Consequences of Inconsistent Policy Implementation in a Developing Country

Le Thanh Ha[1]

Abstract: The study employs SMM with Vietnamese data on the framework of New Keynesian model with Calvo price setting, drifting trend inflation and without the full price indexation assumption to document vital information and economic properties of a typical developing country. Following, the consequences of policy implementation inconsistency on the real economy reflected by the shock to trend inflation are investigated throughout the analysis of the impulse response function, the variance decomposition and welfare, welfare cost and inefficiency sources computation. By the impulse response function, these shocks negatively impact the economy by distorting components and environment leading the long-term economic development. The price dispersion also illustrated a persistently increasing trend, extending the wedge between labor supply and output. Further, the variance decomposition emphasizes the essential role of this shock in explaining variations of the economy, especially in the long-term and when the central bank set a high inflation target. Finally, a high fluctuation and volatility of the economy were recognized when the central bank set the constant positive inflation target, and the problem gets worse when the inconsistent policy implementation happens. The study on welfare's issues shows that the consequences of policy implementation inconsistency were more severe in the developing countries and the cost comes directly from a combination of a lower consumption and a higher working hours. Among all inefficiency sources, the un-optimal inflation target signifies this cost the most considerably while the monopolistic accounts for the modest proportion. And it would be more efficient to compensate the society' loss by improving their consumptions.

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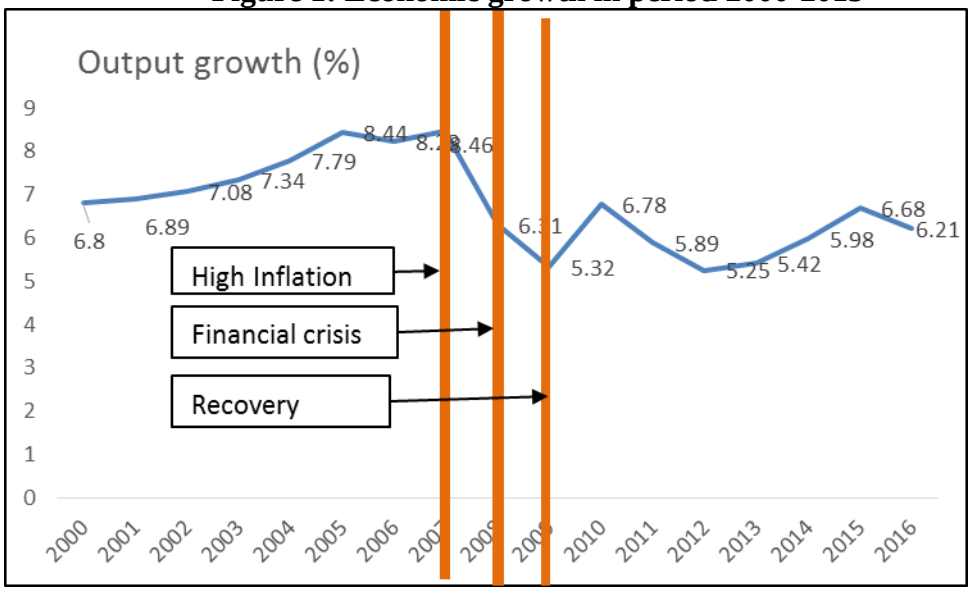
[1] PhD Candidate at the National Institute for Policy Studies (GRIPS), Japan
Lecturer in Economics Department at National Economics University
Email: thanhha9289.neu.kth49@gmail.com
Cell phone: +81-9096839290

1. Introduction

Although Vietnam has started experiencing the period of stable inflation in recent years, the memory of three negative external shocks in period 1996-2015 still looms large in the minds of economists and researchers. Three shocks on the economy are Asian financial crisis in 1997, the upsurge in the price of commodity and gasoline on the world market in 1997, and the global financial crisis in 2008, which bring about severe consequences. The shock from international petroleum prices rocketing in 2008 has damped the economy more seriously and pushed up the inflation. Negative signs in the global market, which are anticipated to cause the similar external shocks have generated concerns regarding the possibility of sustained augmentation in future inflation and the effectiveness of policies to deal with these shocks.

Figure 1: Economic growth in period 2000-2015



Source: General Statistics Office of Vietnam

The lessons from previous crisis indicate weaknesses of policy implementation performed by the State Bank of Vietnam (SBV). It can be seen that the monetary policy has always pursued the objective of stabilizing currency value, curbing inflation, and contributing to the economic development, which was too widely-targeted and lack of specification. SBV did not clearly specify the ultimate objective, thus the monetary policy management had some difficulties, especially when there is a tradeoff between the economic growth and the inflation control. Furthermore, the policy implementation in Vietnam, which is a combination of the monetary policy and fiscal policy has still been inappropriate in the sense that it is used excessively, thus it reacts and become policy shocks. For example, to face the Asian financial crisis in 1997, the government implemented stimulus policies, which led the economy to exceed potential growth and stimulate inflation. As the result, the increase of price level was triggered and reached a peak in 2007 with two digitals. The combination of the increase in gasoline prices in the global market and the loose monetary policy and expansionary fiscal policy for a long time ago had pushed the inflation up to 23% in 2008. The tight monetary policy and narrow fiscal policy was subsequently implemented to

encounter the shocks. However, these policies caused interest rates to rocket, which distorted the economy by freezing the stock market, real estate market and financial market. When the signs of economic recovery appeared in early 2009, a loose monetary policy and expansionary fiscal policy was launched to stimulate the economy from the negative impact of the global financial crisis. Exceedingly implementing the stimulus policy again increased inflation rate significantly in 2010. Figure 1 illustrates the fact that when stimulus policies were implemented, the economy was recovered but the inflation augmented at the same time.

Table 1: Monetary policy targets and performance in period 2000-2015

		2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Inflation	**Target**	6	<5	3-4	<5	<5	<6.5	<8	<8
	Perform	-1.7	-0.4	3.8	3.2	7.8	8.3	7.4	8.3
Output	**Target**	5.5-6	7.5-8	7-7.3	7-7.5	7.5-8	8.5	8	8.2-8.5
	Perform	6.8	6.89	7.08	7.34	7.79	8.44	8.23	8.46
		2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Inflation	**Target**	<10	<15	7-8	<7	<10	8	7	5
	Perform	23.1	7.1	8.9	18.7	9.1	6.59	4.09	0.63
Output	**Target**	8.5-9	5	6.5					
	Perform	6.31	5.32	6.78					

Source: Author's computation from the data of SBV, and Annual Report of SBV

The third weakness of Vietnamese policy implementation was the authority lacked a commitment to consistently purse a fixed inflation target. In particular, the State Bank's monetary policy management aiming at curbing inflation and pushing economic growth toward targets changed dramatically even in the short-run. Table 1 reports these changes in monetary policy targets as well as difficulties to achieve them. For example, the inflation targets were set at under 5 percent and 6.5 percent in 2004 and 2006 but the actual numbers were at 7.8 and 8.3, respectively. The similar evidence happened in 2010 and 2011, which the actual performances were higher the targets. By contrast, the output growth seemed to engage to its targets. Mostly, there was no big differences between targets set and actual percent. Moreover, setting these targets was relatively passive in the sense that the central bank had not pursued the long-term objectives. Instead, these targets were set correspondingly to changes of economic condition. Table 2 provides evidence of the passive policy implementation in Vietnam.

These weaknesses have raised concerns relating to the possibility of a sustained increase in inflation rates. Many researchers have employed a highly persistent trend inflation process to model the sustained increase of inflation during the difficult periods, such as the Recession or the Financial Crisis in 2008. This process could be interpreted as slowly-moving implicit inflation target and any sudden change in the target can be captured as shocks affecting the economy to investigate its implication for a distinct aspect of macroeconomic dynamics. Kozicki and Tinsley (2001) had an early contribution when they explored the implication of time-varying trend inflation for the term structure of interest rates. The impacts of shifting trend inflation shock on output and overall inflation were analyzed by Ireland (2007). While Cogley and Sbordone (2008) examined the effects of drifting trend inflation

on the estimated parameters, implications for the predictability of inflation were exploited by Sogley, Primiceri, and Sargent (2009). However, these studies only performed in the advanced economy and many implications relating welfare issues and inefficiency source derivation have still kept silent in the literature.

This paper fills the gap by studying the implications of drifting trend inflation for welfare and the derived efficiency sources in a case of developing country, Vietnam. The main purpose of this study is to quantify how the policy inconsistency-interpreted as the central banks pursue the short-term and un-optimal inflation target[2] affects the economy to cause the welfare cost. Further, the inadequate implementation of monetary and fiscal policy dampens this cost more seriously. In the spirt of this paper, the trend inflation[3] behaves as a shock and the analysis is conducted in a standard New-Keynesian model with a Calvo price setting. The greatest challenge for researchers who want to exploit the implication of shifting trend inflation in the developing areas is a lack of vital information and economic properties, as well as an unavailability and inconsistency of micro-macro data. Hence, the first task of this study is to estimate some important parameters by employing the Simulated Method of Moment (SMM) with data in Vietnam for preparation. It is worth noticing that although many authors, namely Ascari and Sbordone (2014), Cogley et al (2009), Fuhrer and Moore (2004), Fuhrer (2009) have consensus on the high persistence property of a high persistence property of inflation, a discussion over its magnitude has still remained, especially in an emerging area. Therefore, this paper studies the evolution, dynamics and persistence for trend inflation. The Bayesian method is then considered as a good choice to obtain the estimated parameters in Vietnam.

Following, this paper deals with specific research questions. First, I compare the welfare of a developing economy with a constant positive inflation target in which the variance of innovations to the trend inflation process is zero and an economy with the shifting trend inflation in which the variance is positive. In other words, what are differences in the welfare of a developing country with and without the policy implementation inconsistency? Second, by empirical evidence in Vietnam, I derive the three inefficiency sources, including the inappropriate policy implementation (from the fiscal policy), the monopolistic competition, and un-optimal inflation target and measure how these sources magnify the cost. Finally, I introduce two policies[4] to correct this cost, namely the consumption compensation policy (CCP) and the labor compensation policy (LCP). This study seeks answers of which

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[2] The developing countries like Vietnam are characterized by two features: (i) the central bank set a positive inflation target, and (ii) they have a tendency to change the target, especially during the difficult period like the crisis and recession.

[3] It can be interpreted as central bank's implicit inflation target and private sector's long-run inflation expectation

[4] Nakata (2014) indicates that the shock to trend inflation reduce the welfare and that it does mainly through its effect on consumption and leisure.

Le (2017) also constructs the theory on mechanism of how the shifting trend inflation affects the economy. He indicates that the welfare cost comes from a rise in price dispersion causing a larger difference between output and labor hours; a reduction in an effective aggregate productivity; a decrease in consumption and wage but an increase in labor hours; the effect of distorting an improving path of output growth while amplifying an expansion of inflation and labor supply.

policy should be adapted in the sense the better one could improve the social welfare and make individuals better-off at the lowest cost.

