

Effects of trend inflation on monetary policy and fiscal policy shocks in Vietnam

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Abstract

Purpose – This paper analyzes variations in the effects of monetary and fiscal shocks on responses of macroeconomic variables, determinacy region, and welfare costs due to changes in trend inflation.

Design/methodology/approach – The authors develop the New-Keynesian model, in which the central banks can employ either nominal interest rate (IR rule) or money supply (MS rule) to conduct monetary policies. They also use their capital and recurrent spending budgets to conduct fiscal policies. By using the simulated method of moment (SMM) for parameter estimation, the authors characterize Vietnam's economy during 1996Q1–2015Q1.

Findings – The results report that consequences of monetary policy and fiscal policy shocks become more serious if there is a rise in trend inflation. Furthermore, the money supply might not be an effective instrument, and using the government budget for recurrent spending produces severe consequences in the high-trend inflation economy.

Practical implications – This paper's findings are critical for economists and monetary and fiscal authorities in effectively designing both the monetary and fiscal policies in confronting the shift in the inflation targets.

Originality/value – This is the first paper that examines the effects of trend inflation on the monetary and fiscal policy implementation in the case of Vietnam.

Keywords Trend inflation, Determinacy region, Capital and recurrent spending, Vietnam

Paper type Research paper

1. Introduction

Lessons from previous crises have shown three weaknesses in policy implementations of the State Bank of Vietnam (SBV). First, SBV has always pursued the objective of stabilizing currency value, curbing inflation and contributing to economic development, which was too widely targeted and lack of specification. Second, the policy implementation in Vietnam, which was a combination of the monetary and fiscal policies has still been inappropriate in the sense that it was used excessively, thus it reacted and became policy shocks. Third, the SBV lacked a commitment to consistently pursue a fixed inflation target. Table 1 reports these facts. Following Ha *et al.* (2020a), we also document the evidence of time-varying trend inflation in Vietnam during the 1996–2015 period as in Figure 1. Therefore, the Vietnamese economy was simultaneously buffeted by inefficient implementations of monetary and fiscal policies as well as time-varying trend inflation.

JEL Classification — C63, E31, E52.

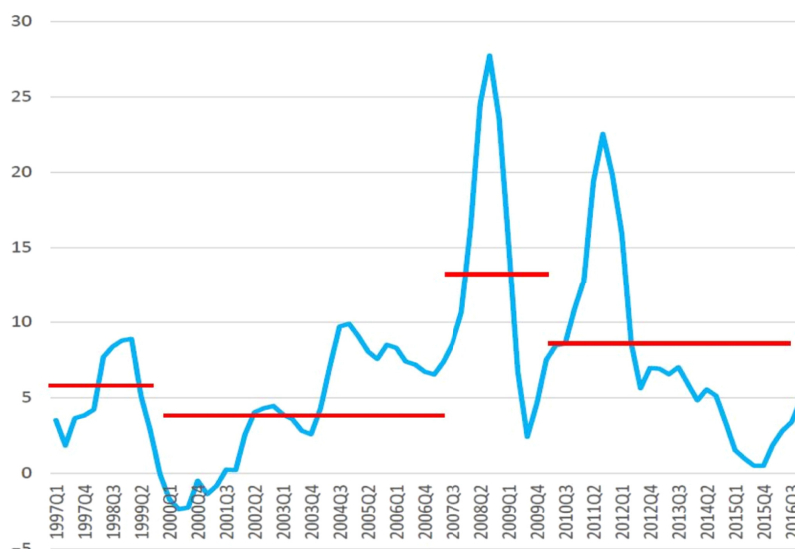
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Table 1.
Objectives and
performances of
monetary policy in
Vietnam (2000–2015)

		2000	2001	2002	2003	2004	2005	2006	2007
Inflation	Target	6	<5	3–4	<5	<5	<6.5	<8	<8
	Performance	–1.7	–0.04	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
	Performance	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
	Performance	23.1	7.1	8.9	28.7	9.1	6.59	4.09	0.63
Output	Target	8.5–9	5	6.5					
	Performance	6.31	5.32	6.78					

Source(s): SBV and [Ha *et al.* \(2020a\)](#)**Source(s):** General Statistics Office of Vietnam and [Ha *et al.* \(2020a\)](#)**Figure 1.**
Vietnam CPI inflation:
1996Q1–2015Q4
(annualized quarter-to-
quarter percent
changes)

Previous papers have exploited various aspects of trend inflation. For example, changes in the transmission mechanism of monetary policy and the dynamics of the economy in response to the shocks due to trend inflation are examined by [Ascari and Sbordone \(2014\)](#). Moreover, [Kiley \(2007\)](#), [Ascari and Ropele \(2009\)](#) and [Coibion and Gorodnichenko \(2011\)](#) have examined the relationship between trend inflation and the model's determinacy. Welfare analysis of trend inflation has also attracted the attention of many scholars such as [Nakata \(2014\)](#), [Ascari *et al.* \(2018\)](#) and [Ha *et al.* \(2019, 2020a, b\)](#). These studies have emphasized the importance and necessity of research on trend inflation.

Although previous works have investigated various aspects of trend inflation, there still exist gaps in the literature. First, the papers examining the effects of trend inflation on the dynamics of the economy to the policy shocks, especially fiscal policies are very scarce. Regarding monetary policy shocks, the prior scholars mostly concentrate on the case that the central banks employ the

nominal interest rate as an important instrument, while they have abstracted a comparison of the efficiency in using the different tools in the economy with time-varying trend inflation. This analysis can provide the central bank with a guideline to improve efficiency if there is a rise in trend inflation. Second, the impacts of trend inflation on consequences of ineffectively using the national budget for different purposes such as capital investment or recurrent spending have not been exploited. Furthermore, there has been a paucity of evidence about an association between trend inflation and policy shocks in developing countries.

