INTRODUCTION

1. Rationale

Inflation is a common phenomenon of macroeconomic and has profound effects on all aspects of socio-economic life. Normally, the macroeconomic policies for an economy will be carried out based on the target inflation. Studying of inflation to obtain the most general view of inflation plays a very important role in the implementation as well as the selection of operating policies to maintain stable macroeconomy and sustainable development. Therefore, analysing the causes of inflation and forecasting inflation helps policy makers to make appropriate policies to stabilize market prices and ensure sustainable economic development.

Vietnam started the transition from a planned economy to a market economy in 1986. The purpose of the Resolution of the Sixth Party Congress was to stabilize the economy, stimulate export and investment, and promote economic growth. In recent years, Vietnam's government policies have always given priority to strict control of commodity prices and wages, but the prices in the economy are still volatile.

In the early years of period 1996-2000, economic growth was over 9% (9.5% and 9.3% respectively in 1995 and 1996) and these were important milestones for a new economic period. In the period 2000-2007, the inflation rate was relatively low at an average of 5.5% per annum and gross domestic product (GDP) has grown at an average rate of 7% per year. This is an important period in Vietnam's international economic integration marked by Vietnam's accession to the WTO in November 2007. This represents Vietnamese openness of its economy to other countries in the world. However, in addition to the positive aspects, the deep openness of the economy also have certain limitations and create negative effects from the world economy onVietnam's economy. These negative impacts are great challenges for macroeconomic policymakers and macroeconomic regulation. Specifically, inflation started to increase sharply from 2007 (12.6% yoy), and inflation in 2008 (19.98% yoy) was the highest rate since Vietnam's reform. Given that situation, the Vietnam's government had to implement fiscal policy and monetary policy tightening to control inflation. The inflation rate in 2009 was only 6.5% and economic growth in 2009 was much lower than initially expected, reaching around 5.4% which was not achieving the economic growth target of the government. Thus, the government has stimulated growth by using the demand stimulus package. Banks lacking cash raised interest rates on deposits to attract cash flow from the residents. Because of this, the price began to increase in the second half of 2009, with inflation reaching 11.9% in 2010 and 18.1% in 2011 which is 2.5 times greater than the government target (7%). Faced the high inflation prospects, the Government issued Resolution 11 / NQ-CP dated February 24, 2011 to curb inflation, which is one of the most important policies to control inflation and promote economic growth. Accordingly, inflation has declined significantly in the first three quarters of 2012, curbing inflation to 6.8% in 2012 and 6.6% in 2013. From 2014 up to now, although inflation has been on a steady trend,

the government has still implementing the prudent fiscal and monetary policies to control inflation and avoid a boom in inflation that may cause macroeconomic instability.

Regarding the social aspect, inflation can have negative impacts such as increasing the gap between the rich and the poor, increasing income inequality, reducing the residents' purchasing capacity, and particularly affects economic growth. In general, besides the positive impacts, Vietnamese economy had to face some problems such as monetary instability, increasing bad debt, declining stock market and real estate maket and difficulties in citizen's livelihood. Inflation control is still considered the most important target in macroeconomic management. To solve this problem, it is important to distinguish between short-term and long-term inpacts of inflation. For example, the price level of some goods or the price of tickets for transportation such as trains, buses, airplanes used to rise during the Tet holidays as the demand increased. However, prices will stabilize again after the Lunar New Year or holidays. So, if policy makers implement policies such as tightening monetary policy to control the high inflation level for these reasons, it woud be a mistake because it would have a detrimental effects leading to production stagnation. Given this situation, the policy-making should be more concerned with core inflation. The core inflation determines the general or core tendency of the price so that it can better evaluate the overall situation of the economy.

In addition, general inflation is often seen as vulnerable to factors under the control of monetary policy and tends to fluctuate rapidly due to shocks or temporary disturbances in some sector of the economy that leads to a change in the long-term trend. In such circumstances, the general inflation rate may no longer be a realiable indicator of price level in the economy. Core inflation is an effective indicator that indicates the price level in the economy, and so core inflation could provide a better way of assessing the overall of the economy. Some temporary shocks in food prices, oil prices and some other similarly disturbed commodities in general inflation are often related to the supply side. These factors tend to be outside the control of the government. Core inflation is considered a good indicator that shows the current and future trend of general inflation. Core inflation helps policy makers to make a more appropriate policy, especially monetary policy.

For that reason, the author chooses the th topic: "Analysis and forecast of core inflation in Vietnam using econometric models" for the thesis to give a more accurate analysis of the causes of inflation by using econotric models and find the best suitable econometric model for forecasting core inflation in Vietnam.

2. Objective of the thesis

The general objective of thesis is to use econometric models to analyze and forecast core inflation in Vietnam's economy, whereby the author undertakes in-depth study of the main contents as follows:

First, measuring the core inflation in period 2000-2015: The thesis overviews the general theoretical foundations and calculates the core inflation in line with the Vietnam'seconomy. After that the author makes an analysis to clarify the causes of core inflation.

Second, analyze the factors that affect Vietnam's core inflation in the period 2000-2015. The thesis analyzes the factors that affect Vietnam's core inflation by using statistical data. In addition, the thesis synthesizes all the related models that are used to analyze core inflation and developing the core inflation analysis model suitable for Vietnamese economy.

Third, developing forecasting econometric model: To forecast core inflation in Vietnam, this thesis reviews all the documents related and developing the core inflation forecasting model suitable for Vietnamese economy.

Fourth, this thesis is a scientifically reference literature for policy makers in macroeconomic regulation and management.

The thesis will answer the following questions:

How to calculate the core inflation?

How has core inflation developed in the past years?

Which econometric model should be used to forecast core inflation in Vietnam?

3. Objects and scopes of the thesis

3.1. 3.1. Research objects

The objects of the thesis are inflation, core inflation, macroeconomic variables, government polices and econometric models. In particular, the author uses econometric models to analyze the relationship between macroeconomic variables and core inflation in the period 2000-2015 in Vietnam.

3.2. Research scope

Spatial scope : Study in Vietnam

Scope of time: the author conduct the study for the period 2000-2015 and forecast for some next quarters.

4. Dara resources and Methodology

4.1. Research data

The data used in the thesis includes Gross Domestic Product (GDP), Core inflation (CORECPI), Consumer price index (CPI), Money supply (M2), Exchange Rate (ER), Interest rate (IR), wage (W), Industrial Price Index (PPI), Import Price Index (CSGNK), World Oil Price (POIL), World Rice Price (PRICE), Private Consumption (HC), Government Consumption (GC) that is collected from the sources including GSO, SBV, WB and IMF.

4.2. The methods used in the thesis includes:

Statistical comparison method: used to collect data, summarize, present, calculate and describe the different characteristics to reflect the general object of study.