Table 2: Overview of the developments of monetary policy in recent years in Vietnam

	Economic conditions	Monetary Policy
2004-mid 2007	Mild inflation, high economic growth Officially entering WTO 2007, a large amount of foreign exchange flew in	Loosening monetary policy and expanding fiscal policy Absorbing capital inflows without sterilising, hence boosting credits and money supply to record level
Mid 2007-Mid 2008	High inflation Sharply increasing interest rate Increasing dollarization Slowing down economic growth	Open market operations (OMO) to withdraw money from circulation Interest rates (i.e. policy rate, rediscount rate and refinancing rate) adjusted upwards Implementation of a floating but controllable foreign exchange rate regime to prevent the appreciation of VND and restricting the fluctuation range of VND/USD exchange rate Selling compulsory SBV's promissory notes to commercial banks Consecutively increase required reserve ratio (RRR)
Second half of 2008-2009	Global financial crisis and economic recession Easing pressure from inflation Capital started flowing out, FDI and capital inflow declining Economic growth slow down further	Interest rates adjusted to create more favourable conditions for financial institutions to lower lending rate Consecutively reducing RRR Trading band of VND/USD exchange rate continuously expanded, and interbank exchange rate followed the upward trend. OMO and refinancing operations applied to control money supply in order to secure the payment system and stabilise monetary market Buying in SBV's compulsory promissory notes Subsidising 4% of interest rate on loans made in VND
First Half 2010	High inflation and dollarisation	Tightening monetary policy to target of lowering inflation
Second Half 2010	Easing pressure on inflation Economic growth was under expectation	Loosening monetary policy again Credit and real money balance in second half increased almost twice the level in first half
2011	High inflation again Sluggish economic growth Severe deficit in balance of payment and budget Escalating interest rate High pressure for devaluation of foreign exchange	Interest rates (i.e. policy rate, rediscount rate and refinancing rate) adjusted upwards to help banks solve shortage of liquidity Overshooting devaluation to break circle of foreign exchange speculation Suppressing parallel foreign exchange market and gold market

	Exhausting foreign reserves Bad loans building up quickly in banking sector Increasingly high inventory	Hard restriction on credit for real estate and stock investment Tightening supervision on commercial banks' operations Setting ceiling for growth of credit and money supply for all banks Stabilising exchange rate
2012	Inflation gradually declined to normal level Improved balance of payment and trade balance Building up foreign reserves to more than 12 weeks Declining interest rate Bad loans stopped increasing Sluggish growth of credit Economic growth declined under expectation Capital inflow has not improved yet	Keep on the cautionary manner in managing monetary policy with the highest priority of maintaining macroeconomic stability. Gradually removing ceiling on growth of credit Consecutively cutting down interest rates (deposit rate, basic rate, refinancing rate, discount rate…) to a level that is lower than those in a good period of 2004-06. Conducting restructure of commercial banking sectors. Keep on stabilising exchange rate

Source: Author collected from different sources

This paper has some crucial findings as follows. By analyzing the impulse response function from the Bayesian method, the study finds that the shock to trend inflation negatively impact the economy by distorting components and environment leading the long-term economic development. In particular, the output growth diminished while the inflation and nominal interest rate enlarged and tented to remain persistently in the long-term. The price dispersion also illustrated a persistently increasing trend, extending the wedge between labor supply and output. Moreover, results of decomposing the forecast error variances in main macroeconomic variables emphasized the essential role of this shock in explaining their variations, especially in the long-term and when the central bank set a high inflation target. Regarding welfare's issues, the shock to trend inflation caused the economy to get more volatile and distorts the economy to bring about a dramatic reduction in welfare, especially in developing countries. The cost comes directly from a combination of a lower consumption and a higher working hours. More importantly, among all inefficiency sources, the un-optimal inflation target signifies this cost the most considerably while the monopolistic accounts for the modest proportion. And it would be more efficient to compensate the society' loss by improving their consumptions.

This paper is closely related to two strands of literature: trend inflation and shifting trend inflation. In an early contribution of trend inflation, Ascari (2004) and Bakhshi Llombart and Rudolf (2003) indicate substantial changes in the short-term and long-term properties of model based on the Calvo staggered price model when trend inflation is considered. Ascari and Ropele (2007) analyze the implications of non-zero inflation for the optimal monetary policy to indicate a strong influence of trend inflation on the optimal monetary policy and a decreasing effectiveness in controlling inflation as the trend inflation increases. Amano, Ambler, and Rebei (2007), however, study the macroeconomic effect of

non-zero inflation and attempt to derive the optimal rate of inflation by using three genres of price setting, namely Calvo pricing, Taylor pricing and truncated-Calvo pricing. Regarding the relationship of trend inflation and the determinacy of the model, Kiley indicates that the equilibrium indeterminacy and the possibility of fluctuations and increased macroeconomic instability happen for an improving fraction of the range of policy setting when trend inflation grows to moderate levels. Ascari and Ropele (2009) also show an expansion of the indeterminacy region under an increase of trend inflation. Furthermore, an alternative interpretation of the Great Inflation relying on the determinacy properties of a non-zero trend inflation model is provided by Coibion and Gorodnichenko (2011). Concerning welfare issue, Coibion, Gorodnichenko, and Wieland (2012) depict three various channels through which the steady state inflation affects welfare, including steady state effects, the magnitude of the coefficients in the utility-function approximation, and the dynamics of the model. Conversely, Alves (2012) finds that the trend inflation inversely relates to the relative weight of output gap by finding a new approach to derive the welfare-based loss function.

However, few papers pay attention to the time-varying property of trend inflation. For example, Kozicki and Tinsley (2001) analyze impacts of drifting trend inflation on the term structure of interest rates. Cogley and Sbordone (2008) find that controlling for trend inflation has an important implication in the estimation of the NKPC, while Cogley, Primiceri, and Sargent (2009) employ two models, namely a univariate and multivariate auto-regression with drifting trend inflation to explore its implication for the predictability of inflation. Recently, Nakata (2014) shows that alternations in trend inflation have some effects on the welfare of the representative agent. This study extend Nakata (2014) for inefficiency sources and effective policies in the case of developing country.

The rest of this paper is organized as follows. The subsequent section presents the detail of model with an assumption of policy inconsistency. Section 3 shows the way to compute welfare, welfare cost, and the inefficiency loss, and then discuss two policies to correct the cost of policy inconsistency. The empirical results is argued in Section 4. Section 5 analyze the welfare, welfare cost, and inefficiency sources computation. Finally, Section 5 concludes with key results.

2. Model

This section briefly describes the standard New Keynesian model in Calvo price setting system that expands from the study of Ireland (2007, 2010) and Nakata (2014). This paper attempts to grasp several vital nuances. *Firstly*, an economy in this study is characterized by two properties. As many previous studies, the central bank sets a positive implicit inflation targeting, acceptance bands in which the target is supposed to be met. By employing means of monetary policy decisions, the central bank is cable of pursuing the targets. Moreover, the central bank is assumed to lack commitment to a fixed inflation target. In other words, the central bank has a tendency to let inflation change, especially during the difficult periods, such as the Great Inflation or Financial Crisis. The inconsistency of monetary policy relating inflation target, a salient feature of the realistic picture, leads to the

welfare cost. *Secondly*, this paper assumes that the final firms operate in the perfect competition market, while intermediate goods-producing firms perform in the monopolistic market. *Finally*, there are frictions in price adjustment as argued by Ireland (2007).

The model consists of an infinitively-lived consumer, a representative final-good producing firm, a representative intermediate-producing firm, a social planner, and the authority. This section will discuss each sector in detail.

2.1. The Representative Household

Generally, households encounter a problem that how they can maximize their utility given a limited amount of budget. A provision of $h_t(i)$ units of labor to each intermediate goods-producing firm i ∈ [0, 1] during period t earns $W_t h_t$ where $W_t$is the nominal wage rate. They also receive a nominal profit (D_t) at the end of period. Suppose that the household carries B_{t-1} units of bonds in the period t, which have the maturity in period t. A lump-sum tax (T_t) is imposed to finance government spending (G_t). Hence, the total budget of a typical household in period t is ($B_{t-1} - P_t T_t + + W_t h_t + D_t$). They distribute this budget for different ways, including consumption (C_t), a purchase of new bond (B_t/r_t). Summing up all information, the budget constraint of a typical household could be represented as

$$\mathrm{P}_t\mathrm{C}_t + \frac{B_t}{r_t} = \mathrm{B}_{t-1} - \mathrm{P}_t\mathrm{T}_t + W_t H_t + D_t \quad (1)$$

Given this budget constraint, the household attempts to maximize the expected discounted sum of future period utility

$$\sum_{t=0}^{\infty} \beta^t \left[\ln(C_t - \gamma C_{t-1}) - \frac{\omega}{1+v} {H_t}^{1+v}\right] \quad (2)$$

Where β and γ denotes the discount factor and the habit formation parameter. These parameters are restricted as $0 < \beta < 1, 0 \leq \gamma < 1$, while ω and v are parameters indicating the marginal utility of labor, and the inverse of Frisch labor supply elasticity, respectively. Solving the household's problem by choosing C_t, H_t, $B_t$such that maximize the utility in equation (2) given the budget constraint described by equation (1) to yield

$$\Lambda_t = \frac{1}{C_t - \gamma C_{t-1}} - \beta\gamma E_t\left(\frac{1}{C_{t+1} - \gamma C_t}\right) \quad (3)$$

$$\Lambda_t = \mathrm{H}_t\left(\frac{\omega}{w_t}\right) \quad (4)$$

$$\Lambda_t = \beta r_t E_t\left(\frac{\lambda_{t+1}}{\pi_{t+1}}\right) \text{ where } \pi_t = \frac{P_t}{P_{t-1}} \quad (5)$$

Where Λ_t is a non-negative Lagrange multiplier on the budget constrain, π_t is the gross inflation rate between t and t+1.

2.2.Representative Final Goods-Producing Firm

This part constructs a model reflecting the behavior of constant-return-to-scale firm, which tends to maximize its profits. In order to manufacture Y_t units of finished products, a typical finished goods-producing firm employs $Y_t(i)$ units of intermediate goods, which are at the nominal price $P_t(i)$ with assumption that this firm has the property of constant –return –to –scale as bellows

$$\left[\int_0^1 Y_t(i)^{\frac{\theta_t-1}{\theta_t}} di\right]^{\frac{\theta_t}{\theta_t-1}} \geq Y_t \quad (6)$$

Where the cost-push shocks are reflected by a parameter θ_t as suggested by Clarida, Gali, and Gertler (1999) because it translates into a random shock to the intermediate goods-producing firm's markup of price over the marginal cost. The stationary autoregressive process of this markup shocks could be depicted as

$$\ln(\theta_t) = (1 - p_\theta)\ln(\theta) + p_\theta \ln(\theta_{t-1}) + \epsilon_{\theta_t} \quad (7)$$

Where ϵ_{θ_t} is the serially uncorrelated innovation, which has a normal distribution with mean zero and standard deviation δ_θ; $p_\theta \in [0, 1)$, $\theta > 1$. I assume that the primary purpose of the final goods-producing firm is to maximize its profits, which can be represented as bellows

$$P_t\left[\int_0^1 Y_t(i)^{\frac{\theta_t-1}{\theta_t}} di\right]^{\frac{\theta_t}{\theta_t-1}} - \int_0^1 P_t(i)Y_t(i)di \quad (8)$$

The first order conditions for this problem is

$$Y_t(i) = \left[\frac{P_t(i)}{P_t}\right]^{-\theta_t} Y_t \quad (9)$$

$$P_t = \left[\int_0^1 P_t(i)^{1-\theta_t} di\right]^{\frac{1}{1-\theta_t}} \quad (10)$$

Equation (9) supports the idea that θ_t is the time-varying elasticity of demand for each intermediate goods, while the equation (10) is the price in which the final-goods producing firms has zero-profit under an assumption of competitive environment.