In this paper, we expect that trend inflation causes consequences of monetary and fiscal policy shocks to be more severe. The reasons are as follows. First, the relationship between trend inflation and structural shocks has been investigated thus far. For example, the transmission mechanism of monetary policy and the dynamics of the economy in response to the monetary shocks are altered by trend inflation (Ascari and Sbordone, 2014). Variations in the parameters of the log-linearized model explain these alternations. Ascari and Sbordone (2014) demonstrate that responses of the macroeconomy to monetary policy shocks are affected by trend inflation since it reduces the slope of the New Keynesian Phillip curve. Similar evidence on effects of trend inflation on the marginal efficiency of investment (MEI) shocks or monetary policy uncertainty shocks are also provided by Ascari *et al.* (2018) and Ha *et al.* (2020b), respectively. Second, Ascari and Sbordone (2014) and Ha *et al.* (2020a) provide empirical evidence that changes in trend inflation are associated with the ability of the monetary authority to guarantee a determinacy region and macroeconomic stability. However, this paper only concentrates on the interest rate rule while the change in determinacy regions when the monetary authority uses the money supply instrument has not been argued so far. In this paper, we follow Woodford (2003) to prove that the determinacy region that is derived from the Taylor principle when the central banks adopt the money supply rule narrow when trend inflation is higher [1]. Third, the literature has also provided empirical evidence that trend inflation influences welfare costs of shocks (Nakata, 2014; Ha *et al.*, 2019, 2020a) and volatility shocks (Ha *et al.*, 2020b). However, the previous scholars have not paid enough attention to the effects of trend inflation on welfare costs of policy shocks.

We, therefore, attempt to fill these gaps in the literature by expanding the model of Ha *et al.* (2020a) in two dimensions. First, we consider that monetary authorities conduct the monetary policies by using two instruments: the nominal interest rate (IR rule, henceforth) and money supply (MS rule, henceforth). Second, we assume that the SBV uses its budget for capital and recurrent spending. This study employs the simulated method of moment (SMM) for the quarterly data in Vietnam during the 1996Q1–2015Q4 period to characterize the Vietnamese economy. The reasons for selecting this period are as follows. The first reason is the data availability. The important contribution of this paper is to distinguish the effects of two forms of fiscal policy shocks: capital and recurrent spending. However, due to confidentiality, we cannot access up-to-date data. Second, as in other studies [2] in the literature, we also use the refinancing rate to reflect the interest rate rule of monetary policies. The empirical data indicates that the SBV did not change this policy interest rate significantly after 2015. Third, focusing on this period helps us confirm our findings and conclusions. Due to the lack of necessary data and information in the case of developing countries like Vietnam, there have been very few empirical studies that use the Dynamic Stochastic General Equilibrium model in Vietnam (Ha *et al.*, 2020). Hence, it is difficult to select the prior parameter values as a standard in the literature and adapt them to Vietnam's economy. Furthermore, it is also a kind of challenge to check the accuracy of the post parameter values. By concentrating on the same period, we can check the validity of these used parameter values before performing further empirical analysis. This paper aims at investigating the influences of trend inflation on policy implementations in Vietnam. To obtain this goal, we concentrate on analyzing how trend inflation causes variations in impacts of monetary and fiscal shocks in terms of responses of macroeconomic variables, determinacy region and welfare costs. This study, therefore, provides a multi-dimension analysis on this issue.

With these expansions, we provide empirical evidence to support the view that trend inflation is associated with the consequences of policy shocks in Vietnam. In particular, impacts of monetary and fiscal shocks on responses of macroeconomic variables, determinacy region and welfare costs are signified if there is a proposal to raise trend inflation. In other words, the consequences of ineffectively implementing policies are more serious if there is a rise in trend inflation. We also document the fact that the money supply might not be an effective instrument and using the government budget for recurrent spending produces severe consequences if trend inflation is higher.

The rest of this paper is organized as follows. The discussion over related papers is presented in [section 2](#). The extended model will be discussed in [section 3](#), while [section 4](#) explains empirical strategies. [Section 5](#) show the main results, and some conclusions are provided in [section 6](#).

2. Literature review

This paper is closely related to three strands of the literature. First, it is related to papers that investigate the effects of trend inflation on the response of variables to shocks. As argued by [Ascari and Sbordone \(2014\)](#), the transmission mechanism of monetary policy and the dynamics of the economy in response to the shocks are altered by trend inflation. These alternations stem from variations in the parameters of the log-linearized model due to trend inflation. They make a simulation to provide evidence to support the view that trend inflation influences responses of variables to technology and monetary policy shocks. They also highlight that trend inflation tends to raise the persistence of variables, while its effects of volatility are conditional on types of shocks, variables and a calibration. Similarly, [Ascari et al. \(2018\)](#) investigate the interaction between trend inflation and the different shocks. They mostly concentrate on variations in the dynamics of the economy in response to the MEI shocks due to a rise in trend inflation. In this study, they study the impulse response of key macroeconomic variables to these shocks in the model for a different level of trend inflation. Recently, [Ha et al. \(2020b\)](#) have provided evidence to support the view that higher trend inflation signifies effects of policy risk on the economy. In particular, they use time-varying volatility shocks to capture monetary policy risk. These shocks then lead to fluctuations in the macroeconomy and large welfare costs, especially in the high-trend inflation economy.

Furthermore, the second strand that this paper is based on is papers examining the relationship between trend inflation and the model's determinacy. For example, [Kiley \(2007\)](#) uses the model with the sticky price to study how trend inflation affects the ability of the monetary authority to guarantee a determinate equilibrium and macroeconomic stability. [Kiley \(2007\)](#) shows that if trend inflation climbs to moderate levels, it leads to the possibility of increased macroeconomic instability and equilibrium indeterminacy. An expansion of the indeterminacy region when trend inflation increases is also observed by [Ascari and Ropele \(2009\)](#). Besides, [Coibion and Gorodnichenko \(2011\)](#) provide an alternative interpretation of the Great Inflation, which relies on changes in the determinacy properties of a non-zero trend inflation model. The combined effects of a strong response to inflation, a non-existent response to output growth, a relatively little interest smoothing and high-trend inflation cause the US economy to be in the determinacy region in the 1970s.