Analytical Synthesis: A Literature Research Methodology for the Analysis and

Synthesis of Fundamental Theoretical Issues of Core Inflation.

Quantitative methods: Used to model the relationships between macro variables and fundamental inflation variables in Vietnam, thereby predicting core inflation in Vietnam in the short run.

The softwares used in analyzing data in this thesisinclude Eview and SPSS.

5. New contributions of the thesis

5.1. Theoritical contributions

After analyzing the theoretical basis of core inflation fully, the thesis proposed the methods to build and calculate the core quarterly inflation index in line with the practice of Vietnam's economy in period 2000-2015. Accordingly, core inflation is calculated based on inflation after eliminating 13 commodities of sub-class 3 including rice, wheat and grains, meat, poultry, eggs, fresh seafood, fresh, dried and processed vegetables, fresh and processed fruits, residential electricity, gas and other fuels, fuels, medical services, education services. In addition, the author has developed the models to analyze and forecast core inflation in Vietnam in the short term.

5.2. Empirical contributions

Expectations on core inflation have a strong impact on core inflation in the current period, and supply and demand side factors as well as monetary factors also impact on core inflation. However, the impact from monetary factors on on inflation is not much. In addition, the opening of the Vietnamese economy in recent years has also had a negative impact from the external factors of Vietnam's core inflation. Meanwhile, the stepwise regression indicates that the energy price index is the most important factor, which implies that the underlying inflation control needs to pay attention to the energy price factor. The impact of the energy price on core inflation shows that cross-effects or spillover effects from energy price on other prices in the Vietnam's economy are significant.

- In long-term relationship, the increase in money supply, import price index, wage and exchange rate will cause basic inflation to increase, while interest rate does not have much impact core inflation.

- The models used to forecast core inflation include: ARIMA model, GARCH model, and MARKOV model. Based on RMSE, MAE and MAPE criteria, the thesis concludes that the ARIMA model is more accurate than other models. The reason is that core inflation is considered relatively stable inflation in the long run because the shock factors and other fluctuating factors in the inflation index are eliminated. The thesis uses a combination forecast method taking into account the influence of time linear and the results show that the forecast quality has improved considerably in terms of RMSE criterion.

6. Structure of thesis

Apart from the sections including introduction, conclusions, references, tables and figures, the thesis is divided into 3 chapters as follows:

Chapter 1: Theoretical basis and the method to build core inflation indicator in

Vietnam

Chapter 2: The context of core inflation and macroeconomic variables in Vietnam in the period 2000-2015

Chapter 3: Developing econometric models to analyze and forecast core inflation in Vietnam

CHAPTER 1
THEORETICAL BASIS AND THE METHOD TO BUILD CORE INFLATION INDICATOR IN VIETNAM

1.1. Theoretical basis of core inflation

1.1.1. Theoritical basis of inflation

1.1.2. Theoretical of core inflation

1.1.3. Theoretical of developing econometric models to analyze and forecast core inflation

1.1.3.1. Theoretical of developing econometric models to analyze core inflation

a) Analysis model from Keynesian perpective

Keynesian theory shows that the pressure of inflation is low during the recession, but the risk of inflation is higher when the output is higher than the potential output. Keynes said that the difference in the classical theory could analyze K inflation and assumes unemployment could make price and wage flexible. Based on this perpective, Phillips - an economist in The London School of Economics and Political Science studied and gave out the important points to develop this theory. In 1958, Phillips showed the relationship between inflation and unemployment in an article "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957". The author showed that the increase in demand of commodities or services is related to the supply of these commodities or services, and so the expectation on price increases if demand is increasingly high. In contrast, the demand falls if the expectation on price decreases, which is a phenomenon of demandshortage. In addition, the author points out that there appeared a negative correlation between the unemployment rate and the inflation rate in the case of the British economy. In these years of low unemployment, inflation used to be high, and vice versa. However, the authors also suggest further research on the relationship between unemployment, wage rates, prices and productivity. These are important suggestions for further research.

Based on researches of Phillips,, Paul Samuelson and Robert Solow (1960) indicated the relationship between inflation and unemployment in USA using the data of the period 1993-1958. The results have a lot of common points with the Phillips'results for the United Kingdom's economy. The authors argued that the correlation between unemployment and price is due to the low unemployment rate associated with high aggregate demand, and that high aggregate demand will put pressure on wages and prices in the economy. .

In 1962, Okun published a study on the relationship between unemployment and economic growth. The author points out that the unemployment rate is closely related to economic growth and potential economic growth in some countries. This is latter called the Okun Law.

In 1973, Lucas published a well-known article in the American Economic Review, entitled "Some International Evidence on Output-Inflation Tradeoffs". This is an imperfect information model in which the economy consists of many businesses and consumers operating in competitive markets. The decision to supply the labor or product of each economic agents depend on relative price, which is the ratio between the producer's product price and the general price level, rather than depend on the changing of general price. However, when an economic agent observes a change in price level for himself; he can not know whether the change is due to a change in the relative price or the general price. This is exactly the assumption of imperfect information, which is decisive for the real effect of aggregate demand regulation policies on the economy. Man makes decision based on his best observation, on which part of the price change he sees caused by a change in the overall price level, and which is partly due to the relative price change. Man always interpret price changes is due to the relative price change, so, some nominal shocks will have an effect on output.

In Lucas's model, the magnitude of nominal shocks depends on their variances. A big nominal shock is due to general price changes rather than relative prices. So, the nominal demand will make the Phillips curve steeper and the demand shock will primarily increase prices without significantly increasing output.

However, Sargent (1976), Lucas and Sargent (1979) had important critiques of the Phillips curve. Both authors agree that future expectations on inflation will have a strong influence on wages and unemployment, but expectations are difficult to determine in modelling the behavior of the economy. Sargent and Wallace (1976) solved the problem of determining the expectated factors in the model by building a system of simultaneous equations with constraints on expected factors. The authors propose the Phillips curve equation as follow:

$$p_t - p_{t-1} = \phi_0 + \phi_1 U_t + {}_{t-1}P_t^* - P_{t-1} + \varepsilon_t \qquad (1.1)$$

Where U_t is unemployment,

P_t is a logarithm of price level

${}_{-1}P_t^*$ is a logarithm of price that shows the expectation of price at time t equal to price level at t-1 lag.

ε_t is random factor.

In 1988, Ball, Mankiw and Romer developed the new Keynesian model where enterprises can control their own price levels in the imperfect market.

According to the Keynesian economics, nominal shocks have effects because nominal prices fluctuate infrequently. An increase in the average inflation rate makes firms adjust prices more frequently to suit rising price trends. In turn, the constant

price adjustment implies that prices are rapidly adjusting to nominal shocks, so that nominal shocks will have no real effect. Thus, Keynes scholars argue that the real effect of nominal aggregate demand shocks will be small when the average inflation is large.