2.3. Representative Intermediate Goods-Producing Firm

In order to produce Y_t units of intermediate goods (i), the intermediate goods-producing firms hire $h_t(i)$ units of labor from the household during the period t. The property of constant-return-to-scale technology of the intermediate goods-producing firm can be written as

$$Z_t\, h_t(i) \geq Y_t(i) \quad (11)$$

And the aggregate technology shock follows a random walk with drift

$$\ln(Z_t) = \ln(z) + p_z \ln(Z_{t-1}) + \epsilon_{zt} \quad (12)$$

Where ϵ_{zt} is the serially uncorrelated innovation, which has a normal distribution with mean zero and standard deviation δ_z.

The Calvo model (1983)

According to Calvo (1982), in each period, there is a fixed fraction $(1 - \eta)$ that a firm can re-optimize its nominal price, whereas a fraction η of firms cannot. For firms, which they cannot optimize their prices, update their prices as follows[5]

$$P_t(i) = \left(\pi_{t-1}^{\mu} \bar{\pi}_{t-1}^{1-\mu}\right)^{\chi} P_{t-1}(i) \quad (13)$$

[5] Another formula: $P_t(i) = \left(\pi_{t-1}^{\mu} \bar{\pi}_t^{1-\mu}\right)^{\chi} P_{t-1}(i)$

Where μ, χ denotes a degree of indexation and the relative weight on lagged inflation in the indexation, respectively. Intermediate-goods producing firms set the price P_t^* to maximize the expected discounted sum of future profits as below

$$E_t \sum_{j=0}^{\infty} \beta^j \frac{\lambda_{t+j}}{\lambda_t} \eta^j \left\{ \frac{P_{i,t}^* (\bar{\pi}^{\chi j})^{1-\mu} \left(\pi_{t-1,t+j-1}^{\chi}\right)^{\mu}}{P_{t+j}} Y_{i,t+j} - \frac{W_{t+j}}{P_{t+j}} \left(\frac{Y_{i,t+j}}{Z_{t+j}}\right) \right\} \quad (14)$$

$$\text{S. t: } Y_{i,t+j} = \left[\frac{P_{i,t}^* (\bar{\pi}^{\chi j})^{1-\mu} \left(\pi_{t-1,t+j-1}^{\chi}\right)^{\mu}}{P_{t+j}} \right]^{-\theta} Y_{t+j} \quad (15)$$

$$\pi_{t,t+j} = \begin{cases} \left(\frac{P_{t+1}}{P_t}\right)\left(\frac{P_{t+2}}{P_{t+1}}\right) \dots \left(\frac{P_{t+j}}{P_{t+j-1}}\right) & for\ j = 1,2,3 \dots \\ 1 & for\ j = 0 \end{cases} \quad (16)$$

Where λ_t is the same as the Lagrangian multiplier on the household's budget constraints. The first order condition of this problem can be represented as

$$\frac{P_{i,t}^*}{P_t} = \frac{\theta}{\theta - 1} \frac{E_t \sum_{j=0}^{\infty} (\beta\eta)^j \Lambda_{t+j} \frac{W_{t+j} Y_{t+j}}{P_{t+j} Z_{t+j}} Y_{i,t+j} \left[\frac{P_{i,t}^* \left(\bar{\pi}_t^{\chi j}\right)^{1-\mu} \left(\pi_{t-1,t+j-1}^{\chi}\right)^{\mu}}{P_{t+j}} \right]^{-\theta}}{E_t \sum_{j=0}^{\infty} (\beta\eta)^j \Lambda_{t+j} Y_{i,t+j} \left[\frac{P_{i,t}^* \left(\bar{\pi}_t^{\chi j}\right)^{1-\mu} \left(\pi_{t-1,t+j-1}^{\chi}\right)^{\mu}}{P_{t+j}} \right]^{1-\theta}} = \frac{\theta}{\theta - 1} \frac{No_t}{De_t} \quad (17)$$

Let denote $\mathcal{p}_t^* = \frac{P_{i,t}^*}{P_t}$, No_t and De_t are a numerator and denominator of equation (17). Notice that the future expected inflation rates enter on both No_t and De_t, thus have effects on the future variables. Price-setting becomes more "forward-looking" so inflation does. Intuitively, if intermediate firms are cable of freely adjusting, they will set higher prices to compensate erosions of relative prices and profits that changes in trend inflation bring about. In other words, optimal price-setting under shifting trend inflation reflects future economic conditions rather than the current cyclical fluctuations. No_t and De_t can be rewritten as

$$No_t = E_t \sum_{j=0}^{\infty} (\beta\eta)^j \Lambda_{t+j} \frac{W_{t+j}}{P_{t+j}} \frac{Y_{t+j}}{Z_{t+j}} Y_{i,t+j} \left[\frac{P_{i,t}^* \left(\bar{\pi}_t^{\chi j}\right)^{1-\mu} \left(\pi_{t-1,t+j-1}^{\chi}\right)^{\mu}}{P_{t+j}} \right]^{-\theta}$$

$$= w_t + \beta\eta \left(\bar{\pi}_t^{-\chi\theta}\right)^{1-\mu} \left(\pi_t^{-\chi\theta}\right)^{\mu} E_t \left\{ \pi_{t+1}^{\theta} No_{t+1} \right\} \quad (18)$$

$$De_t = E_t \sum_{j=0}^{\infty} (\beta\eta)^j \Lambda_{t+j} Y_{i,t+j} \left[\frac{P_{i,t}^* \left(\bar{\pi}_t^{\chi j}\right)^{1-\mu} \left(\pi_{t-1,t+j-1}^{\chi}\right)^{\mu}}{P_{t+j}} \right]^{1-\theta}$$

$$= 1 + \beta\eta \left(\bar{\pi}_t^{\chi(1-\theta)}\right)^{1-\mu} \left(\pi_t^{\chi(1-\theta)}\right)^{\mu} E_t \left\{ \pi_{t+1}^{\theta-1} De_{t+1} \right\} \quad (19)$$

The evolution of aggregate price is presented according to

$$P_t = \left[\int_0^1 P_{i,t}^{1-\theta} di\right]^{\frac{1}{1-\theta}} = \left\{(1-\eta){P_{i,t}^*}^{1-\theta} + \eta P_{t-1}^{1-\theta}\left(\bar{\pi}_{t-1}^{\chi(1-\mu)}\pi_{t-1}^{\chi\mu}\right)^{1-\theta}\right\}^{\frac{1}{1-\theta}} \quad (20)$$

As Ascari (2014), this paper also introduces the price dispersion that derives from the aggregate output as

$$s_t = \int_0^1 \left[\left(\frac{P_{i,t}}{P_t}\right)^{-\theta}\right] di \quad (21)$$

Equation (21) dictates that the price dispersion (s_t) represents the resource costs due to relative price dispersion under the Calvo price setting. If a higher level of s_t means that a firm needs more labors to produce the similar level of output. s_t can be rewritten as

$$s_t = (1-\eta)\left(\mathcal{p}_{i,t}^*\right)^{-\theta} + \eta\left(\bar{\pi}_{t-1}{}^{-\chi\theta}\right)^{1-\mu}\left(\pi_{t-1}^{-\chi\theta}\right)^{\mu}\pi_t^{\theta}s_{t-1} \quad (22)$$

2.4.Authority's policy

2.4.1. Monetary Policy

The interest rate rule: The extended Taylor rule

By applying the Taylor rule (1993), the way, the central bank conducts the monetary policy, can be illustrated as bellows

$$\frac{r_t}{\bar{r}_t} = \left(\frac{r_{t-1}}{\bar{r}_t}\right)^{p_r}\left[\left(\frac{\pi_t}{\bar{\pi}_t}\right)\left(\frac{y_t}{\bar{y}_t}\right)^{p_y}\right]^{1-p_r}\delta_r e^{rt} \quad (23)$$

where $\bar{r}_t, \bar{\pi}_t, \bar{y}_t$ are the steady state of interest rate and output gap, and trend inflation, respectively. $e^{rt}$is an i.i.d monetary policy shock. The parameter p_r illustrates the degree of interest rate smoothing.

Trend Inflation

The evolution of trend inflation can be described as a highly persistent AR(1) process by two statistical models as follow

$$\ln\bar{\pi}_t = (1-\rho_\pi)\ln\bar{\pi}^* + \rho_\pi \ln\bar{\pi}_{t-1} + \epsilon_{\overline{\pi,t}} \quad \text{(Model 1)}$$

Where $\epsilon_{\overline{\pi,t}}$ is a standard normal and independent of time. Although widely used in the literature, the trend inflation can be unrealistically negative with a high probability as suggested by Nakata (2014). Therefore, the following model should also mentioned here

$$\ln[\bar{\pi}_t - 1] = (1-\rho_\pi)\ln[\bar{\pi}^* - 1] + \rho_\pi \ln[\bar{\pi}_{t-1} - 1] + \epsilon_{\overline{\pi,t}} \quad \text{(Model 2)}$$

2.4.2. Fiscal policy

The government budget resource is represented as

$$B_t + G_t = T_t + \frac{B_{t+1}}{r_t} \quad (24)$$

As Christiano et al (2005), government expenditure is financed by lump-sum taxes as follows

$$G_t = T_t \quad (25)$$

Let $g_t$denote the government spending growth, and then the government spending is a fraction of aggregate output

$$G_t = \left(1 - \frac{1}{g_t}\right) Y_t \tag{26}$$

where g_t, which is greater than unit, is an AR(1) process

$$\ln(g_{t+1}) = \left(1 - p_g\right) \ln(g) + p_g \ln(g_t) + \epsilon_{g_t} \tag{27}$$

where $(1 - 1/g)$ is the value of government spending in the steady state.

2.5. Market Clearing Conditions

The market clearing condition in the labor market can be expressed as

$$H_t = \int H_t(i) di \tag{28}$$

The condition in Calvo model is given

$$Y_t = C_t + G_t \tag{29}$$

Finally, the zero net supply of bond is

$$B_t = 0 \tag{30}$$

3. Welfare's Issues Computation

3.1. Welfare Computation

In the similar spirit of previous studies, the paper also employs the second order approximation to compute the welfare. The utility function in the stationary variables is expressed

$$\begin{aligned} & \ln(C_t - \gamma C_{t-1}) - \frac{\omega}{1+v} {H_t}^{1+v} \\ = \; & \ln(c_t z_t - \gamma c_{t-1}) + \ln(\mathrm{Z}_t) - \ln(\mathrm{Z}_{t-1}) - \frac{\omega}{1+v} {H_t}^{1+v} \\ = \; & \ln(c_t z_t - \gamma c_{t-1}) + \ln(\mathrm{z}_t) - \frac{\omega}{1+v} {H_t}^{1+v} \end{aligned} \tag{31}$$

Where $x_t = [c_t, c_{t-1}, H_t, m_t, z_t\,]$ are stationary for a New Keynesian model[6].