Other researchers have focused exclusively on a relationship between positive trend inflation and welfare. In particular, this relationship is investigated by [Coibion et al. \(2012\)](#) in the New-Keynesian model while embedding the zero-lower bound for the nominal interest rates. Following Woodford's approach, they derive the utility-based welfare loss function. Moreover, they also analyze three various channels, namely steady-state effects, the magnitude of the coefficients in the utility-function approximation and dynamics of the model, through which the steady-state inflation affects welfare. They also show that typical

targets adopted by industrialized countries are higher than the optimal level of inflation. However, two conclusions, independence of variance of log deviation of output around the steady-state on the trend inflation and dependence of the intercept of the approximation and the coefficient of the variance of the log-deviation of inflation from its trend on trend inflation are controversial. It stems from their way of deriving the welfare loss function that does not depend on the trend inflation. [Alves \(2012\)](#) perceives the issues from the approach of [Coibion et al. \(2012\)](#) and then derives the trend inflation welfare-based loss function that merely depends on aggregate variables to avoid the previous approximation pitfall. With this approach, [Alves \(2012\)](#) finds that trend inflation is inversely related to the relative weight of the output gap that contrasts with [Coibion et al. \(2012\)](#). Furthermore, he also derives a way to compute the inefficiency sources that affect the loss function. By using the same approach, [Alves \(2014\)](#) provides evidence of a policy trade-off that happens when trend inflation deviates from zero, thus the divine coincidence no longer holds.

Recently, [Ascari et al. \(2018\)](#) and [Ha et al. \(2020a\)](#) have quantified welfare costs of trend inflation in the model featuring staggered price and wage contracts. They reveal that the welfare consequences of trend inflation are severe. Instead of directly measuring welfare costs of trend inflation, [Ha et al. \(2020b\)](#) show that welfare costs of policy risk are signified if there is an increase in trend inflation. They also discuss mechanisms through which trend inflation indirectly affects economic welfare.

In general, there is a multiple of studies that have shown diverse consequences of trend inflation. However, we realize gaps in the literature that can be exploited. First, very few papers have examined effects of trend inflation on the consequences of policy shocks. [Ascari and Sbordone \(2014\)](#) pay attention to this issue, but they only consider the alternations of the transmission mechanism of monetary policy, while [Ha et al. \(2020b\)](#) focus on monetary policy uncertainty. Prior scholars have not analyzed an interaction between trend inflation and fiscal policies. Second, the previous papers only consider the case that monetary authorities use either nominal interest rate or money supply as the main tool to conduct monetary policies. No paper compares the efficiency of using these tools to conduct policies in the economy featuring trend inflation. Moreover, the scholars have not concentrated on measuring the indirect effects of trend inflation on welfare costs of policy shocks. Finally, the effects of trend inflation on the consequences of ineffectively using the national budget for different purposes such as capital investment or recurrent spending have not been exploited. Therefore, the present article is an effort to fill these gaps in the literature.

3. Model

We develop the model that consists of four classes of agents: the household indexed by $j \in [0, 1]$, the final-goods producing firms, a continuum of intermediate-goods producing firms indexed by $i \in [0, 1]$ and the authority.

3.1 The household

In the model, we assume that given a budget constraint, households determine the level of consumption (C_t) and working hours (H_t) to maximize their expected discounted present value of future period utility. Their period utility function can be expressed as follows:

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

where β and γ denote the discount factor and the habit formation parameter, which are restricted as $0 < \beta < 1$, $0 \leq \gamma < 1$. ν is the inverse Frisch elasticity of labor supply. The flow budget constraint is given as:

$$P_t C_t + \frac{B_t}{R_t} + M_t = B_{t-1} + M_{t-1} - P_t T_t + W_t H_t + D_t. \quad (2)$$

Equation (2) illustrates distinct sources of income of households. Households can supply $h_t(i)$ units of labor to each intermediate-goods producing firm $i \in [0, 1]$ to earn $W_t h_t(i)$ at the beginning of each period. By owning the intermediate goods, they also receive a nominal profit, D_t , and receive lump-sum government transfer, T_t . And then they decide to distribute their income in diverse ways. During each period t , households purchase consumption goods, C_t , from the final-goods producing firms at the nominal price, P . They also purchase the one-period bond, B_t , from the intermediate-goods producers at the price $1/R_t$ as saving. Suppose that the households carry M_{t-1} units of money. Therefore, households choose labor supply, h_t , bond holding, B_t , money holding M_t , and consumption, C_t , to maximize the lifetime utility subject to the budget constraint.

3.2 The final-goods producing firm

Final-goods producing firms employ the constant-return-to-scale technology to maximize profits. They use $Y_t(i)$ units of intermediate goods sold at a nominal price $P_t(i)$ to manufacture Y_t units of final products, as follows:

$$\left[\int_0^1 Y_t(i)^{\frac{\theta_p-1}{\theta_p}} di \right]^{\frac{\theta_p}{\theta_p-1}} = Y_t, \quad (3)$$

where θ_p denotes the price elasticity of demand for intermediate goods. The profit maximization problem of the final goods-producing firms is demonstrated as follows:

$$P_t \left[\int_0^1 Y_t(i)^{\frac{\theta_p-1}{\theta_p}} di \right]^{\frac{\theta_p}{\theta_p-1}} - \int_0^1 P_t(i) Y_t(i) di. \quad (4)$$

We derive the first-order condition for the problem of final-goods producing firms that is represented as:

$$Y_t(i) = \left[\frac{P_t(i)}{P_t} \right]^{-\theta_p} Y_t. \quad (5)$$

Due to the zero profit in the equilibrium of the competitive final-goods firms, we can represent the final good price as follows:

$$P_t = \left[\int_0^1 P_t(i)^{1-\theta_p} di \right]^{\frac{1}{1-\theta_p}}. \quad (6)$$