Similar to the Lucas's guess, BMR (1988) argues that the frequency of price changes depends on the variance of the aggregate demand. Countries with strong aggregate demand changes will have a steeper Phillips curve. To explain this, Keynes scholars argue that when aggregate demand fluctuates sharply, firms feel the same uncertainty as when average inflation is large, so they will adjust prices more frequently.

In 1982, Robrt J. Gordon modeled the Phillips curve for the analysis and forecast of inflation using the econometric model. The author completed the model in 1990, and it is called Triangle model. Triangle model is an estimation form of Phillips theoretical model that have developed in equation (1.1). Acording to Triangle model, inflation rate is difined by (i) Inflation due to inflation expectations; (Ii) demand-pull inflation; and (iii) inflation due to cost push or supply shocks. Supply shocks and the change in inflation expectation are major factors that shift the Phillips in short-term.

$$P_{t+1} = \mu + \alpha^G(L)P_t + \beta(L)u_{t+1} + \gamma(L)z_t + v_{t+1} \qquad (1.2)$$

Where,

P is iflation rate;

u is unemployment rate;

z is a form of supply shocks.

As mentioned above, the variable explaining the unemployment rate can be replaced by the variables of output gap (the difference between the actual output of an economy and its potential output) or growth rate. The triangle model has several important implications as following:

First, inflation always originates from nominal output (for example, nominal GDP) exceeding potential ouput in long-term. So, the focus of monetary policy is nominal GDP growth in controlling inflation. This opinion is not only of Gordon, but also of other prominent economists such as Robert Hall, Bennett McCallum, John Taylor, James Tobin, etc. Because inflation has inertia (High inflation in the past can cause workers and firms to expect high inflation in the future, which in turn will push up real inflation), the model suggests the central bank should begin to see nominal GDP growth as a goal of monetary policy when the economy had no output gap. It means that the nominal GDP growth is equal to the nominal potential GDP growth plus the basic inflation rate taking into account the inertia factor.

Second, in the short run, if showing on graphs, the relationship between output gape and inflation can be described as follows: when nominal GDP growth is higher than nominal potential GDP growth, Phillips curve will rotate counterclockwise repective to the initial low inflation period and after that high inflation and recession (stagflation) may occur.

Nguyen Khac Minh (2011) argues that "output gap should be introduced in the Phillips curve model as an indicator of demand-side pressure and inflation equation can be derived from the wage and price equations"

From theoretical basis above, Nguyen Khac Minh suggested the Phillips curve model for core inflation with adding expectation factors and shocks as follow:

$$\dot{P}_t = a_1 GAP_t + a_2\left(\dot{W}_t - \dot{q}_p\right) + a_3 SS_{pt} \qquad (1.3)$$

$$W_t = b_0 + b_1 GAP_t + b_2 \dot{P}_t^e + b_3 SS_{wt} \qquad (1.4)$$

$$\dot{P}_t^e = \sum_{i=1}^{n} \lambda_j \dot{P}_{t-j} \qquad (1.5)$$

Where the dot above the variable implies a percentage change and

P_t is expected inflation rate at time t ;

W is nominal wage growth;

q_p is trend growth of labor productivity;

SS_{pt} is the supply shock that affects commodity price;

SS_{wt} is the supply shock that affects nominal wage;

GAP is GDP gap that is determined by the difference between the real output and the potential output; and P_t^e is expected inflation at time t.

Equation (1.3) show that price is higher than the cost of labor. The price is set at higher level than the cost of labor adjusted for productivity ($\dot{W} - \dot{q}_p$) and is affected by the cyclical demand side (measured by GDP difference) and exogenous price shocks (SSp). Equation (1.4) shows that Wage inflation is assumed to depend on cyclical demand, expected inflation $\dot{P}_e$ and exogenous wage shocks(SS_w). Expected inflation rate modelled is a one period lag of the past iflation in equation (1.5).

The combination of equations (1.3), (1.4), and (1.5) will give the Phillips curve for inflation as follows:

$$\dot{P}_t = d_0 + \sum_{s=0}^{n} d_1 \dot{P}_{t-s} + d_2 GAP_t + d_3 SS_{pt} + d_4 SS_{wt} \qquad (1.6)$$

Where, d_0, d_1... are parameters and other variables are difined as above.

Real GDP is nominal GDP that is eliminated the effecst of price. For example, Y_t is logarithm form of nominal GDP and P_t is logarithm of price index, then the logarithm form of real GDP may be expressed as: $y_t = Y_t - P_t$

So, GAP is expressed as follow:

$$GAP_t = y_t - y_{pt} = Y_t - P_t - y_{pt} \qquad (1.7)$$

Where:

Y_t is logarithm of nominal GDP;

y_t is logarithm of real GDP; and

y_{pt} is logarithm of real potential output where the supply is not access demand. If real output is larger than potential output, it can limit economic growth and inflation pressure. In contrast, if real output is smaller than potential output, the trend of inflation decreases (CBO, 2004).

Take the first order difference of the equation (1.7) and group the variables together, then the GDP can be expressed as:

$$GAP_t = y_t - y_{pt} = \left(y_{t-1} - y_{pt-1}\right) + \left(\dot{Y}_t - \dot{y}_{pt}\right) - \dot{P}_t \qquad (1.8)$$

Replace (1.8) into (1.6), the basic of Phillips curves can be expressed as:

$$\dot{P}_t = f_0 + \sum_{s=0}^{n} f_1 \dot{P}_{t-s} + f_2\left(y_{t-1} - y_{pt-1}\right) + f_2\left(\dot{Y}_t - \dot{y}_{pt}\right) + f_3 SS_{pt} + f_4 SS_{wt} \qquad (1.9)$$

Phillips curve is specificated as above that nominal demand (expressed by $(\dot{Y}_t - \dot{y}_{pt})$) effect to core inflation. SS_p and SS_w in equation (1.9) are the changes of relative price matching with food price and energy price in empirical estimation.

So, Phillips curve equaton is defined as:

$$\dot{P}_t = g_0 + g_1\left(y_{t-1} - y_{pt-1}\right) + g_2\left(\dot{Y}_t - \dot{y}_{pt}\right) + \sum_{s=0}^{n1} g_{3s}\dot{P}_{t-s} + \sum_{s=0}^{n2} g_{4s}\, \dot{REP}_{t-s} + \sum_{s=0}^{n3} g_{5s}\, \dot{RFP}_{t-s}$$

(1.10)

Where, $\dot{REP}$ and $\dot{RFP}$ are the relative changes of of food price and energy price

The Phillips curve is used to analyze the relationship between inflation and unemployment, but in generall, it is a raltionship between inflation and real economy. According to author, marcoeronomic factor includes: Producer Price Indexes, real personal income, total net products and real trade, number of non-farm payroll employees, labor productivity in the manufacturing sector, the unemployment rate of male or female labors in the working age.

b) Analytical model based on monetarist perspective

Economists in monetarist perspective show that the more rapid increase in money supply than national income growth rate will lead to inflation pressure.