3.2. Welfare Cost Computation

Based on the results of Nakata (2014) and the theory constructed by Le (2017), there are two ways to improve the social welfare. The government can compensate the reduction in welfare caused by the shock to trend inflation by increasing individual's consumption or reducing his or her working hours. From this spirit, this paper discuss two genres of policies, namely consumption compensation policy (CCP) and labor compensation policy (LCP) and run an argument over the question of which policy is effective such that the welfare of household can be better-off as others in the economy without the shock to trend inflation at a lower cost.

DEFINITION 1 (CCP): An improvement in consumption that enhances the welfare of a typical household in one economy to make them as better-off as others in another economy, can be defined as welfare cost (wc). Mathematically, wc can be represented as

$$\mathrm{E}\left\{\sum_{\mathrm{t}=0}^{\infty} \beta^{\mathrm{t}} \mathrm{u}\left(\left(1 + \frac{\mathrm{wc}}{100}\right) \mathrm{C}_{\mathrm{A,t}}, \mathrm{H}_{\mathrm{A,t}}\right)\right\} = \left\{\sum_{\mathrm{t}=0}^{\infty} \beta^{\mathrm{t}} \mathrm{u}\left(\mathrm{C}_{\mathrm{B,t}}, \mathrm{H}_{\mathrm{B,t}}\right)\right\} \tag{32}$$

[6] Note that I do not consider money in the cashless model

DEFINITION 2 (LCP): A reduction in labor hours that enhances the welfare of a typical household in one economy to make them as better-off as others in another economy, can be defined as welfare cost (wc). Mathematically, wc can be represented as

$$\mathrm{E}\left\{\sum_{t=0}^{\infty}\beta^{t}\mathrm{u}\left(\mathrm{C_{A,t}},\left(1-\frac{\mathrm{wc}}{100}\right)\mathrm{H_{A,t}}\right)\right\}=\left\{\sum_{t=0}^{\infty}\beta^{t}\mathrm{u}\left(\mathrm{C_{B,t}},\mathrm{H_{B,t}}\right)\right\} \tag{33}$$

Where $C_{A,t}$, $H_{A,t}$are consumption, and labor supply in the economy with $\sigma_{\bar{\pi}}>0$ and $C_{B,t}$, $H_{B,t}$, $m_{B,t}$ are in economy with $\sigma_{\bar{\pi}}=0$. Typically, wc in this case is the welfare cost under impacts of shifting inflation shock. Broadly speaking, I can derive the welfare cost of business cycle where A, B denotes the state that with ($\sigma\ of\ shocks>0$) and without shocks ($\sigma\ of\ shocks=0$) in the economy.

3.3. Steady-State Distortions

Subsequently, I present another contribution of this paper that I set up a way to decompose varying sources of inefficiency and indicate how they magnify the welfare cost. Firstly, I characterize the behavior of a social planner who maximizes the social welfare function under the frictions associated monetary trade and sluggish price adjustments. The social planner's problem is given by

$$\max_{Q_t,n_t} E_0\sum_{t=0}^{\infty}\beta^{t}\left[\ln(Q_t-\gamma Q_{t-1})-\int_0^1\omega\frac{h_t(i)^{1+v}}{1+v}di\right] \tag{34}$$

$$s.t.\,Z_t\left[\int_0^1 h_t(i)^{\frac{\theta_t-1}{\theta_t}}di\right]^{\frac{\theta_t}{\theta_t-1}}=g_tQ_t \tag{35}$$

Where Q_t is the efficient level of consumption, $h_t(i)$ is the efficient amount of labor. Both of them are chosen by the social planner to maximize the social welfare. The first order condition is

$$h_{it}{}^{1+v\theta_t}=\frac{1}{\omega^{\theta_t}}\left[\frac{\Xi_t}{a_t}\right]^{\theta_t}Z_t{}^{\theta_t}\left[\frac{g_tQ_t}{Z_t}\right] \tag{36}$$

$$\Xi_t=\frac{1}{g_t}\left\{\frac{1}{Q_t-\gamma Q_{t-1}}-\beta\,\gamma E_t\left(\frac{1}{Q_{t+1}-\gamma Q_t}\right)\right\} \tag{37}$$

Where Ξ_t is the non-negative Lagrange multiplier on the negative feasibility constraint for period t. The equation (36) implies that $h(i)=h_t$ for all $i\in[0,1]$ and

$$h_t{}^{1+v\theta_t}=\frac{1}{\omega^{\theta_t}}\left[\frac{\Xi_t}{1}\right]^{\theta_t}Z_t{}^{\theta_t}\left[\frac{g_tQ_t}{Z_t}\right] \tag{38}$$

The efficient level of output (Q_t) must satisfy

$$\frac{\omega}{g_t^{1/\theta_t}}\frac{1}{Z_t}\left(\frac{Q_t}{Z_t}\right)^{v}=\frac{\Xi_t}{1}=\frac{1}{g_t}\left\{\frac{1}{Q_t-\gamma Q_{t-1}}-\beta\,\gamma E_t\left(\frac{1}{Q_{t+1}-\gamma Q_t}\right)\right\} \tag{39}$$

The equation (39) shows that the (Q_t) varies with technology shocks (Z_t). As illustrated in the study of Clardia, Gali, and Gertler (1999), the efficient output does not rely on the cost-push shock (θ_t). Finally, the definition of output gap is $x_t=\frac{Y_t}{Q_t}$.

Following, the method to derive distinct inefficiency source is presented. Woodford (2003), Yun (2005) are pioneers who attempted to measure the welfare cost by constructing the standard welfare-based loss function. However, little research has devoted to the search for inefficiency sources, especially a consideration of constant and shifting trend inflation.

Alves (2011) made the first contribution to search for two inefficiency sources affecting the loss function, for example, monopolistic competition and a non-optimal inflation target. In order to develop some methods to investigate sources of inefficiency to fill the gap in the literature, I utilize a distinct approach to this issue. In particular, I initially derive the steady state of the output from a set of equations in the Calvo model, while the efficient level of output in the steady state is computed from equation (43). Specifically, they are given by

$$q = \left[\frac{g^{(1-\theta)/\theta}}{\omega}\frac{z-\beta\gamma}{z-\gamma}\right]^{\frac{1}{1+v}} \text{ and } c = \left\{\frac{1}{\omega}\left(\frac{z-\beta\gamma}{z-\gamma}\right)\frac{w}{s^{v}g^{v}}\right\}^{\frac{1}{1+v}}$$

The inefficiency sources are defined here as components making the consumption deviate from its efficient amount in the steady state. By comparing (q) and (c), the consumption deviates from its efficient amount by $\frac{w}{s^{v}g^{v+\frac{1-\theta}{\theta}}}$. Therefore, in this regard, this study treats this part as sources of inefficiency that causes the loss of welfare. In particular, I plug w and s (the steady-state wage and price dispersion) in this part to yield

$$\frac{w}{s^{v}g^{v+\frac{1-\theta}{\theta}}} = \frac{1}{g^{v+\frac{1-\theta}{\theta}}} * \left\{\frac{\theta-1}{\theta}\frac{1-\eta\beta\pi^{(1-\chi)(-\theta)}}{1-\eta\beta\pi^{(1-\chi)(\theta-1)}}\mathscr{P}^{*}(\pi)\right\} \Big/ \left\{\frac{1-\eta}{1-\eta\pi^{(1-\chi)(\theta)}} * [\mathscr{P}^{*}(\pi)]^{-\theta}\right\}^{v}$$

$$= \frac{1}{g^{v+\frac{1-\theta}{\theta}}} * \frac{1}{\mu_m} * \left[\frac{1-\eta\beta\pi^{(1-\chi)(-\theta)}}{1-\eta}\right]\left[\frac{1-\eta}{1-\eta\pi^{(1-\chi)(\theta)}}\right]\left[\frac{1-\eta\pi^{(1-\chi)(\theta-1)}}{1-\eta}\right]^{\frac{1+\theta v}{1-\theta}} \quad (40)$$

Let define $\mu_m = \frac{\theta}{\theta-1}$, which is the gross mark-up term. Note that μ_m and g are greater than unit.

Let define $\bar{\eta} = \eta\pi^{(1-\chi)(\theta-1)}$ and $\mathscr{v} = \pi^{(1+\theta v)(1-\chi)}$, thus $\bar{\eta}\mathscr{v} = \eta\pi^{\theta(1+v)(1-\chi)}$. Hence, an equation (40) can be rewritten as

$$\frac{w}{s^{v}g^{v+\frac{1-\theta}{\theta}}} = \frac{1}{g^{v+\frac{1-\theta}{\theta}}} * \frac{1}{\mu_m} * \left[\frac{1-\beta(\bar{\eta}\mathscr{v})^{-\frac{1}{1+v}}}{1-\beta\bar{\eta}}\right]\left[\frac{1-\eta}{1-(\bar{\eta}\mathscr{v})^{\frac{1}{1+v}}}\right]\left[\frac{1-\bar{\eta}}{1-\eta}\right]^{\frac{1+\theta v}{1-\theta}} \quad (41)$$

The first term of deviation is driven by the authority's fiscal policy throughout changes in the government expenditure. Probably, the fiscal policy can be a source of inefficiency due to weak policy implementation. The change in the second term $\left(\frac{1}{\mu_m}\right)$ is stem from the monopolistic competition distortion alone as discussed by Woodford (2003) and Alves (2012), and the last term is driven by the non-zero trend inflation. Let denote them be $d_f, d_m, and\ d_i$, respectively. Efficiency require these three distortions to be unit, thus an output is equal to its efficient amount. It is worth noticing that I assume that these parameters are small enough to be the first order disturbance term, thus linear term multiplied by them become of second order. In brief, this study considers three sources that lead to inefficiency in the market, namely: (i) changes from other policy rather than monetary policy; (ii) the monopolistic competition distortion; and (iii) the non-optimal inflation target.

4. Estimation

4.1. Data

The system involves three observable variables, including output growth $\left(g_t^y\right)$, inflation (π_t) and short-term nominal interest rate (r_t). This study uses quarterly Vietnam data collected from 1996Q1 to 2015Q4. The raw data are taken from the database available at General Statistics Office of Vietnam (GSO) and International Financial Statistics (IFS). Seasonally-adjusted figures for real GDP, which is converted to GDP per capital by dividing by the total population, serves as a measure of output growth. Quarterly changes in seasonally-adjusted figures for Consumer Price Index and quarterly lending rate yield the measure of inflation and nominal interest rate, respectively. All data are de-trended prior to the estimation of the model.

4.2. Simulated Method of Moments (SMM)

4.2.1. Econometric Methodology

This study examines the application of SMM to obtain the second-order approximation solution of non-linear DSGE model. The application of SMM is more advantageous than others due to the following reasons. First, moment-based estimators are more robust to misspecification than Maximum Likelihood (ML). It is advocated by the estimation of time-series models proposed by Lee and Ingram (1991) and Duffie and Singleton (1993), and Monte-Carlo analysis to compare various methods adapted for the estimation of DSGE models performed by Ruge-Murcia (2007). It is essential since DSGE models are more likely mis-specified by an unknown form. However, it is worth noting that if the specification of DSGE model is precise, ML should be adapted rather than Method of Moment. Moreover, an attraction of method of moment estimators for an estimation of non-linear DSGE models is also illustrated by a cheap numerical evaluation of its objective function. In other words, the researcher is cable of employing genetic algorithms for its optimization, which although requiring a large number of function evaluations than distinct gradient-based methods, the possibility of converging to a local optimum is substantially decreased. By these reasons, a method of the moment is more attractive to others.