3.3 The intermediate-goods producing firm

During the period t , a continuum of intermediate-goods producing firms indexed by $i \in [0, 1]$ hire $h_t(i)$ units of labor supplied by households to produce Y_t units of intermediate goods (i). Their constant-returns-to-scale technology is expressed as follows:

$$Z_t h_t(i) = Y_t(i). \quad (7)$$

The logarithm of an aggregate technology shock, Z_t , follows a stationary stochastic process

$$\ln(Z_t) = \rho_Z \ln(Z_{t-1}) + \epsilon_{Z_t}, \quad (8)$$

where ϵ_{Z_t} denotes the serially uncorrelated innovation, which is characterized by a normal distribution with mean zero and standard deviation σ_Z . The intermediate-goods producers are presumed to follow staggered Calvo price fashion to set nominal. Specifically, a fixed fraction, η_p , of firms, which cannot re-optimize their nominal prices, still set their prices according to the indexation rule (Calvo, 1983). We can represent the way that those firms reset their prices as follows:

$$P_t(i) = \left(\pi_{t-1}^{\mu_p} \bar{\pi}_t^{1-\mu_p} \right)^{\chi_p} P_{t-1}(i), \quad (9)$$

where χ_p and μ_p expresses a degree of price indexation and the relative weight on lagged inflation, respectively. The inflation, π_t , is computed as $\frac{P_t}{P_{t-1}}$ and we interpret $\bar{\pi}_t$ as the central bank's inflation target. By contrast, there is a fraction $(1 - \eta_p)$ of firms, which can set their price. They select the price P_t^* to maximize the present value of future profits:

$$E_t \sum_{s=0}^{\infty} \beta^s \frac{\lambda_{t+s}}{\lambda_t} \eta_p^s \left[P_t^*(i) \left(\bar{\pi}_t^{\chi_{ps}} \right)^{(1-\mu_p)} \left(\pi_{t-1,t+s-1}^{\chi_p} \right)^{\mu_p} - \frac{W_{t+s}}{Z_{t+s}} \right] Y_{t+s}(i), \quad (10)$$

such that

$$Y_{t+s}(i) = \left[\frac{P_t^*(i) \left(\bar{\pi}_t^{\chi_{ps}} \right)^{(1-\mu_p)} \left(\pi_{t-1,t+s-1}^{\chi_p} \right)^{\mu_p}}{P_{t+s}} \right]^{-\theta_p} Y_{t+s}, \quad (11)$$

where $\pi_{t+s-1} = \left(\frac{P_{t+2}}{P_{t+1}} \right) \dots \left(\frac{P_{t+s}}{P_{t+s-1}} \right)$ if $s = 1, 2, 3, \dots$, λ_t is the same as the Lagrangian multiplier on the household's budget constraints, and W_t denotes the nominal wage.

3.4 Authority's policy

3.4.1 Monetary policy. Regarding the IR rule, the authority sets the short-term nominal interest rates (R_t) to deviations of inflation (π_t) from the central bank's inflation target ($\bar{\pi}$) and deviations of output (y_t) from the steady-state ($\bar{y}$) as follows:

$$\frac{R_t}{\bar{R}} = \left(\frac{R_{t-1}}{\bar{R}} \right)^{\rho_R} \left[\left(\frac{\pi_t}{\bar{\pi}} \right)^{\phi_\pi} \left(\frac{y_t}{\bar{y}} \right)^{\phi_y} \right]^{1-\rho_R} \exp(\epsilon_{R_t}). \quad (12)$$

The parameter ρ_R illustrates the degree of interest rate smoothing. ϵ_{R_t} is an i.i.d monetary policy shock.

Regarding the MS rule, we follow Zhang (2009) to represent the central bank's money supply (M_t^s) mechanism as follow:

$$M_t^s = (g_{m,t}) M_{t-1}^s, \quad (13)$$

$$\frac{M_t^s}{P_t} = (g_{m,t}) \frac{M_{t-1}^s P_{t-1}}{P_t P_{t-1}}. \quad (14)$$

Money growth rule can be expressed as

$$\frac{gm_t}{gm} = \left(\frac{gm_{t-1}}{gm} \right)^{p_{gm}} \left(\frac{\pi_{t+1}}{\bar{\pi}_t} \right)^{-s_1} \left(\frac{y_t}{y} \right)^{-s_2} \delta_r e^{mt}, \quad (15)$$

$$e_{mt} = p_{em} e_{mt-1} + \epsilon_{mt}. \quad (16)$$

This rule bases on the idea that the central bank implements monetary policies by using the money supply. In [equation \(4\)](#), gm_t is the growth rate of money, p_{gm} , illustrates the persistence of the money growth, and s_1 , s_2 are responses of money growth to the deviation of inflation from the target and output from the steady-state, respectively.

The evolution of trend inflation is described as a persistent AR(1) process as

$$\ln(\bar{\pi}_t) = (1 - \rho_{\bar{\pi}}) \ln(\bar{\pi}^*) + \rho_{\bar{\pi}} \ln(\bar{\pi}_{t-1}) + \epsilon_{\bar{\pi}_t}, \quad (17)$$

where $\rho_{\bar{\pi}}$ denotes the degree of shock persistence and $\epsilon_{\bar{\pi}_t}$ is a standard normally distributed shock which is independent of time.

3.4.2 Fiscal policy. The public spending is written as

$$G_t = \left(1 - \frac{1}{g_t} \right) Y_t, \quad (18)$$

where g_t is an exogenous disturbance following the stochastic process

$$\ln(g_{t+1}) = (1 - \rho_g) \ln(\bar{g}) + \rho_g \ln(g_t) + \epsilon_{g_t}, \quad (19)$$

where $\left(1 - \frac{1}{g} \right)$ represents the steady-state value of government spending relative to output. In this paper, we consider that the government uses the budget for different purposes: capital and recurrent spending and then measure their impacts.

3.5 Market clearing condition

The market-clearing condition in the labor market, the goods market and the bond can be expressed in turn as

$$H_t = \int H_t(i) di, \quad (20)$$

$$Y_t = C_t + G_t, \quad (21)$$

$$B_t = 0. \quad (22)$$

4. Empirical strategy

4.1 Method for quantifying welfare costs

The present article follows [Ha et al. \(2019, 2020a, b\)](#) to use the perturbation method to compute the approximation to the policy functions around the deterministic steady-state. We then use those to quantify the welfare. The welfare can be decomposed into three diverse component as follows:

$$E \left[\sum_{t=0}^{\infty} \beta^t u(x_t) \right] \approx \sum_{t=0}^{\infty} \beta^t u(\bar{x}) + \sum_{t=0}^{\infty} \beta^t M u(\bar{x}) E[x_t - \bar{x}] + \sum_{t=0}^{\infty} \beta^t N u(\bar{x})$$

$$E \left[(x_t - \bar{x}) \otimes (x_t - \bar{x}) \right] = U_d + U_l + U_v,$$

where $x_t = [C_t, C_{t-1}, H_t]$; and $Mu(\bar{x})$ and $Nu(\bar{x})$ denote vectors which express the first and second derivative of $u(\cdot)$ evaluated at the deterministic steady state of x_t ($\bar{x}$). Three components are respectively the deterministic component, $U_d = \sum_{t=0}^{\infty} \beta^t u(\bar{x})$, the level component, $U_l = \sum_{t=0}^{\infty} \beta^t Mu(\bar{x})E[x_t - \bar{x}]$, and the volatility component, $U_v = \sum_{t=0}^{\infty} \beta^t Nu(\bar{x})E[(x_t - \bar{x}) \otimes (x_t - \bar{x})]$.