John Hicks (1937) is a first person who proposed IS-LM model to explain the phenomena of commodity market and money market . Hicks assumes that wage is rigid and income originates from consumption and investment. In the commodity market, investment is asummed to have a negative sign with interest rate, i.e. an increase in interest rate leads to a reduction in investment, and saving has positive sign with income, i.e. an increase in saving leads to an increase in income.

Modiglianli (1944) developed the model above and this was introduced in detail by Alvin Hansen (1953), and it is called Hicks – Modigliani model.

The most of importance researchs in monetarist perspective were strongly developed by the studies of Friedman (1970) "Inflation is always and everywhere a monetary phenomenon"; Brunner (1970); Johnson (1972); Laider (1975, 1976, and 1981), and Parkin (1975).

Traditional monetarist approach assumed that the growth of currency in the past help to predict inflation rate in long-term. Monetary inflation model give out the relationship as follows:

$$\dot{P} = f\left(M_t, \Delta M_t, \Delta M_{t-1}, ..., \Delta M_{t-i}\right) \qquad (1.11)$$

In which:

$\dot{P}$ is inflation rate at time t;

ΔM is the money growth at time t;

According to this theory, inflation depends on the growth rate of in the past period and in the current period. Empirical estimations of the monetarist's forecast models depend on the selection of the measurement of money supply and the number of lags. The selection of the measurement of money and the length of lags cannot be explained by economic theories, but has strong effects on the forecasting quality of the model.

Nguyen Khac Minh (2011) states that monetary models can introduce an additional fiscal variable (the ratio of budget deficit to gross domestic product variable, government expenditure change variable) and other variables (relative prices of food and energy) to explain the changes in aggregate supply that may affect inflation in the short run. The author proposed the general model as follows:

$$\dot{P}_t = g_0 + \sum_{s=0}^{n} g_1 \dot{M}_{t-s} + \sum_{s=0}^{m} g_2 \dot{G}_{t-s} + \sum_{s=0}^{k} g_3 SS_{t-s} \qquad (1.12)$$

In the equation above, inflation is determined by the growth rate of money supply at the current period and in the past period (M), government expenditure (G), and supply shocks (SS), and it is reflected in the relative food price change.

Chhibber (1991) and Nguyen Thi Thu Hang (2013), inflation (π) is expressed the change in price level logP, affected by commodity price (log P^T), noncommercial goods price (logP^N) and controlling price (LogP^c). This relationship can be expressed as belows:

$$\log P = \alpha_1 \log P^T + \alpha_2 \log P^N + (1 - \alpha_1 - \alpha_2)\log P^C \qquad (1.13)$$

Where $\alpha_1 + \alpha_2 < 1$.

As core inflation has eliminated the prices of some controlled goods such as electricity, water, transportation, petrols and postal services, we have the following equation:

$$\log P_{core} = \alpha_1 \log P^T + \alpha_2 \log P^N \qquad (1.14)$$

Where $\alpha_1 + \alpha_2 < 1$.

The changes in tradable goods prices depend on the changes in world price $\log P^f$ and the changes in exchange rate logE. Tradable goods prices can be modelled through purchasing power parity PPP and it is called the impact channel of tradable goods prices on core inflation.

$$\log P^T = \log P^f + \log E \qquad (1.15)$$

The author assumed that non-tradable goods market operates in the same direction with the national maket. Then, non-tradable goods prices depend on aggregate supply and aggregate demand. In the supply side, the changes of non-tradable goods denpend on intermediate cost IC (including imported intermediate goods and domestic products), cost of labor (measurement by wage W) and the increase of price from supply side (MU) caused by imperfect market. The changes in imported intermediate good prices obey the PPP law in equation (1.14). These factors are called cost-push factors that have impacts on the domestic core inflation.

In demand side, aggregate demand depends on income (Y), interest rate (r), tax on assets and government expenditure. The changes in these factors may cause excess

demand and affect price level, and they can be considered as the demand pull factors of core inflation.

So, the equation shows the channel of noncommercial good can be written as below:

$$\log P^N = \beta_1 MU + \beta_2 \log IC + \beta_3 \log W \qquad (1.16)s$$

The changes in general price depend on the change in price increase from the supply side and the excess demand in the economy, and the excess demand itself affect the real money amount in the domestic currency market. The changes in any fator in equation (1.16) above in the production process will be reflected in the price level of the producer. Because of this, the change in non-tradable goods can be modelled by the change in producer's price. On the other hand, as the monetary market has large influence on inflation, the author has concretized the increase in price from supply side MU. The author uses excess real money balances (EMB) as a partial proxy for the price increase in non-tradable commodity prices.

$$MU = MU^S + EMB = MU^S + \log(\frac{M^S}{P}) - \log(\frac{M^d}{P})$$

$$= MU^S + \log(\frac{M^S}{P_{-1}}) - \log(\frac{M^d}{P}) - \log P + \log P_{-1} \qquad (1.17)$$

Where, MU^S is the increase of producer price or price increase from supply side, M^S is money supply, M^d is money demand and P_{-1} is the price of the previous period.

In economic theory, money demand depends on real income Y, interest rate r, and the changes in expected inflation P^e. So, money demand function can be writing as follow:

$$\log(\frac{M^d}{P}) = \gamma_0 + \gamma_1 \log Y + \gamma_2 \log r + \gamma_3 \log P^e \qquad (1.18)$$

From equations (1.14) to (1.18), the function of core inflation (defining the logarithm function is Δ) take the form as following:

$$\Delta P_{core} = F(\Delta P^f, \Delta E, \Delta IC, \Delta W, \Delta M^S, \Delta Y, \Delta r, \Delta P^e_{core}) \qquad (1.19)$$

The collection of resources data is difficult as the data on the cost of imported inputs are not availale, so the author suggested the function of core inflation as follow:

$$\Delta P_{core} = F(\Delta P^f, \Delta E, \Delta M^s, \Delta W, \Delta Y, \Delta r, \Delta P^e_{core}) \qquad (1.20)$$

1.1.3.2 Theoretical basis for building core inflation forecast models

Based on Stock and Watson (2008), the author devided three group models to forecast core inflation, including: (1) Forecast based on past information; (2) Forecast based on measuring; (3) Combination forecast model.

(1) Forecast based on the past information: Autoregressive models

- ARIMA model of forecasts h random steps ahead

$$\pi^h_{t+h} - \pi_t = c^h + \gamma^h(L)\Delta\pi_t + u^h_{t+h} \qquad (1.21)$$

Where π is inflation, c^h is constant, $\gamma^h(L)$ is lag operator, u^h_{t+h} is forecast error of h random steps.