Let denote $\kappa \in K \in \mathcal{R}^q$ be a (qx1) vector of structural parameters and x_t be a sample of T observations. In a complex system of this study, κ can consist of many parameters, particularly, $\kappa = \{\beta, \gamma, dn, v, \rho_r, \phi_y, \phi_\pi, \theta, g, \rho_z, \rho_\theta, \rho_g, \sigma_z, \sigma_\theta, \sigma_g, \eta, \chi, \mu, \overline{\Pi}^*, \rho_{\overline{\Pi}}, \sigma_{\overline{\Pi}}\}$, and the economic data in $\{x_t\}$ are presumed to be stationary and ergodic[7].

The set of p moment condition in the SMM estimation of DSGE model can be expressed as

$$\mathbf{H}(\kappa) = \left\{(1/T)\sum_{i=1}^{T} h(x_t) - (1/\tau T)\sum_{j=1}^{\tau T} h\left(x_j(\kappa)\right)\right\} \quad (42)$$

Then, the SMM estimator can be achieved by solving the following problem

$$\hat{\kappa}_s = \min_{\kappa \in K} \mathbf{H}(\kappa)' W \mathbf{H}(\kappa) \quad (43)$$

[7] A prior transformation of the raw data , for example a de-trending procedure $(1/T)\sum_{t=1}^{T} m(x_t)$can induce the stationarity and ergodicity

T is the sample size, τ is a positive constant, and W is a (qxq) weighting matrix. In words, the SMM estimator is the value of κ that makes the distance between the moments implied by the model and those obtained from the observed data as small as possible. A necessary condition for identifications is p ≥ q while sufficient conditions for a local identification requires rank $\left\{\frac{\partial E(h(\kappa))}{\partial \kappa}\right\} = q$. Put it differently, it simultaneously requires at least as many moment conditions as the number of parameters; and point κ in the parameter space K determined when the rank condition is evaluated for both necessary and sufficient conditions.

The regularity conditions argued by Duffie and Singleton (1993) for SMM estimators to be consistent and asymptotically normal states that

$$\sqrt{T}(\hat{\kappa} - \kappa_0) \to N(0, (1 + 1/\tau)(S'WS)^{-1}S'W\boldsymbol{R}WS(S'WS)^{-1}) \quad (44)$$

Where $S = \frac{\partial E(h(\kappa))}{\partial \kappa}$ is a (pxq) matrix of full column rank and $R = \sum_{s=-\infty}^{+\infty}\left(h(x_t) - E\left(h(x_t)\right)\right)\left(h(x_{t-s}) - E\left(h(x_{t-s})\right)\right)'$. If $\mathbf{W} = \boldsymbol{R^{-1}}$, the asymptotic distribution simplifies to

$$\sqrt{T}(\hat{\kappa} - \kappa_0) \to N(0, (1 + 1/\tau)(S'R^{-1}S)^{-1}) \quad (45)$$

The main purpose of this part is to obtain some estimated parameters that are not well-documented in developing countries. In this application, κ consists of parameters relating to shocks, namely technology shock persistence (p_z), shock to trend inflation persistence $(\rho_{\bar{\pi}})$ and volatility $(100\delta_{\bar{\pi}})$; monetary shock persistence (p_r), volatility $(100\delta_r)$, and Taylor coefficient on the inflation gap (ϕ_π) and output gap (ϕ_y). The innovations are drawn from a Normal distribution for the simulation of the model, while the weighting matrix W is the diagonal of the inverse of the matrix with the long-run variance of the moments.

4.2.2. SMM Estimates

This study utilizes baseline parameter values for household's preference as Justiniano and Primiceri (2008) set for a medium-size DSGE model with constant volatilities. Regarding a production sector, estimates of parameters for the Calvo model permitting an imperfect indexation and shifting trend inflation are adapted from Cogley and Sbordone (2008). Table 3 reports specific SMM parameters estimates based on the second-order

Table 3: SMM Estimates

Parameter	Description	Estimated Value	S.e.
p_r	Monetary shock persistence	0.8099*	0.0002
p_z	Technology shock persistence	0.8000*	0.0226
$\rho_{\bar{\pi}}$	Shock to trend inflation persistence	0.9949*	0.0000
$100\delta_{\bar{\pi}}$	Shock to trend inflation volatility	0.0007 *	0.0088
$100\delta_r$	Monetary shock volatility	0.0024*	0.0096
ϕ_π	Taylor coefficient on the inflation gap,	1.9200*	0.0036
ϕ_y	Taylor coefficient on the output gap	0.0655*	0.0004

Note: S.e. is a standard error. The superscripts * denote that the null hypothesis that the true parameter value is zero is rejected at the 5 percent significance levels.

approximate solution employing Vietnamese data while fixing other parameters. It is worth noticing that the null hypothesis that each estimated parameter does not differ from zero is

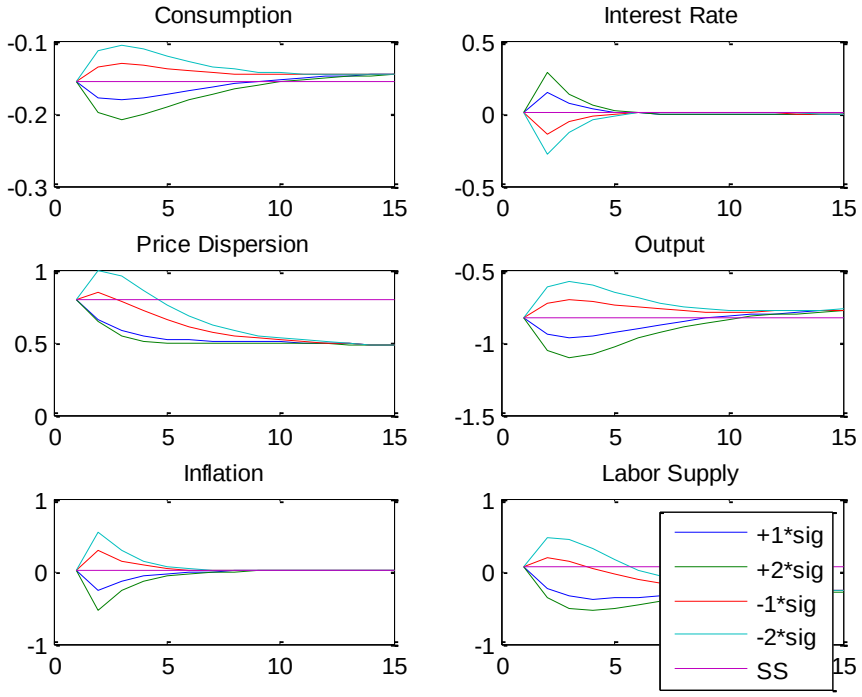
statistically rejected at 5 percent significance level. Regarding a shock to trend inflation, although previous work, such as Ascari and Sbordone (2014), Cogley et al (2009), Fuhrer and Moore (2004), Fuhrer (2009) holds the consensus on the high persistence of trend inflation, its exact magnitude has still remained debated, especially a consideration of time-varying trend inflation in emerging countries. Table 3 shows that the persistence of trend inflation is close to 0.995 and statistically significant at 5 percent. This figure is consistent with Cogley et al (2010) and others. An evidence of the relatively similar magnitude of trend inflation between countries is indicated.

Regarding coefficients of Taylor rule, this study shows a fairly high persistence of monetary shock. Further, the obtained parameters dictate that by employing the nominal interest rate as a policy instrument, the central responses more considerably to the inflation gap, whereas the response to the output gap is relatively weak. That is consistent to Justiniano and Primiceri (2008) studying a medium-size DSGE model with constant volatilities. Moreover, the monetary shock volatility is smaller than those of shock to trend inflation.

4.2.3. SMM Impulse Responses

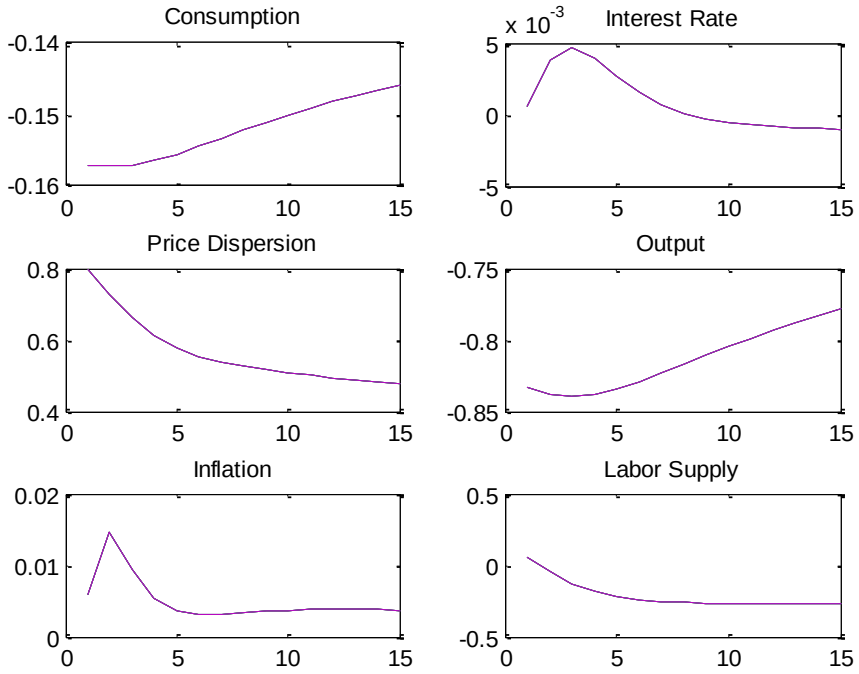
This section investigates how the economy responds to various shocks, namely technology shock, monetary policy shock and shock to trend inflation. Starting at the stochastic steady state but differing from previous studies to what extent that the constant

Figure 2: Dynamic Responses to a Monetary Shock



positive steady-state inflation is considered, the economy is subjected to an unanticipated temporary shocks, the graphs for responses of consumption, nominal interest rate, price dispersion, output, inflation and labor supply are regarded as a function of time. It is worth noticing a distinction between the linear models and non-linear model when considering the effects of shocks on the economy. A shock size 2ϵ and $-\epsilon$ are double those and the mirror image of those to a shock of size ϵ in the linear model, while responses in the non-linear models are contingent upon on both sign and the size of the shock as indicated by Gallant, Rossi, and Tauchen (1993) and Koop, Perasan and Potter (1996). By this spirit, I study responses to innovations with various level of standard deviations using SMM and basing on the second-order approximation. The vertical axis and horizontal axis are respectively the percentage deviation from the deterministic steady state and the level of the stochastic steady state. The effect of uncertainty on the unconditional first moments of the variables are illustrated by the distance between this line and zero, and the model starts from certainty equivalence.

Figure 3: Dynamic Responses to a Shifting Trend Inflation Shock



Before analyzing dynamic responses of the economy to shock, recall that changes in trend inflation affect the steady state, which leads to a change in the point around which the model is log-linearly approximated. As a result, the macroeconomic variables in the steady state do not stay on the zero-line[8]. Regarding the monetary policy shock, Figure 2 indicates

[8] The study on behaviors of economy to shocks with different levels of standard deviation in the model with zero steady-state inflation is indicated by Kim and Ruge-Murcia (2007).

that the interest rate increases, while there is a decreasing path for other variables correspondingly to a positive monetary policy shock. Further, the consumption, output and price dispersion deviate from the zero line when considering a constant positive steady state.