Then we can quantify the welfare cost as follows

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

where $C_{A,t}$, $H_{A,t}$ are consumption and labor supply in the economy with $\sigma_{\pi} > 0$ and $C_{B,t}$, $H_{B,t}$ are in the economy with $\sigma_{\pi} = 0$.

4.2 Estimation

4.2.1 Data. The system consists of five observable variables, including output growth (g_t^y), inflation (π_t), short-term nominal interest rate (r_t), money supply growth (g_t^M) and government spending growth (g_t) that is either capital or recurrent spending. This study uses quarterly Vietnam data collected from 1996Q1 to 2015Q4. We collect the raw data from the database available at the General Statistics Office of Vietnam (GSO) and International Financial Statistics (IFSs). The data for government spending growth is available at the website of the SBV. We also divide seasonally-adjusted figures for real GDP by the total population, which is GDP per capita. This indicator then serves as a measure of output growth. We also obtain measures of inflation and nominal interest rate, respectively, by making quarterly changes in seasonally-adjusted figures for consumer price index and quarterly lending rate. All data are de-trended before the estimation of the model.

4.2.2 Simulated method of moment estimates. In this paper, we follow [Ha et al. \(2020a\)](#) to use the SMM suggested by [Ruge-Murcia \(2012\)](#) to estimate parameters in the developed model. As in [Ha et al. \(2020\)](#), we fix parameters prior to estimation. [Table 2](#) reports information of fixed parameters.

The remaining parameter, including persistence level and volatility level of monetary shock (ρ_R and σ_R), money supply shock (ρ_{gm} and δ_{gm}), technology shock (ρ_Z and σ_Z) and shock to trend inflation (ρ_{π} and σ_{π}), the Taylor coefficients on inflation (ϕ_{π}) and output gap (ϕ_y) or money supply on inflation (s1) or output gap (s2). Note that we consider that the central banks employ either IR rule or MS rule to conduct their monetary policy. We report SMM estimated parameters based on the second-order approximate solution for Vietnamese data in [Table 3](#).

5. Empirical results

5.1 Cyclical effects of trend inflation

This part simulates how an increase in trend inflation affects the dynamic response of the endogenous variables to monetary and fiscal policy shocks. We consider two monetary policy rules: IR and MS. [Figures 2a and 2b](#) present the path of macroeconomic dynamics by adapting the IR and MS rules, respectively, in the model considering different values of trend inflation, for example, 0% ($1.00^{0.25}$); 2% ($1.02^{0.25}$); 4% ($1.04^{0.25}$). For IR rule, the contraction of output and inflation is recorded as in the theory, while an interest rate expands under the impacts of monetary shock. However, they immediately return to a steady state. The changes in trend inflation significantly affect the response of output

Table 2.

Fixed parameters

Parameter	Description	Value	Target
$\bar{\pi}$	Steady-state inflation	1.02 ^{0.25}	2% inflation steady state
β	Discount factor	0.99	Standard value
ν	Inverse Frisch elasticity of labor supply	3.00	Standard value
γ	Consumption habit	0.80	Standard value
θ	Elasticity of substitution	10.0	Standard value
χ	Degree of indexation	0.00	Cogley <i>et al.</i> (2009)
μ	Weight on lagged inflation	1.00	Cogley <i>et al.</i> (2009)
G/Y	Government expenditure share	0.22	Sample mean

Source(s): Ha *et al.* (2020)

Parameter	Description	Estimated value
p_R	Monetary shock persistence	0.8102*
p_Z	Technology shock persistence	0.7999*
$\rho_{\bar{\pi}}$	Shock to trend inflation persistence	0.9949*
p_{gm}	Money supply shock persistence	0.8500*
$100\delta_R$	Monetary shock volatility	0.0024 *
$100\delta_Z$	Technology shock volatility	0.0099*
$100\delta_{\bar{\pi}}$	Shock to trend inflation volatility	0.0007*
$100\delta_{gm}$	Money supply volatility	0.0025*
ϕ_{π}	Taylor coefficient on the inflation gap	2.4234*
ϕ_y	Taylor coefficient on the output gap	0.5000*
S1	Money supply coefficient on the inflation gap	1.9200*
S2	Money supply coefficient on the output gap	0.0800

Note(s): * means $p_value < 0.05$: statistically significant at 5% significance level

Source(s): Author's calculation

Table 3.

SMM estimates

growth and price dispersion, while there are modest changes in the response of inflation and real interest rate.

Adapting the MS rule, a positive monetary shock leads to an expansion of both output and inflation, whereas an interest rate experiences a contraction. Moreover, a rise in trend inflation tends to distort the effect of monetary policy shock on output and aggrandize it on inflation, real interest rate and price dispersion. Seemingly, there may be relatively similar responses of macroeconomic variables to monetary supply and interest rate shocks. There is a weaker response of output to these shocks, the differences in the response of inflation and interest rate to money supply and interest rate shocks are slight. Hence, in the present analysis, we cannot conclude the distinction in marginal effects of two types of shocks on the economy. The Figure 2c depicts the impacts of fiscal shocks (government spending) on the economy. The fiscal shocks cause all macroeconomic variables to increase. However, an increase in trend inflation reduces the impacts of these shocks on the economy.