Lag is defined by Aikaike information critarion (AIC) from 1 to 6 in this forecast model.

IGARCH model

$$\pi_t = \mu_t + u_t$$

$$u_t = \sigma_t \varepsilon_t$$

$$\sigma^2_t = \alpha_0 + \alpha_1 u^2_{t-1} + \alpha_2 u^2_{t-2} + \ldots + \alpha_p u^2_{t-p} + \beta_1 \sigma^2_{t-1} + \beta_2 \sigma^2_{t-2} + \ldots + \beta_q \sigma^2_{t-q}$$

$$\alpha_0 + \sum_{i=1}^{p} \alpha_i u^2_{t-i} + \sum_{j=1}^{q} \sigma^2_{t-j}$$

Where, $\alpha_0 > 0; \alpha_i \geq 0; \beta_j \geq 0; \sum_{i=1}^{\max(p;q)} (\alpha_i + \beta_i) < 1$

ε_t is standard distribution; $E\varepsilon_t = 0; Var\varepsilon_t = 1$

If p>q, β_i=0 with i>q

If q>p, α_i = 0 with i>p

So, the variance of the model depends on the past shock and the variance in the previous period.

IGARCH model is built based on the assumption that the parameters in GARCH model are restricted to be equal to 1 and eliminating constant c in varicance function of residual. Then,

$$\sigma^2_i = \sum_{i=1}^{p} \alpha_i u^2_{i-1} + \sum_{j=1}^{p} \beta_i \sigma^2_{i-j}$$

with

$$\sum_{i=1}^{p} \alpha_i + \sum_{i=1}^{p} \beta_i = 1$$

Forecast h random steps ahead of the variation:

$$\sigma^2_{i+h} = \alpha_0 + \sum_{i=1}^{p} \alpha_i u^2_{i+h-i} + \sum_{j=1}^{p} \beta_j \sigma^2_{i+h-j}$$

Forecast h random steps ahead of core inflation:

$$\pi_{t+h} = \dot{\mu} + \sigma^2_{i+h}$$

Where, $\dot{\mu}$ is the average value of the series.

Markov Switching model

Assume that the core inflation (πt) is a process that depends on an unobserved discrete status variable, st. M is the probability of occurring the mechanisms and status mechanism m in period t when s_t = m with m=1,…,M.

$\pi_t = \mu_t(m) + \sigma(m)€_t$

When s_t = m and $€_t$ is under the standard distribution iid; $\sigma(m) = \sigma_m$ is the mechanisim that depends on μ_t (m) and it is expressed as below:

$\mu_t(m) = X_t'\beta_m + Z_t'\gamma$

Where, βm , γ , kX and kZ are coefficient vectors. Xt is the switching mechanism with βm and Zt obeying the invariant mechanism with coefficients γ.

Forecast h steps ahead by using *Markov Switching model*

$\pi_{t+h} = \mu_{t+h}(m) + \sigma(m)€_{t+h}$

(1) Forecast based on measurement :

This method is based on forecasting Phillips curve that use the variables such as unemployment rate, output gap, output growth and other variables.

In which, 02 core inflation forecasting models are suggested by Gordon in 1982 and in 1990, and the model in 1990 is called a triangle model. Gordon model (1982) is autoregressive distributed lag model and Gordon model (1990) is a Stepwise function.

Gordon (1990) has adjusted his model in 1982. In 1990, the author focused on the adjustments to select the lags of unemployment rate. In 1998, the author completed the model that was suggested in 1990. The author showed that the supply shocks are unemplotment rate, food and energy price inflation, and import of inflation . In this model, the author droped some supply shocks as nominated in the model above, and so this model is mainly based on autoregressive distributed lag model.

Phillips model forecast h steps ahead for core inflation prosposed by Gordon as following:

$$\pi^h_{t+h} - \pi_t = \mu^h + \alpha^h(\mathrm{L})\Delta\pi_t + \beta^h(L)u_t + v^h_{t+h}$$

In which, $\alpha^h(\mathrm{L})$ and $\beta^h(\mathrm{L})$ are selected based on AIC criteria with max lag 4.

(2) Combination forecasting model

a) Defination

Assume the given forecast value π_{t+h} (forecast h steps ahead at time t of time series {πt} and its real values π^*_{t+h}).Evaluate the optimization and accuracy of single forecasts

- *Assess the optimization* of forecasts: The term $e_{t+h} = \pi_{t+h} - \pi^*_{t+h}$ is the error of forecasting h steps ahead at time t. In practice, to test the optimization of forecasts, the following regression equations are used to be tested:

$e_{t+h} = \alpha_0 + \alpha_1\pi_{t+h} + u_t$. Forecast is optimization if (α_0, α_1) = (0,0).

The regression equation above can be written as following:

$\pi_{t+h} = \beta_0 + \beta_1\pi^*_{t+h} + u_t$. Forecast is optimization if (β_0, β_1) = (0,1).

Measure the accuracy of forecasts: To evaluate the accuracy of forecasts, what can be considered is the percentage of absolute error to real value. However, what is used more often is the mean squared error $MSE = \frac{1}{T}\sum_{t=1}^{T} e^2_{t+k,t}$, in which $e_{t+k,t}$ is the error of forecasting k steps ahead at time t to evaluate the accuracy of forecast. The forecast value is more accurate if MSE is smaller.

The square root of the mean squared error $RMSE = \sqrt{MSE}$ is also often used instead of MSE.

(3) Forecast encompassing test

Assume π^a_{t+h} and π^b_{t+h} are forecasting results of π_{t+h} from two forecasting model a and b respectively. The question is what forecast among those two forecasts covers the useful information for the forecast of π_{t+h}? To answer this question, the forecast encompassing test can be used. In other words, forecast encompassing test is used to determine whether one forecast contains the information of the other, and if the answer is yes, this forecast is said to encompass the other forecast.

The method to conduct the forecast encompassing test is as following: Estimte the regression model:

$$\pi_{t+h} = \beta_a\pi^a_{t+h} + \beta_b\pi^b_{t+h} + \varepsilon_{t+h}. \quad (1.22)$$

If (β_a, β_b) = (1,0) the forecasting model a is considered to contain the forecasting model b (while the model b is considered to contain the useless information) and if (β_a, β_b) = (0,1), the forecast model b contains the model a.

With respect to the pairs of (β_a, β_b) that were different from the two cases mentioned above, what model has higher absolute value of coefficient is considered to contain more information, and in this case both models contain valuable information. In this case, the combination of these two forecasts into one forecast that contain the information of two forecasting models should be raised.

b) The Algorithm of Forecast Encompassing Test

Assuming that there are n models to forecast an economic variable. The idea of this algorithm is to compare all those forcasting results by using forecast encompassing test to eliminate the models that are encompassed in other models. These comparisons were made for each pair by encompassing test and the final result of the algorithm is to eliminate the models that are are encompassed by some other model.

c) Combination forecasting

This thesis only introduces the weighted method that it is combined with time variant.