It is essential to analyze consequences of policy implementation inconsistency throughout the shock to trend inflation. It is apparent that this shock leads to a reduction of output and then consumption, while the interest rate and inflation reach a higher level as in Figure 3. Price dispersion also augments with respect to this shock, implying that there is a wedge between output and labor required. In other words, the inefficiency of the economy is reflected in part by an increasing demand for labor to produce a given amount of output. Obviously, a lack of commitment to consistently pursue the fixed inflation target distorts the economy severely in the case of developing country. The inefficiency in production, a lack of necessary conditions for a stable development when the growth of inflation and interest rate causes difficulties for production are explicit consequences.

4.3. Bayesian Method (BM)

4.3.1. Econometric Methodology

This part discusses the application of Bayesian Method (BM) to the estimation of non-linear DSGE models. Hamilton (1994) indicates that the prior density function of the parameters could be represented as follows

$$p(\Psi_M|M) \tag{46}$$

Where p is the probability density function, for example normal, gamma, inverse gamma, beta, uniform and other functions; and Ψ_M denotes the parameters of the model and M is the model. Additionally, a likelihood function, which illustrates the density of the observed data given a model and its parameters, can be expressed

$$\mathcal{L}(\Psi_M \mid X_T, M) \equiv p\,(X_T|\,\Psi_M, M) \tag{47}$$

Where X_T denotes the set of observed data with T periods. The equation (47) could also be expressed as below

$$\mathcal{L}(\Psi_M \mid X_T, M) \equiv p\,(x_0|\Psi_M, M)\prod_{t=1}^{T} p(\,x_t|X_{t-1},\,\Psi_M, M) \tag{48}$$

$$p(\Psi_M|\,X_T) = \frac{p(\Psi_M;\,X_T)}{p(\,X_T)} \tag{49}$$

and then

$$p\,(X_T|\Psi_M) = \frac{p(\Psi_M;\,X_T)}{p(\Psi_M)} \quad then\; p(\Psi_M;\,X_T) = p\,(X_T|\,\Psi_M)p(\Psi_M) \tag{50}$$

By combining the prior density and the likelihood function, the posterior density could be depicted as

$$p(\Psi_M|\,X_T, M) = \frac{p(\,X_T|\,\Psi_M, M)p(\,\Psi_M|M)}{p(X_T|M)} \tag{51}$$

Where $p(\,X_T/M)$ is defined as marginal density of the data and represented as

$$p(X_T|M) = \int p(\,X_T|\,\Psi_M, M)p(\,\Psi_M|M)\,d\Psi_M \tag{52}$$

Therefore, plugging equation (52) into (51), the posterior density of the model parameter can be written as

$$p(\Psi_M|\, X_T, M) = \frac{p(\, X_T|\, \Psi_M, M)p(\, \Psi_M|M)}{\int p(\, X_T|\, \Psi_M, M)p(\, \Psi_M|M)d\Psi_M} \quad (53)$$

From the equation (53), one of the important parts in Bayesian approach is to identify the model M, which maximizes the posterior probability given by $p(\Psi_M|\, X_T, M)$.

The economic model possesses the following state-space representation

$$S_{t+1} = \Gamma_1 S_t + \Gamma_2 w_{t+1} \quad (54)$$

$$X_t = \Lambda S_t + \mu_t \quad (55)$$

Where S_t consists of a vector of endogenous variables, w_t is a vector of state innovations, X_t is a (k x 1) vector of observed variables and μ_t can be interpreted as the measure error. The matrices Γ_1 and Γ_2 are ancillary on the values of parameter in the model. The relationship between the observed and state variable is defined by the matrix Λ. Furthermore, $\int_{\Psi_M} p(\, X_T|\, \Psi_M, M)p(\, \Psi_M|M)\, d\Psi_M$ is constant for a specific model M, thus we only need to evaluate the posterior density up to a proportional constant, which based on the relationship

$$p(\, \Psi_M|\, X_T, M) \propto p(\, X_T|\, \Psi_M)p(\, \Psi_M) \quad (56)$$

The posterior density is regarded as a way of summarizing information in the likelihood weighted by the prior density p(Ψ_M). The law of large number indicates that

$$E_{\,\Psi_M}[g(\, \Psi_M)] = \frac{1}{N}\sum_{j=1}^{N} g(\Psi_M^j) \quad (57)$$

Where g(.) denotes some function of interest. The MCMC (Monte Carlo Markov Chain) approach with Metropolis-Hastings method is utilized to calculate the posterior distribution. Moreover, the likelihood function is calculated by employing the Kalman Filter.

4.3.2. Bayesian Estimate

Regarding the model's structural parameters, two ways to pin down are calibration and estimation. In particular, some of the model parameters are obtained using the standard calibration technique based on steady state targets. The calibrated values for a discount factor, β, and the government expenditure, g, are reported in Table 4. For a level of trend inflation, I compute it as an average of inflation targets set by the central bank[9]. The remaining model parameters are estimated by using the Bayesian method with prior information and three empirical series, namely quarterly real output growth, inflation and short-run nominal interest rate.

Note that two ingredients are served as prior information in this research. The priors consist of information borrowing from other paper in the literature, such as household's preference as Justiniano and Primiceri (2008), parameters for the Calvo as Cogley and Sbordone (2008); and the SMM estimates from the previous section. Theoretically, although they choices for prior distribution do not matter since they do not affect posteriors, the choice should be meticulously examined to satisfy the Blanchard and Kahn condition (Koop, 2003). To put it in the right way, the prior distributions in this paper are generally linked to the

[9] They are collected from the annual reports of State Bank in Vietnam and General Statistics Office of Vietnam.

literature. Specifically, the choice for consumption habit, γ, Inverse Frisch elasticity of labor supply, v, the monetary policy parameters, parameters relating to cost-push shock, technology shock and government spending shock are based on those in Ireland (2004), Ireland (2010) and Ascari et al (2010). The choice for Calvo price-setting is followed Ascari et al (2010) in the case of constant trend inflation. For shifting trend inflation shock parameters, I set up their distributions that follow the rule and be consistent with other parameters since up to present time no empirical work employs a Bayesian method for a model with shifting trend inflation. The calibrated values, the choice of prior distributions and the estimated parameters are reported in Table 4.

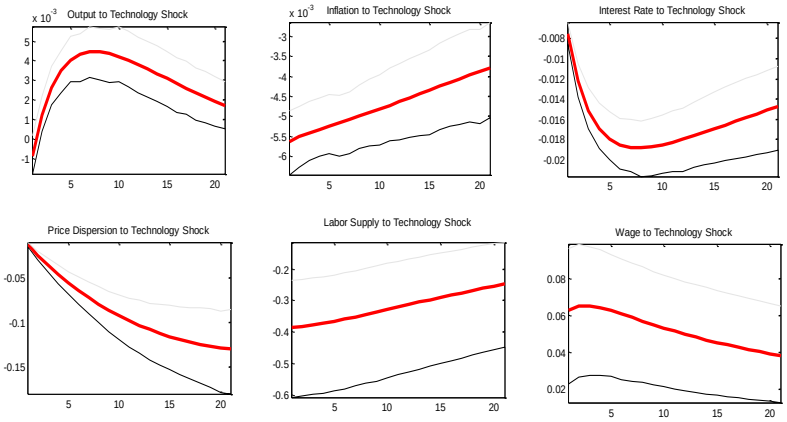
Table 4: Calibration and Estimation Results

Calibrated		
Discount factor, β		0.9974
The government expenditure growth, g		1.068
The trend inflation,		7.281
Estimated Parameters	**Prior[mean,sd]**	**Bayesian[5%,95%]**
Consumption habit, γ	Beta[0.81,0.1]	0.8632[0.839,0.859]
Inverse Frisch elasticity of labor supply, v	Normal[1.59, 0.1]	1.6245[1.613,1.639]
Elasticity of substitution, θ	Normal[10, 0.1]	10.2151[10.163,10.278]
Technology shock persistence, p_z	Beta[0.8,0.1]	0.9569[0.949,0.963]
Government spending shock persistence, p_g	Beta[0.98,0.1]	0.9019[0.880,0.922]
Cost-push shock persistence, p_θ	Normal[0,0.1]	0.0917[0.067,0.117]
Technology shock volatility, $100\delta_z$	IGamma[1,2]	0.2635[0.229,0.293]
Government spending shock volatility, $100\delta_g$	IGamma[0.55,2]	0.0028[0.002,0.003]
Cost-push shock volatility, $100\delta_\theta$	IGamma[0.17,2]	0.0016[0.000,0.003]
Monetary Policy (The interest rate rule)		
Taylor coefficient on the inflation gap, ϕ_π	Normal[1.91,0.1]	2.0434[1.968,2.113]
Taylor coefficient on the output gap, ϕ_y	Beta[0.06,0.1]	0.0433[0.000,0.074]
Monetary shock persistence, p_r	Beta[0.81,0.1]	0.7194[0.695,0.738]
Monetary shock volatility, $100\delta_r$	IGamma[0.24,2]	0.0055[0.005,0.006]
Calvo Price Setting		
Probability of not being able to optimize, η	Beta[0.6,0.1]	0.8492[0.839,0.859]
Shifting Trend Inflation		
Persistence of trend inflation, $\rho_{\bar{\pi}}$	Beta[0.995,0.1]	0.9987[0.997,1.000]
Shocks to trend inflation volatility, $100\delta_{\bar{\pi}}$	IGamma[0.7,2]	0.0008[0.000,0.001]

Posterior Estimates: The posterior means for consumption habit, inverse Frisch elasticity of labor supply, substitution elasticity are standard. The result also illustrates a high probability of being unable to optimize the price. It implies that the price is relatively fully inflexible in the case of developing countries like Vietnam. Regarding Taylor rule, the result suggests that a strong long-run systematic reaction to the inflation gap that consistent to estimates provided by Ascari et al (2010) and Blanchard and Riggi (2009), and a fairly

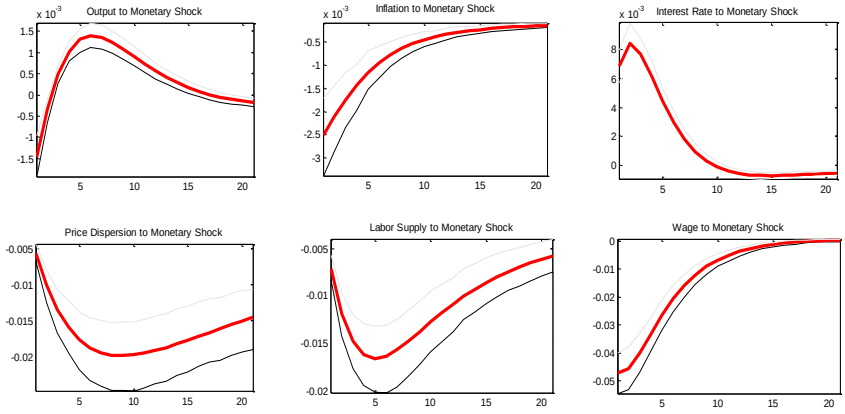
negligible reactiveness to the output gap. However, the policy seems less persistent as expected. It is considerably smaller than those of technology and government spending shock. The highly persistent magnitude of technology shock is consistent to those obtained by Ascari et al (2010) and Smets and Wouters (2007). However, the technology shock is reported significantly volatile as compared to those of other shocks.