5.2 Effects of trend inflation on determinacy region

Subsequently, the paper examines the effects of changes in trend inflation on the ability of the monetary authority to guarantee a determinacy region and macroeconomic stability as in Ascari and Ropele (2009) and Ascar and Sbordone (2014). This part particularly concentrates on a determinacy region to analyze how the Taylor rule parameters (ϕ_y , ϕ_{π}) as well as the money supply rule parameters (s_1 , s_2) response concerning changes in trend inflation.

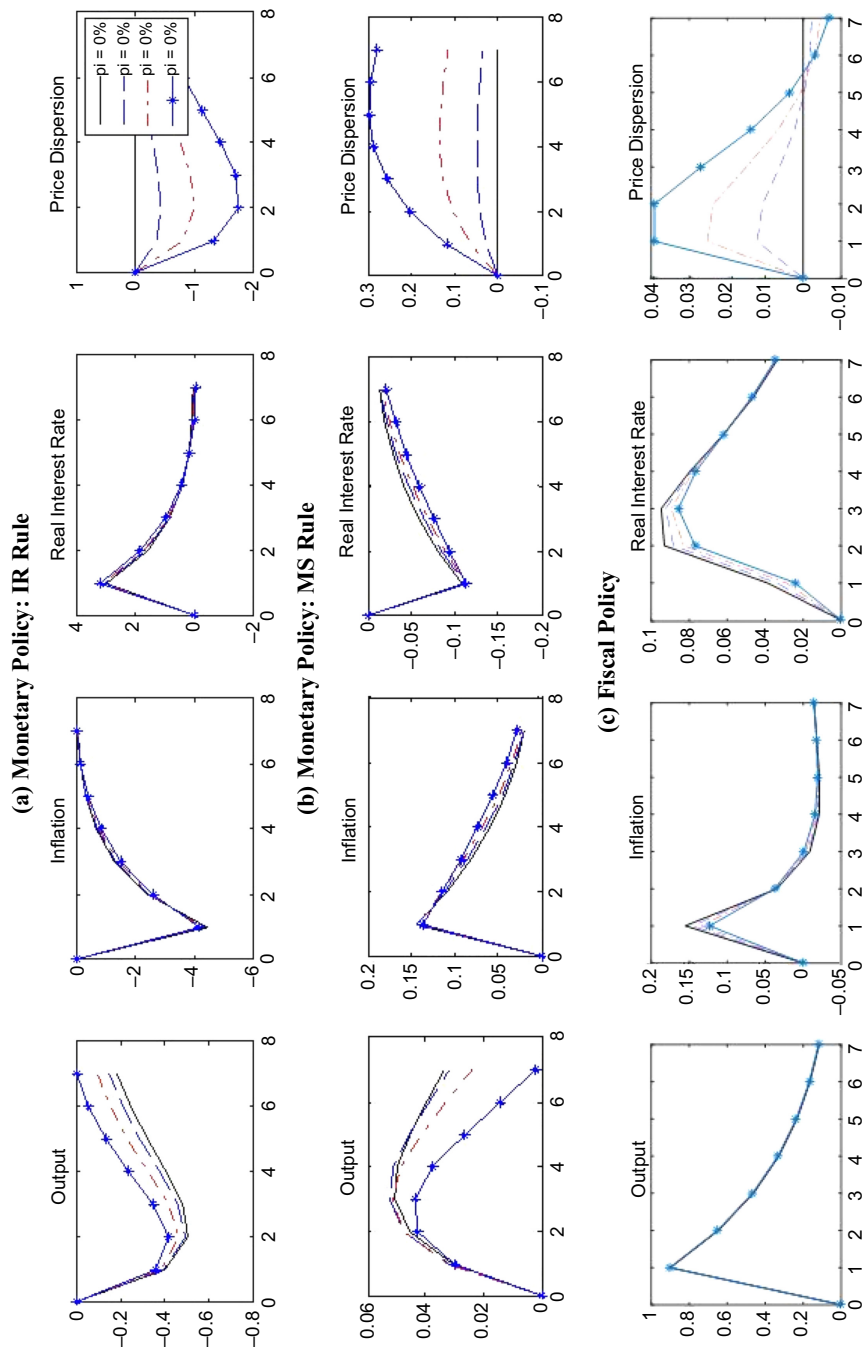


Figure 2.
Impulse response
functions to policy
shocks

Source(s): Author's calculation

Following [Woodford \(2003\)](#), a determinacy condition is derived from the Taylor principle as follows:

$$\frac{d\hat{r}}{d\hat{\pi}} = (1 - p_r) \left[\phi_{\pi} + \phi_y \frac{d\hat{Y}}{d\hat{\pi}} \right] > (1 - p_r),$$

$$\text{and } \frac{d\hat{g}\hat{m}}{d\hat{\pi}} = \left[-s_1 - s_2 \frac{d\hat{Y}}{d\hat{\pi}} \right] > 1.$$

[Figure 3](#) illustrates the determinacy region in the space of the policy parameters (ϕ_y, ϕ_{π}) and (s_1, s_2) . Panel (a) and (b) portraits the determinacy region with IR and MS rule, respectively. The determinacy region narrows rapidly with trend inflation, especially when the central bank adapts the MS rule. Visually, the determinacy region shrinks because two lines governing the generalized principles rotate when trend inflation increases. Hence, a weaker policy toward output as long as a stronger policy toward inflation is required simultaneously to guarantee the region regardless of the adapted policy rules.

5.3 Trend inflation vs welfare costs

5.3.1 Welfare costs of monetary shocks. In this analysis, we examine the effects of trend inflation on welfare costs of policy shocks. These policy shocks include the monetary and fiscal policy that may distort the economic welfare to produce welfare costs. A high level of trend inflation then magnifies these costs and leads to more severe consequences. Previous scholars such as [Nakata \(2014\)](#), [Ha et al. \(2019, 2020a\)](#) concentrate on measuring welfare costs of trend inflation. [Ascari et al. \(2014\)](#) and [Ascari et al. \(2018\)](#) pay attention to the cyclical effects of trend inflation. [Ha et al. \(2020\)](#) investigate interactions between trend inflation and policy risk shocks in terms of welfare costs and dynamic responses of variables to policy risk shocks. To our best knowledge, however, no paper studies the effects of trend inflation on welfare costs of policy shocks. Therefore, this article serves to fill this gap in the literature.