Assuming that there are n forecasting results of π for h steps ahead, with i=1,…,n.

The Encompassing method is defined by the estimation equation as follow:

$$\pi^*_{t+h} = (\beta^0_0 + \beta^1_0 TIME) + (\beta^0_1 + \beta^1_1 TIME)\pi^1_{t+h} + (\beta^0_2 + \beta^1_2 TIME)\pi^2_{t+h} + ... + (\beta^0_n + \beta^1_n TIME)\pi^n_{t+h} + \varepsilon_{t+h}$$

Where π^*_{t+h} is the forecasting value that it is combinated from n forecasting results.

Where, TIME is time variable.

It is possible to assess the importance of time variant for forecasting results by testing the value and significance level of the estimates of β^1_i, with i=0,…,n.

1.1.4.1. Review the empirical research results on core inflation analysis and forecast

1.1. Building the core inflation indicator for Vietnam

1.1.1. International experience in building the core inflation indicator

1.1.2. Vietnam's experience in building the core inflation indicator

1.1.3. Developing the core inflation in Vietnam

Conclusion of chapter 1

CHAPTER 2
THE CONTEXT OF CORE INFLATION AND MACROECONOMIC IN VIETNAM IN PERIOD OF 2000-2015

2.1. The socio economic context

Along with the progress of economic development, Vietnam has implemented and developed many macroeconomic policies to promote economic growth and macroeconomic stability. Especially, after the high inflation years of 2008 and 2011, the top target of Vietnamese economy has been set on macroeconomic stability, which is specified in the socio-economic development plans.

Vietnamese economy has experienced several tough periods: slowdown growth due to the effects of the Asian financial crisis in 1998-1999, the global financial crisis in 2007-2009 and the stagnation period from 2010 up to now. In the periods of 2000-2005 and 2006-2010, the leading goal is to maintain the momentum of growth. However, after 2011, the economy has shown many signs of instability and imbalance. Thus, macro stability is considered the top priority in policy administration. Recent fiscal and monetary policy developments in Vietnam can be summarized as follows: the loosening of the monetary policy in 2007; Fiscal and monetary tightening to control inflation in 2008, demand stimulus in 2009; tight and flexible fiscal and monetary policies to control inflation, stabilize the macro-economy and ensure the growth in the period 2010-2012 and continue to give priority to curbing inflation and stabilizing the macroeconomic situation from 2013 period up to now.

2.2. The contexxt of core inflation and macroeconomic in period of 2000-2015

Vietnam's economy has been transforming from 1990 up to now, marking the success of the transition from a centrally planned to a market economy. Economic growth has been relatively high compared to other countries in the region, and per capita income has risen, promoting Vietnam from a low-income developing country to a middle-income country. The economic structure has made positive changes in the direction of industrialization and modernization, linking production with the market. Vietnam has also become one of the strongest exporters of agricultural products. The high growth rate makes the situation of inflation in Vietnam more complicated. Looking at the trend of fluctuations in inflation from 2000 to 2015, it can be seen that Vietnam's inflation is characterized by strong fluctuations with high fluctuation bands; there were years of sudden increase in inflation compared to previous years (as in 2008 and 20111); Short-term cyclicality (two years of high inflation, one year of low inflation).

2.3. Conlusion of chapter 2

CHAPTER 3
DEVELOPING THE MODELS TO ANALYSE AND FORECAST CORE INFLATION IN VIETNAM

3.1. Data description

3.2. Developing the models to analyse and forecast the core inflation in Vietnam

3.2.1. Developing the models to analyse the core inflation

3.2.1.1. Phillips curve model

+ In this part, the author develops the model for analysing core inflation in Vietnamese economy based on the theory of Keynesian economics. In chapter 1, the author showed that Phillips curve model is used to analyze the core inflation in Vietnam as following:

$$corecpi_t = c + \sum_{i=1}^{4} \alpha_i corecpi_{t-i} + \sum_{i=1}^{4} \beta_i GAP_{t-i} + \sum_{i=1}^{4} SS_{dt} + \sum_{i=1}^{4} SS_{st} + u_t$$

In which, corecpi is core inflation, i is a lag level of variables

GAP is output gap

SS_{dt} are demand shocks, and GDP is selected a proxy for demand shock.

SS_{st} are supply shocks, and world oil price (POIL) is selected a proxy for supply shock.

Estimation results of Phillips curve model suggest the conclusions on the impact of some macroeconomic factors on core inflation as follows:

R^2 coefficient is equal to 0.2911, which indicates that the explainatory variables can explain 39.11% the changing in core inflation.

Core inflation is effected by its lag or expected inflation. So, the government solutions to curb inflation need time for the consumers to change the expected inflation.

GAP variable also has effect on core inflation, which shows that the heating economic growth has impact on the core inflation. This is in line with the real situation in Vietnam as shown in the analysis above, where core inflation in Vietnam depends on the energy price index, investment and money supply in the economy, moreover rapid growth rate also has a certain impact on core inflation. Specifically, if the GAP variable increases 1 percentage point at lag periods of 2 and 4, the core inflation will decrease and increase by 0.0362 percentage points and 0.0286 percentage points, respectively. The above results showed that when the growth rate of the Vietnamese economy gets closer to the potential output, the pressure on core inflation will decrease. And to curb inflation, fiscal policy remains an appropriate tool.

Demand factors: Proxy for demand shock is wage; if wage goes up, core inflation goes up, and the impact coefficient of wage (W) on the core inflation is 0.0846. This implies that core inflation in the recent period has been influenced by the monetary factors.

Supply shock: Crude oil price is a proxy variable for supply shock in the model. If crude oil price goes up, core inflation goes up. The impact coefficient of crude oil price on the core inflation is 0.00276>0 and is statistically significant at 1%, so the increaseof crude oil price has an impact on core inflation.

3.2.1.2. Regression model by using stepwise regression

Assume that Y is depnend varibable; X is a set of independent variables. The econometric model to analyze the impact of independent variables on dependent variable takes the form as following:

$CORECPI = a_1 + a_2X$

Where CORECPI is core inflation

a_1 and a_2 are intercept and impact coefficient of set variables X on CORECPI, respectively.

X is a set of variables including: GDP, GC, HC, W, real money supply M2, ER, IR, CPINN, CPINL, CPILTTP, CSGNK.

