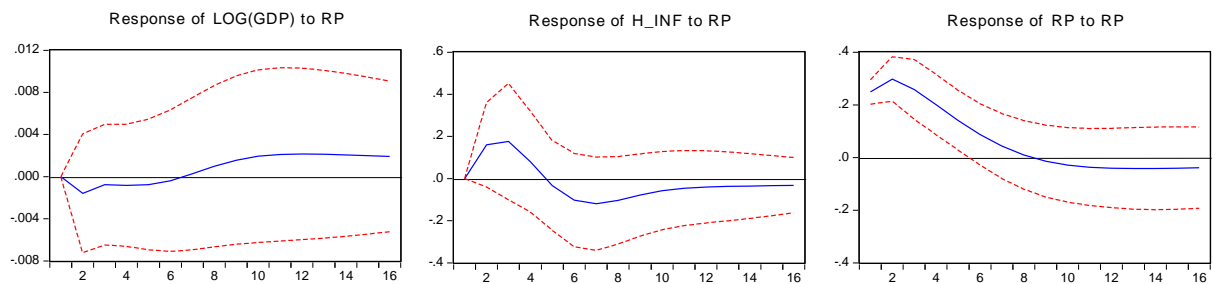
Core Free Price Inflation

Response to Cholesky One S.D. Innovations ± 2 S.E.



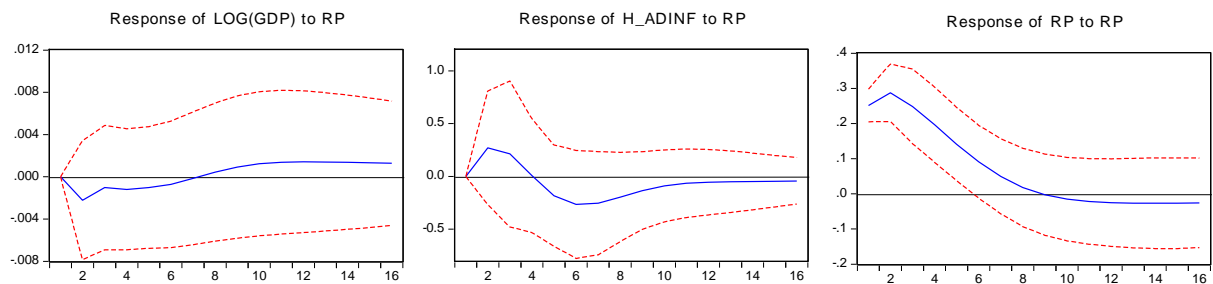
Headline Inflation

Response to Cholesky One S.D. Innovations ± 2 S.E.



Headline Administered Price Inflation

Response to Cholesky One S.D. Innovations ± 2 S.E.



Headline Free Price Inflation

Response to Cholesky One S.D. Innovations ± 2 S.E.