Figure 4: Dynamic Responses to Technology Shock



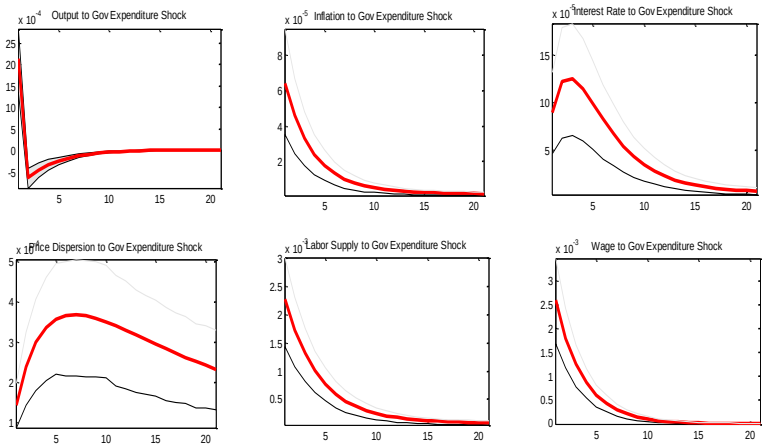
Concerning to a shock to trend inflation, the persistence magnitude is relatively higher than estimates provided by Ascari and Sbordone (2014), Cogley et al (2009), Fuhrer and Moore (2004), Fuhrer (2009). It suggests that impacts of policy implementation inconsistency last longer and more vigorously. As a result, a lack of commitment to pursue a fixed inflation target is expected to cause severe consequence in Vietnam as opposed to developed countries. This shock is also less volatile than others

Figure 5: Dynamic Responses to Monetary Shock



Impulse Response. Figure 4, 5, 6, and 7 illustrate dynamic responses of output growth, inflation, nominal interest rate, price dispersion, labor supply and wage to different shocks. Theoretically, a positive technology shock induces an increase in output and a reduction in inflation. Conversely, these variables fall down under an impact of the positive monetary shock adapting the interest rule. However, a higher $\bar{\pi}_t$ tends to distort this effect. Overall, the realistic behaviors of economy are consistent to theory. The output growth increases and inflation diminishes correspondingly to the technology shock, whereas there is a contraction in both variables under the impact of monetary shock. Further, the technology shock causes nominal interest rate and labor supply to drop. Opposite trends are observed when considering the monetary shock. On the other hand, the price dispersion, generating a wedge between output and labor supply, with respect to both shock. In words, the required labor supply to produce a given amount of output reduces with respect to these shocks.

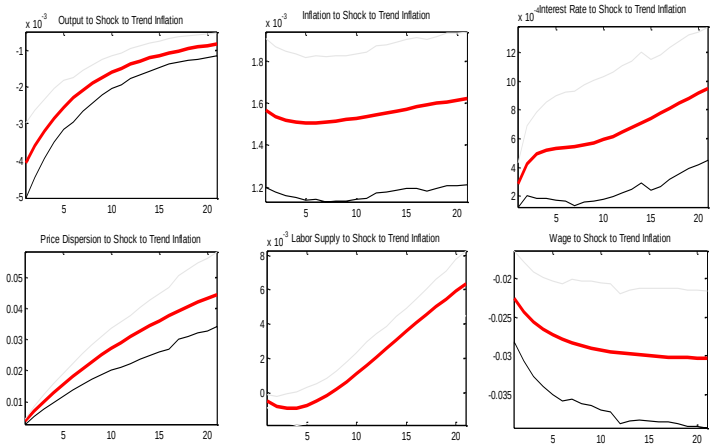
Figure 6: Dynamic Response to Government Expenditure Shock



This study is more interested in the responses of the economy to the shifting trend inflation shock to analyze consequences of policy inconsistency, and to the government expenditure shock to understand how an inadequate policy plays a role as an inefficiency source to magnify the welfare cost. The government spending shock creates an enlargement in output, but this short-lived growth is compensated by a rise in the inflation, interest rate, and price dispersion. Following, the direct consequences of policy inconsistency can be observed throughout the shock to trend inflation. In particular, the output growth diminishes while the inflation and nominal interest rate enlarge and tent to remain persistently in the long-term. There is a decreasing path for wage and labor supply with respect to this shock. More importantly, the price dispersion also illustrates a persistently increasing trend, extending the wedge between labor supply and output. In brevity, these shocks negatively impact the economy through distorting components and environment leading the long-term economic development.

Variance Decomposition. Table 5 reports the variance decomposition, which decomposes the forecast error variances in the output growth, inflation, interest rate, price dispersion, labor supply and wage into components attributable to each of the exogenous shocks in both the short-term and long-term. Accordingly, variations of output growth are mainly explained by the government expenditure and the shifting trend inflation shock, which account for roughly 19.38 percent and 73.82 percent, respectively. The impact of shock to

Figure 7: Dynamic Responses to Shock to Trend Inflation



trend inflation on output growth, however, have a decreasing tendency overtime, whereas the the role of technology shock has become increasingly clearer in the long-run, making up 68.32 percent. Approximately 5 percent of the variations in inflation are attributed to the shifting trend inflation, which is considerably lower than those of technology shock (79.05 %) or the monetary shock (16.48 %). The technology shock and monetary shock also play a vital role in explaining for movements of interest rate, price dispersion, labor supply and wage in the short-term. A shock to trend inflation merely accounts for a modest part of.

Table 5: Variance Decomposition

	Short-term (t=1)				**Long-term (t=40)**			
	ϵ_{zt}	ϵ_{g_t}	ϵ_{rt}	$\epsilon_{\overline{\pi,t}}$	ϵ_{zt}	ϵ_{g_t}	ϵ_{rt}	$\epsilon_{\overline{\pi,t}}$
Output	3.16	19.38	3.63	73.82	68.23	1.48	5.26	25.03
Inflation	79.05	0.01	16.48	4.46	80.95	0.00	4.51	14.84
Interest Rate	77.52	0.01	22.35	0.11	97.59	0.00	1.85	0.56
Price Dispersion	79.05	0.01	16.48	4.46	83.00	0.00	2.78	14.22
Labor Supply	99.93	0.01	0.06	0.00	99.52	0.00	0.34	0.13
Wage	40.82	0.11	45.05	14.02	41.87	0.01	11.14	46.98

variations in inflation, price dispersion and wage, which is respectively 4.46 percent, 4.46 percent, and 14.02 percent. It is notable that impacts of this shock on inflation, price dispersion and wage augment considerably to over 14 percent and nearly 47 percent. In brevity, the impacts of shifting trend inflation shock on output growth tend to diminish

dramatically, whereas its effects on inflation, price dispersion, and wage become stronger in the long-run since it is inherited a high persistence from a shock to trend inflation

Sensitivity Analysis. Table 6 reports that how the shifting trend inflation's persistence and volatile level, and the variance decomposition change correspondingly to a different level of the inflation target, for instance, 2 and 6 percent. In general, the table holds the consensus on the high magnitude of trend inflation's persistence in the case of developing country. It is worth noticing that the volatile of this shock seems to decline as long as the trend inflation increases. In particular, when the central bank sets a low target for inflation, the variance of this shock is (0.03). This number drop dramatically to 0.0078 when the target increases from 2 percent to 6 percent. More importantly, Table 3 also confirms the role of shifting trend inflation shock on explaining variations of main macroeconomic variables, especially in the long-term and when the central bank sets the higher inflation target.

Table 6: Changes of Shifting Trend Inflation Shock to Different Targets

	$\bar{\Pi} = 1.02^{0.25}$			$\bar{\Pi} = 1.06^{0.25}$		
Parameters						
$\rho_{\bar{\pi}}$	0.9993			0.9904		
$100\delta_{\bar{\pi}}$	0.0308			0.0078		
Variance Decomposition	g^y	π	i	g^y	π	i
Short-term (t=1)	0.9	45.3	70.5	20.6	16.2	33.9
Long-term (t=40)	6.3	87.01	96.7	36.5	67.8	66.1

5. Welfare, Welfare Cost, and Inefficiency Sources Computation

To understand the source of the welfare cost of shifting trend inflation, this paper firstly discusses the welfare cost of constant positive trend inflation. Following, the cost of shifting trend inflation is presented. For the purpose of policy implications, I describe and compare two ways to compensate costs causing by the constant and shifting trend inflation in each part. Hence, a good policy is expected to bring about a high benefit (the social welfare) at a low cost (a low welfare cost). Le (2017) argued mechanisms in which the shifting trend inflation affects the economy, this paper introduces two ways to improve the welfare: consumption compensation policy (CCP) and labor compensation policy (LCP).

5.1. Welfare and Welfare Cost of Constant Positive Inflation

Table 7 compares the welfare, welfare cost, inefficiency sources and a few other properties of an economy in which central bank set the target at 0 annualized percent and 6 annualized percent. Concerning the properties of developing country performed in this model, the mechanism that the welfare cost is generated throughout a combination of lower consumption and higher labor supply because of a high price dispersion is guaranteed. In other words, the household needs to work more to maintain the given amount of consumption or he needs to consume less if he does not want to provide more labor. The steady state price dispersion differs from unit in the high-trend-inflation economy. As a result, the steady state consumption decreases from 1.0341 to 1.0300, while there is a rising path, from 1.1044 to

1.1069 for labor supply when the economy moves from the zero inflation target to 6-percent target. Additionally, the economy also becomes more volatile that is reflected by a higher standard error of consumption (from 0.7343 to 0.7676) and labor supply (from 0.8390 to 0.8903) in the high-inflation-target economy.

It can be seen that the high-trend-inflation economy produces a lower welfare as opposed to the zero-trend-inflation economy (a decrease by 7 percent). When comparing to the case of a developed country with positive trend inflation as argued by Le (2017) and Nakata (2014), the welfare in developing the country with positive trend inflation is significantly lower. Regarding welfare cost, the economy with a constant positive trend inflation results in the welfare cost. This cost, however, varies accordingly to policies implemented to compensate the cost. Table 7 illustrates that the welfare cost is higher when the labor compensation is adapted in the circumstance of constant positive trend inflation. In particular, the labor compensation needs 139.61 units while the consumption compensation only needs 5.1464 units to achieve the same level of welfare. Therefore, the cost to improve the social welfare when considering the realistic picture of positive inflation target would be substantially smaller if the policy makers compensate the society' loss by increasing their consumption.