We first quantify the welfare costs of monetary shocks in Vietnam and report the results in [Table 4](#). With an assumption that the central bank sets an inflation target at 2%, welfare costs of monetary shocks are modest (0.015%). An increase in trend inflation level produces higher welfare costs. Furthermore, we compare welfare changes due to trend inflation when the central bank uses distinct instruments. [Figure 4](#) indicates trends of output and welfare when using the IR ([Figure 4a](#)) and MS ([Figure 4b](#)) rule. Both rules show that welfare decline nonlinearly. However, adopting the MS rule causes welfare to decline more considerably but this negative effect seems to diminish when trend inflation is higher, as indicated on the convex downward curve. On the other hand, welfare follows the concave downward curve under IR rule implying that welfare falls more substantially when trend inflation rises.

5.3.2 Welfare costs of fiscal shocks. This section concentrates on the welfare costs of fiscal shocks. We consider that the government uses the budget for various purposes: capital and recurrent spending. By using the actual data in Vietnam taken from SBV, we estimate respective values of fiscal shocks, including $\bar{g}$; ρ_g ; and σ_g . We report the results in [Tables 5](#) and [6](#).

Regarding capital spending, we obtain the estimated parameters: $\bar{g} = 1.07$; $\rho_g = 0.85$; $\sigma_g = 0.007$. [Table 5](#) reports welfare costs of government capital spending shocks on the economy. We show that the welfare costs of the government's capital spending are very small (0.08%). The variation in inflation target levels does not cause any change in these costs. [Table 5](#) reports no significant change in the business cycle properties. Thus, the

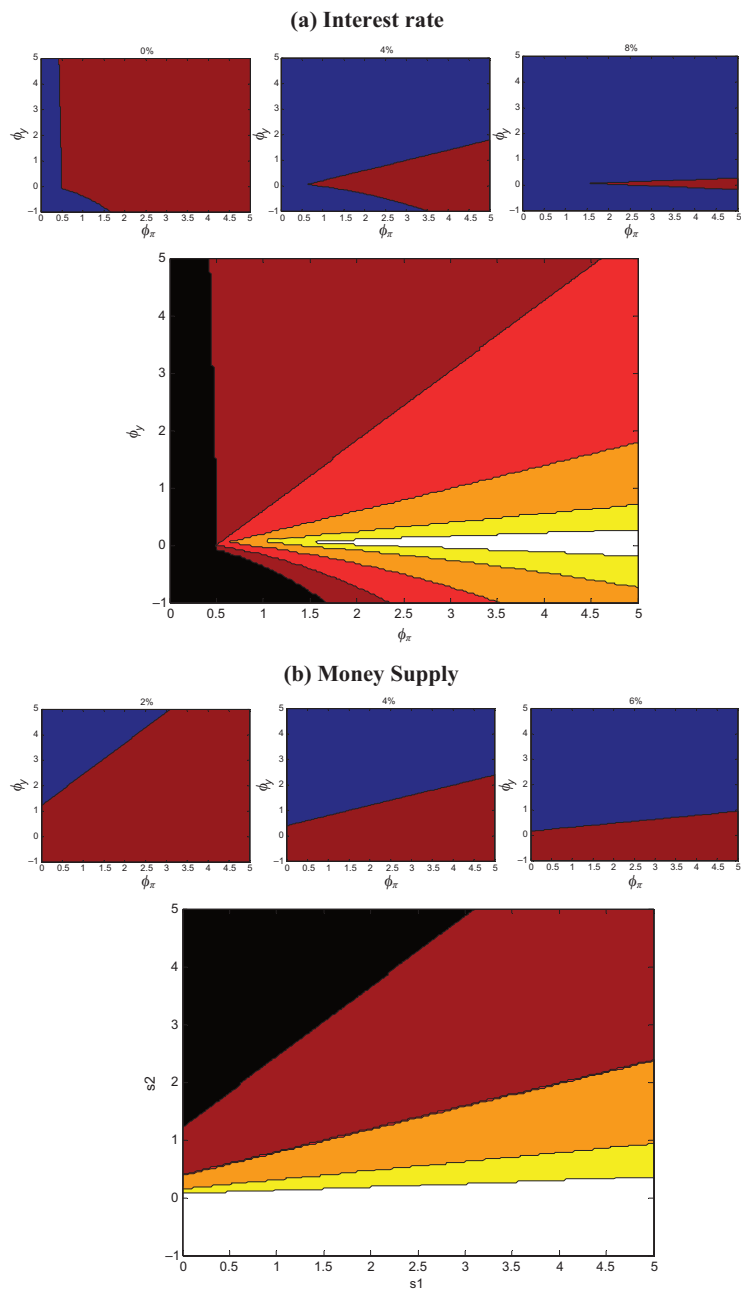
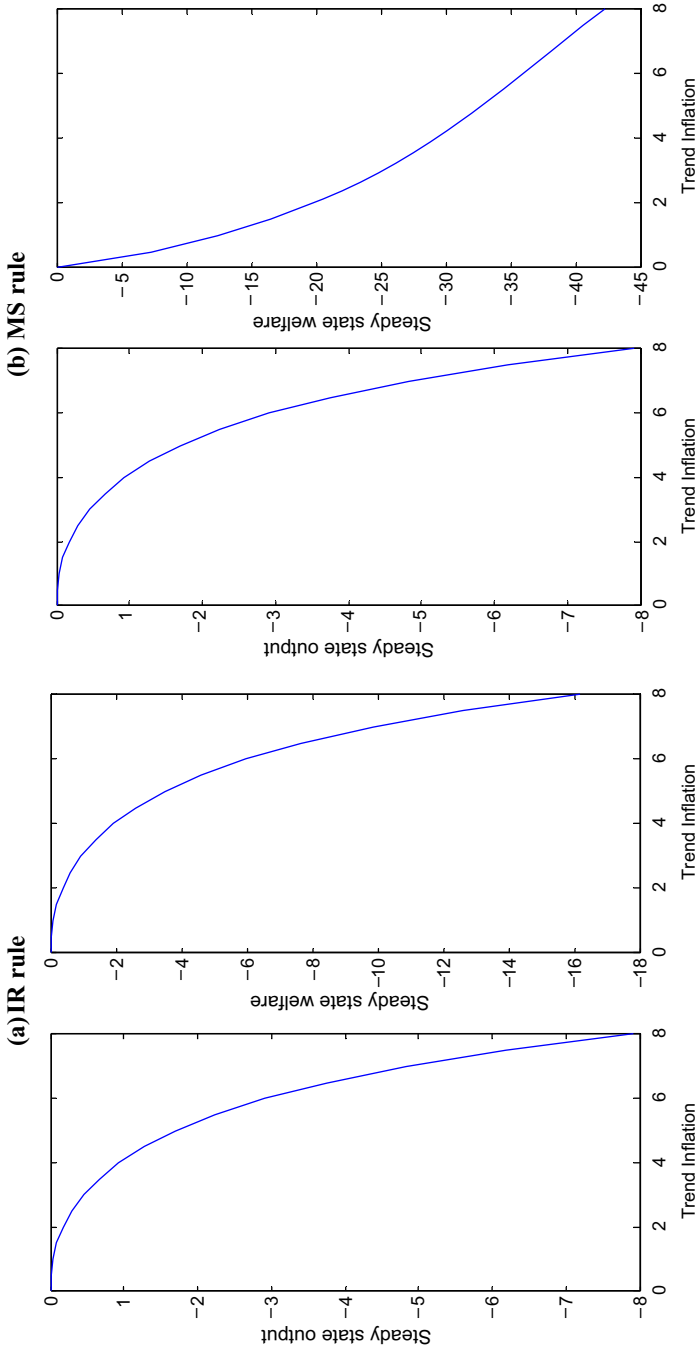