The Estimated results show that:

- According to this method, CPINL, M2, CPINN, IR, GC and W variables are selected to introduce into model and ER, CPILTTP and HC varibles are eliminated. So, the analysis result of the determinants of core inflation in Vietnam show that the factors including CPINL, M2, CPINN, IR, GC and W have impacts on core inflation. Meanwhile, the other factors including ER, CPILTTP and HC have no effects on core inflation.

The effects of variables on core inflation by using this method show that CPINL is ranked as the most important factor that has effect on core inflation. CPINL is calculated as the price of residential electricity, gas and other fuels, and fuels, which can be considered the input costs for the production process. It can be interpreted that the increase in CPINL has the cost push effect on core inflation.

The CPINN coefficicent is negative, indicating that the price increase of this commodity group will reduce the core inflation. Specifically, the CPINN is calculated from the commodity group at sub-class 3, including health services and education services, which are essential for Vietnamese economy. Thus, the increase in prices of these groups will force people to pay more for this group and reduce spending on other groups. This makes the demand for other items decrease and lead to lower prices.

- The coefficient of IR is negative, meaning that when the central bank adjusts the basic interest rate, it can have a positive impact on curbing inflation or implementing the inflation target of Vietnam.

- All variables including M2, GC, and W have positive coefficients, i.e. the increase in these variables will also increase the core inflation.

3.2.1.3. Vector error correction model VECM

Based on the theory in chapter I, the author develops the monetarist-based VECM model to analyze core inflation as follow:

$\Delta corecpi = f(\Delta poil, \Delta M2, \Delta IR, \Delta CSGNK, \Delta W, \Delta ER, \Delta corecpi^e)$

Where the variables are defined as above and Δ is the changes in variables.

Analysis of the response of core inflation to shocks:

a) Reponse of core inflation to expected inflation shock

The author considers the response of core inflation to its shock as the shock of expected inflation. The results show that if the expected core inflation goes up, the core inflation will go up in next period. However, this shock can lead to the highest increase in core inflation at the fourth period, and this effect decreases slightly after that.

b) Reponse of core inflation to money supply and interest rate shocks

This thesis examines the real suppy in the economy, meaning that the author eliminated the inflation in money supply by dividing nominal money supply by GDP deflator. The results show that the shock of increasing money affects core inflation, but not much. The shock of money supply have lagged and discontinuous effect on core inflation. Specially, the shock of money supply has highest effect in the second period and there is no impact in the fifth and sixfth periods. From the seventh period onwards, money supply shows a clearer impact on the core inflation. The impact of money supply can be seen clearly in the period 2005-2007 with average increasing of the money supply around 26,6% and the ratio of money supply to GDP at 100.6% in 2007, and this is one cause of high inflation in 2008.

Core inflation is also relatively sensitive to the shock in average interbank lending interest rate. However, the shock of interest rates does not immediately affect basic inflation. In particular, the interest rate shock has only less impact in the first period, clearer in the second period and then stronger in subsequent periods. This suggests that the State bank's interest rate policy also has an impact on controlling inflation in the economy. In the years of high inflation in Vietnam, the State bank used interest rate as a major tool in controlling inflation. However, due to issues related to policy implementation and policy issuance in Vietnam, the effect of money policies has lags.

c) Reponse of core inflation to exchange rate shock

The results show that core inflation responses to the exchange rate shock but not much. The increasing of exchange rate could make the core inflation increase and this effect can be extended to the next periods. This result is consistent with the research on inflation by Nguyen Thi Hang and Nguyen Duc Thanh (2013). However, the study of Nguyen Lien Hoa and Trang Dang Dung (2013) using monthly data in the period from 1/2001-6/2011 gives a different result, with the exchange rate effect lasting only from period 4 to 12 and then decreases to 0. The author explains the difference in research results by the differences in the studied period. Particularly, in recent years, the exchange rate has been adjusted by the State bank to be more flexible rather than being rigid as before.

d) Reponse of core inflation to supply shocks

The author uses the import price index as a proxy for supply shock in this thesis. The results show that this shock does not lead to an increase in core inflation, while lowering the core inflation in the second period. This is caused by the import goods structure: the import price index includes intermediate goods' prices and comsumer goods' price, while the imported intermediate goods for domestic production account for as much as over 70% (65% in 2015). Because of this, the import good price shock affects the core inflation with some lags, which are 4 lags in this case.

e) Reponse of core inflation to demand shock

The author used total wage of the economy as a proxy for a demand shock. The results show that this shock could have strong and immediate impact on core inflation. Besides, the impact of wage shock on core inflation can be prolonged and continuous, as the increase in wages leads to the increase in demand for goods in the economy, which in turn leads to a rise in core inflation.

3.2.2. Developing the application models for forecasting core inflation

3.2.2.1. ARIMA model

3.2.2.2. GARCH model

+Develop and estimation the model

Base on the theory of GARCH model, GARCH model used for analysis and forecasting for Vietnam can be written as follow:

$CORECPI_t = a_0 + b_i * CORECPI(-i) + e_t$ (3.1)

$e_t | I_{t-1} \sim N(0, h_t)$ (3.2)

$h_t = w + ce^2_{t-1} + dh_{t-1}$ (3.3)

$e_t = \rho_i e_{t-i} + \varepsilon$

Ở đây, I_{t-1} là tổng hợp thông tin của các nhân tố ảnh hưởng trong thời kỳ trễ t-1, h_t là phương sai của e_t, e_t – phần sai số của mô hình

Where, I_{t-1} is the synthesize information of factor effects in the lag period t-1, h_t is the variance of e_t, and e_t is the error in model.

In this thesis, the auhor used IGARCH model, this is a special case of GARCH model to calculate the volatility of exchange rate. So, the equation (3.3) can be written as following:

$h_t = \eta e^2_{t-1} + \theta h_{t-1}$ (3.4) với $\eta + \theta = 1$

3.2.2.3. Morkov switching model

The author estimated Morkov switching model for the data series on core inflation in Vietnam in period from I/2001 to IV/20015 by using Morkov switching model AR(4). To make it more easy to estimate the model, the author set d1=d(Log(corecpi)).

The author eliminated AR that is not statistical significance in model.

3.2.2.4. Cobination forecasting model

In order to get more accurate forecast, the author used combination forecasting method mentioned above with the expectation of more accurate forecasting results.

Specially, the author used the encompassing test and combination method with time-variant weight.

Then, the function of core inflation is developed as below:

CORECPI=f(F1, F2, F3, T*F1, T*F2, T*F3)

Where

T is time variable

F1 is the forecasting result of ARIMA model

F2 is the forecasting result of GARCH model

F3 is the forecasting result of Markov model

Tác giả thực hiện ước ước lượng và loại bỏ các biến số không có ý nghĩa thống kê trong mô hình, kết quả ước lượng mô hình dạng rút gọn thu được như bên dưới:

The author implemented the estimation and eliminated the statistically insignificant varibles in the model.