Table 7: Welfare Cost of Constant Trend Inflation

	Model with $\bar{\Pi} = 1.00^{0.25}$		**Model with $\bar{\Pi} = 1.06^{0.25}$**	
	CCP	LCP	CCP	LCP
Welfare costs of constant trend inflation				
Welfare	-1373	-1373	-1471	-1471
Welfare Cost	0	0	5.1464	139.61
Inefficiency Sources				
d_f	0	0	4.9366	133.92
d_m	0	0	4.6423	125.94
d_i	0	0	20.7543	563.93
Steady-State C	1.0341	1.0341	1.0300	1.0300
Steady-State H	1.1044	1.1044	1.1069	1.1069
Steady-State S	1	1	1.0063	1.0063
E[C]	0.0266	0.0266	-0.2011	-0.2011
E[H]	0.2546	0.2546	0.3051	0.3051
E[S]	0.1683	0.1683	0.4312	0.4312
100*Std[C]	0.7343	0.7343	0.7676	0.7676
100*Std[H]	0.8390	0.8390	0.8903	0.8903

Note: CCP, LCP stand for Consumption Compensation Policy and Labor Compensation Policy, respectively.

Further, regardless of policy implemented, the un-optimal inflation target source distorts the economy the most significantly. Compare the magnitude of this source between the industrialized country (Le, 2017) and developing the country, although the greatest impact of un-optimal inflation source is confirmed, the gap between this source and other two sources can be seen clearly in the developing country. The impact of the un-optimal

inflation target is roughly 5 times greater than the others in spite of policy implemented. For an instant, if the CCP is employed, the un-optimal inflation target distorts the economy by 20.7543 percent while other shocks are only approximately 5 percent. The monopolistic competition source takes the third place, which accounts the modest proportion of the economy's distortions. This result is consistent to Le (2017) performed in the U.S.

5.2. Welfare and Welfare Cost of Shifting Trend Inflation

The first and second columns of Table 5 and Table 6 illustrate the welfare, welfare cost, inefficiency sources, and a few properties of economy with shifting trend inflation($100\delta_{\bar{\pi}} = 0.08$) and with constant trend inflation ($100\delta_{\bar{\pi}} = 0$), while the last column reports the economy without business cycle fluctuations. The differences in the Table 5 and Table 6 come from the distinct formulas of shifting trend inflation shock. It can be seen that the economy with drifting trend inflation is more volatile than the constant-trend-inflation economy as illustrated by the standard error of main macroeconomic variables. Therefore, an act, an improvement of consumption or a reduction in labor hours is necessary to compensate the loss in welfare caused by the shifting trend inflation shock. Both tables report that the welfare in the economy with time-varying trend inflation is smaller than in the constant trend inflation economy. However, the difference is not substantial. Relating to

Table 8: Welfare Cost of Shifting Trend Inflation (Model 1)

	Model with all shocks		Model with $\sigma_{\Pi} = 0$		Model with $\sigma_{\Pi}, \sigma_{\theta}, \sigma_{g}, \sigma_{R} = 0$	
	CCP	LCP	CCP	LCP	CCP	LCP
Welfare	-1578	-1578	-1574	-1574	-93.1	-93.1
Welfare Cost	0.1551	4.0600	0	0	391.8	231.83
Inefficiency Sources						
d_f	0.1488	3.8945	0	0	375.79	222.38
d_m	0.1399	3.6624	0	0	353.33	209.12
d_i	0.6256	16.3732	0	0	1579.9	934.91
Steady-State C	1.0274	1.0274	1.0274	1.0274	1.0274	1.0274
Steady-State H	1.1084	1.1084	1.1084	1.1084	1.1084	1.1084
E[C]	-0.3126	-0.3126	-0.2656	-0.2656	-0.0470	-0.0470
E[H]	0.3293	0.3293	0.3242	0.3242	0.0052	0.0052
100*Std[C]	0.7833	0.7833	0.7826	0.7826	0.0335	0.0335
100*Std[H]	0.9109	0.9109	0.9109	0.9109	0.0049	0.0049

Note: CCP, LCP stand for Consumption Compensation Policy and Labor Compensation Policy, respectively.

welfare and welfare cost performed in the U.S argued by Le (2017) and Nakata (2014), the welfare is significantly greater while the welfare cost is futile in the U.S as compared to Vietnam. It suggests that the policymakers should pay attention to consequences of policy implementation inconsistency happening in developing countries. To improve the welfare, two policies are employed. Comparing the efficiency of two policies, the LCP proves itself as an inefficient policy once again by producing a high welfare cost as opposed to CCP. Put

it differently, the LCP requires more sources to achieve the same level of social welfare. Moreover, the welfare cost produced by CCP policy is much sizably lower than LCP policy (0.1551 versus 4.0600). The computation in Table 9 derived from the second formula of shifting trend inflation shock is fairly higher than in Table 8.

The policy implication is various from how business cycles reduces the welfare and which policy is more effective. The third column of Table 8 and 9 dictates the case in which the variances of all exogenous shocks, except for the shock to trend inflation are set to zero. An elimination of business cycle shocks results in the welfare gain. The results here also advocate the CCP policy in the sense that it generates more welfare gain if adapted. It is notable that the welfare improves dramatically when excluding all exogenous shocks from model in the case of developing country while this change is not noteworthy in the U.S. Regarding the inefficiency sources, the non-optimal inefficiency source signifies the welfare cost the most, which is approximately 5 times larger than other sources in all cases. This source is expected to distort the economy or create more benefit to the society. On the other hand, the monopolistic competition source still plays a minor role in explaining the economy's distortions. This result is consistent to Le (2017) but differ to what extents that the magnitude of the non-optimal inflation target is twofold larger than others in an advanced economy, while it is nearly 5 times in an emerging country.

Table 9: Welfare Cost of Shifting Trend Inflation (Model 2)

	Model with all shocks		Model with $\sigma_{\Pi} = 0$		Model with $\sigma_{\Pi}, \sigma_{\theta}, \sigma_{g}, \sigma_{R} = 0$	
	CCP	LCP	CCP	LCP	CCP	LCP
Welfare	-1578	-1578	-1574	-1574	-94.1	-94.1
Welfare Cost	0.1882	4.9566	0	0	389.7	231.83
Inefficiency Sources						
d_f	0.1805	4.7546	0	0	378.3	222.38
d_m	0.1697	4.4711	0	0	351.5	209.12
d_i	0.7590	19.9890	0	0	1571.8	934.91
Steady-State C	1.0274	1.0274	1.0274	1.0274	1.0274	1.0274
Steady-State H	1.1084	1.1084	1.1084	1.1084	1.1084	1.1084
E[C]	-0.3356	-0.3356	-0.2656	-0.2656	-0.0700	-0.0700
E[H]	0.3323	0.3323	0.3242	0.3242	0.0081	0.0081
100*Std[C]	0.7833	0.7833	0.7826	0.7826	0.0335	0.0335
100*Std[H]	0.9109	0.9109	0.9109	0.9109	0.0049	0.0049

Note: CCP, LCP stand for Consumption Compensation Policy and Labor Compensation Policy, respectively.

In short, an introduction of the shock to trend inflation causes the economy to get more volatile and distorts the economy to bring about a dramatic reduction in welfare, especially in developing countries. Therefore, some policies are necessarily implemented to improve the social welfare under impacts of shocks. By analyzing properties of the economy, the welfare cost comes from a reduction of consumption while providing more working hours, thus the consumption compensation policy and labor compensation policy are studied in this

paper. The results show that the CCP is more effective than LCP in the sense that CCP produces the lower welfare costs and generates the high welfare gains. Concerning the inefficiency sources, the non-optimal inflation target distorts the economy the most significantly while the monopolistic source only accounts for a small proportion. Further, the difference in magnitude of impact between a non-optimal inflation target and other sources is significant in Vietnam as opposed to the U.S. In general, the consequence of policy implementation inconsistency is more severe in the developing countries and it would be more efficient to compensate the society' loss by improving their consumptions.

6. Conclusion

The biggest challenge for researchers who want to conduct the study on emerging countries is that vital information and economic properties are not well-documented, in addition to an unavailability and inconsistency of micro-macro data. The problem gets more toilsome for those who adapts the New-Keynesian model because it requires more prior information. Therefore, the first task of this study was to estimate some important parameters in the case of developing countries. To fulfil this task, I employed the Vietnamese data and studied a standard New Keynesian model with forward-looking Calvo price setting, drifting trend inflation and without the full price indexation assumption. The SMM was adapted because of its superiority, for instance, a robust to misspecification or a cheap numerical evaluation. Subsequently, the Bayesian method was considered as a good choice to obtain the estimated parameters in Vietnam. More importantly, the consequences of policy implementation inconsistency on the real economy were investigated by the analysis of the impulse response function, the variance decomposition and welfare's issues and inefficiency sources, which illustrate how the shock to trend inflation affects the economy.

By the impulse response function, these shocks negatively impact the economy by distorting components and environment leading the long-term economic development. In particular, the output growth diminished while the inflation and nominal interest rate enlarged and tented to remain persistently in the long-term. The price dispersion also illustrated a persistently increasing trend, extending the wedge between labor supply and output. Moreover, results of decomposing the forecast error variances in main macroeconomic variables emphasized the essential role of this shock in explaining their variations, especially in the long-term and when the central bank set a high inflation target.

Regarding welfare's issues, a high fluctuation and volatility of the economy were recognized when the central bank set the constant positive inflation target. The inconsistent policy implementation presented by the shock to trend inflation then caused the economy to get more volatile and distorts the economy to bring about a dramatic and substantial reduction in welfare. The problem got worse especially in developing countries where not only does the welfare cost of impacts of un-optimal inflation target were considerably higher, but they were more likely to last longer and more vigorously. Hence, the policy, namely the consumption compensation policy, and labor compensation policy is required to improve the

social welfare. The result showed that the consequences of policy implementation inconsistency were more severe in the developing countries and it would be more efficient to compensate the society' loss by improving their consumptions.

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Table 2: Description of variables

Variable		
h_t	Units of labor	
W_t	The nominal wage rate	
D_t	(Nominal dividend), the profit earned by the various intermediate goods-producing firms	
M_t	Units of money	
B_t	Units of bonds	
T_t	A lump-sum tax	
G_t	The government spending	
Y_t	Units of the finished good	
C_t	Units of the finished product	
Λ_t	the non-negative Lagrange multiplier on the budget constrain	
π_t	The gross inflation rate	$\pi_t = P_t/P_{t-1}$
P_t	Nominal price of finish product	
Z_t	The aggregate technology shocks	
Q_t	The efficient level of output	
n_t	The efficient amount of labor	
Ξ_t	The non-negative Lagrange multiplier	
r_t	The nominal interest rate	
g_t	The output growth	$g_t = Y_t/Y_{t-1}$
x_t	The output gap	$x_t = Y_t/Q_t$
M_t^s	The central bank's money supply	
g_m	The growth rate of money	
m_t^s	The real money supply	
Calvo Price		
P_t^*	The optimizing price of intermediate-goods producing firm	
No_t	A numerator of equation (18)	
De_t	A denominator of equation (18)	
$\wp_t^*$	A relative optimal price	$\wp_t^* = P_{i,t}^*/P_t$
s_t	A price dispersion	
Welfare loss		
d_f	An inefficiency source due to weak policy implementation	
d_m	An inefficiency source due to the monopolistic competition	$d_m = 1/\mu$
d_i	An inefficiency source due to the non-zero trend inflation	

Exogenous Shocks		
Shock	Description	Note
ϵ_{rt}	The monetary shock (interest rate rule)	
ϵ_{mt}	The monetary shock (money growth rule)	
$\epsilon_{\theta t}$	The cost-push shock	
ϵ_{gt}	The government spending shock	
ϵ_{zt}	The technology shock	
$\epsilon_{\bar{\pi}t}$	The trend inflation shock	