The results are as below:

The forcasting values of ARIMA, GARCH and MARKOV model are statistically significant.

The time-variant weights are statistical significance in the model when ARIMA model and MAROV model are combined, which means that the forecasting results will be improved significantly compared with the results of the original forecasting models.

3.2.3. Comparing the forecasting results of the sample between models

3.2.4. Producing out of sample forecast results

3.3. Conclusion of chapter 3

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusion

The dissertation has focused on the theoretical and empirical aspects of core inflation in Vietnam as well as in the world. The author provides the most comprehensive overview of core inflation in Vietnam's macroeconomic context for the period 2000 - 2015. Through the analysis of the current situation, the author has indicated the periods of high inflation of Vietnam and the linkages of core inflation in implementing the macroeconomic policies. Based on theoretical models, the author has also developed and proposed the models for analyzing and forecasting core inflation in Vietnam. The specific contents of the thesis are as follows:

This thesis has presented a systematic and scientific view on inflation and core inflation based on the theoretical and practical basis. Based on that, the author divided the core inflation analysis models into the Keynesian-based models and the monetarist-based models. With respect to the forecasting models, the authors divided into three groups: (1) Forecasting based on past information, (2) forecasting based on measuring and (3) combination forecasting methods. The author also synthesized the empirical researchs on the basic core inflation calculatio method, the methods to analyse and forecast inflation as well as core inflation in Vietnam and in the world.

This thesis has presented in a general and systematic way the context of core inflation. In particular, the author has outlined the policy system in Vietnam which is directly related to inflation as well as core inflation in recent years. Besides, through the analysis of the causes of core inflation with practical data, the thesis indicated that Vietnam's core inflation is also affected by the factors including inflation expectation, the supply side factors, and the demand side and currency factors. In addition, the opening up of Vietnamese economy in recent years has also caused negative impact from the external factors on Vietnam's core inflation.

The thesis was based on the methodology of Clark (2001) to demonstrate the relevance of core inflation based on the criteria as following*:*

- Core inflation is stable and less volatile than inflation

- Over a long period of time, the average core inflation rate is commensurate with the average inflation rate and there is no systematic deviation between them.

- Forecast inflation in advance through core inflation

- Thereby, the thesis proposes to use core inflation as the inflation after eliminating 13 commodities in sub-class 3 including rice, wheat and cereals, meat, poultry, eggs, fresh seafood, fresh, dried and processed vegetables, fresh and processed fruits, residential electricity, gas and other fuels, fuels, medical services, education services.

To analyze core inflation, the author used the Phillips curve model, stepwise regression model and VECM model. In general, the Phillips curve model and the VECM models show similar results, i.e. the expectation of core inflation has a strong impact on the core inflation in the current period. Besides, supply and demand side

factors as well as monetary factors also have an impact on core inflation. However, the impact from monetary factors on core inflation is not large. Meanwhile, stepwise regression model indicated that CPINL is the most important factor, which implies that CPINL price should be focused in controlling the core inflation. The impact of the CPINL price on core inflation shows that the cross-effects or spillover effects from energy prices to other prices in the Vietnamese economy are quite significant in the past time.

Models are used to forecast core inflation including: ARIMA model, GARCH model and MARKOV model. Base on RMSE, MAE and MAPE criteria, this thesis concludes that the forecasting results of ARIMA model are more accurrate than other models. The reason is that core inflation is considered a relatively stable inflation in the long run, as the shock factors and other fluctuating factors in the inflation index are eliminated. The thesis applies the combination forecasting method with linear time trend and its results to show that the forecast quality has improved considerably in terms of RMSE criterion.

1. Recommendations

Vietnam’s government has made important efforts to control inflation in Vietnam. In particular, the State Bank has issued the legal documents for regulating inflation through the tools such as exchange rates, money supply and interest rates timely and effectively. As a result, the macroeconomic instability and high inflation has disappeared and the macroeconomic situation has bee gradually stabilized. However, the performance and implementation of policies must be consistent with changes in the dosmestic market and international market to achieve the economic goals, especially the inflation target.

The analyses above show that core inflation plays an important role in policymaking for a number of countries, especially the core inflation plays an important role in making good prediction for inflation in the economy. In recent years, Vietnam has been setting up inflation targeting to run and implement monetary policy. So, the State bank can base on core inflation to make forecast for inflation and thereby adjust the monetary policy in a reasonable way to achieve the inflation targeting of the economy.

The results of the econometric models show that core inflation in the past time has effects on core inflation in current and future period. This means that the government polies on core inflation in the past time hhave strong effects on core inflation in the current time. Thus, the implementation of government policies should be consistent, well-aligned and clearly strategic.

Vietnam's core inflation is mainly due to internal factors rather than external factors such as world prices. Therefore, the controlling of inflation targeting in Vietnam should focus more on factors that directly affect core inflation, and so, inspect and consider the effects of factors on inflation before implementing policies. For the monetary policy, the State Bank must closely monitor the macroeconomic

developments in order to control flexibly and synchronously the monetary policy instruments.

The State bank should continue to manage the exchange rate appropriately, implement the consitstent solutions and monetary policy tools to ensure the value of VND and contributes to control the domestic inflation. Besides, the State Bank should continue to control the lending activities in foreign currency strictly, in line with the policy of anti-dollarization of the economy. In addition, the State Bank needs to closely monitor the changes in the macro-economy, the developments in the domestic and international monetary markets to implement the suitable solutions and tools to regulate and stabilize the market.

An important finding in the thesis is the strong cross-effects between the price increases of the commodities in the CPI basket. Specifically, although energy prices have been excluded from core inflation, the increase in its price still increases core inflation. This is a spillover effect between prices, particularly rising energy prices that will drag on the prices of some energy-using items to produce the products. Thus, Government must have a combination of fiscal policy and monetary policy in the administration of policy to achieve the inflation targeting. More emphasis should be given to the factors that affect to core inflation, especially the energy price indexes in policy management, in order to provide more appropriate policy solutions.

Money supply and interest rates also have an impact on inflation in the economy. The control of inflation must closely control the money supply, especially the gradual reduction of cash payments in the economy. The interest rate tools in the past to curb inflation of the State Bank are relatively effective. However, it is necessary to maintain stable interest rates and stick to market movements.

Salaries are an important element in the economy. Salary reform is always a hot issue for Vietnamese economy. Salaries can help increase productivity, increase consumption leading to growth but also increase inflation in the economy. Vietnam's salary system has had many changes in the past years, though the salaries have not been calculated adequatelly to produce the highest productivity. Therefore, it is necessary to consider and propose reasonable salary policies to optimize productivity and inflation in the economy depending on the economic context of each period.

Policy delay is always problem in the enforcement of policies in Vietnam. Results of the models show lag effects of policy variables on core inflation. Thus, the State bank needs consider the lag of policies and be active in policy management.