Figure 3.
Trend inflation and
determinacy region

Note(s): The determinacy region is expressed by the red color area
Source(s): Author's calculation

	$\bar{\pi}^* = 1.02^{0.25}$	$\bar{\pi}^* = 1.06^{0.25}$
Welfare cost		
Welfare		
U_d	-213.03	-219.08
U_l	-211.15	-212.11
U_r	-0.43	-4.81
U_f	-1.44	-2.16
C_{SS}	0.82	0.81
H_{SS}	1.05	1.05
$E(C)^*$	-0.34	-0.01
$E(H)^*$	0.01	0.06
$100\sigma_C$	1.66	1.33
$100\sigma_H$	1.63	1.95
Note(s): *Expressed as a percentage deviation from the deterministic steady-state. U_d , U_l and U_r are the deterministic steady-state, level and volatility components, respectively		
Source(s): Author's calculation		

Table 4.
Welfare costs of
monetary shocks



Source(s): Author's calculation

Figure 4.
Trend inflation and
welfare

	$\bar{\pi}^* = 1.02^{0.25}$		$\bar{\pi}^* = 1.06^{0.25}$	
Welfare cost	0.08%		0.08%	
Welfare	-193.43	-193.61	-199.61	-199.78
U_d	-192.79	-192.79	-193.66	-193.66
U_l	-0.44	-0.45	-4.37	-4.41
U_v	-0.20	-0.37	-1.60	-1.71
C_{SS}	0.93	0.93	0.93	0.93
H_{SS}	1.0008	1.0008	1.0008	1.0008
E(C)*	-0.40	-0.41	-0.394	-0.397
E(H)*	0.01	0.01	0.14	0.14
$100\sigma_C$	0.68	0.93	1.97	2.04
$100\sigma_H$	1.28	1.54	1.66	1.90

Note(s): *Expressed as a percentage deviation from the deterministic steady-state. U_d , U_l and U_v are the deterministic steady-state, level and volatility components, respectively $\bar{g} = 1.07$; $\rho_g = 0.85$; $\sigma_g = 0.007$

Source(s): Author's calculation

Table 5.
Welfare costs of fiscal
shocks (capital
spending)

	$\bar{\pi}^* = 1.02^{0.25}$		$\bar{\pi}^* = 1.06^{0.25}$	
Welfare cost	0.45%		0.69%	
Welfare	-207.63	-208.53	-213.91	-215.34
U_d	-206.99	-206.99	-207.93	-207.93
U_l	-0.44	-0.94	-4.40	-5.46
U_v	-0.21	-0.60	-1.58	-1.95
C_{SS}	0.84	0.84	0.84	0.84
H_{SS}	1.04	1.04	1.04	1.04
E(C)*	-0.36	-0.79	-0.35	-0.44
E(H)*	0.01	0.01	0.15	0.15
$100\sigma_C$	0.61	0.85	1.77	1.83
$100\sigma_H$	1.32	3.91	1.72	4.34

Note(s): *Expressed as a percentage deviation from the deterministic steady-state. U_d , U_l and U_v are the deterministic steady-state, level and volatility components, respectively $\bar{g} = 1.23$; $\rho_g = 0.46$; $\sigma_g = 0.034$

Source(s): Author's calculation

Table 6.
Welfare costs of fiscal
shocks (recurrent
spending)

increase in capital spending does not cause severe issues to the economy and the signifying effects of trend inflation are also not recognized.

By using the data for recurrent spending, we achieve estimated values for fiscal shocks given as: $\bar{g} = 1.23$; $\rho_g = 0.46$; $\sigma_g = 0.034$. Table 6 reports welfare costs of recurrent spending shocks, which is significantly higher than capital spending shocks. More importantly, a higher trend inflation level signifies these costs. The results suggest that recurrent spending might produce more severe consequences as compared to capital spending, especially there is a rise in trend inflation.

6. Conclusions

This paper extended the New-Keynesian model in Ha *et al.* (2020a) by two dimensions. We assumed that the monetary authorities employ two instruments: nominal interest rate and money supply to conduct the policies. In the specific analysis regarding fiscal policy, we decomposed the government spending into capital and recurrent spending. The main

purpose of this article is to investigate the impacts of trend inflation on the consequences of policy shocks in Vietnam. While prior scholars focused on the cyclical effects of trend inflation, our attention is paid to changes in welfare costs of policy shocks due to trend inflation. Although a few papers investigated changes in welfare costs of policy risk caused by trend inflation, there is no paper to study the interaction between trend inflation and policy shocks. A change indeterminacy region when the central banks use the nominal interest rate and the money supply was another interest. Our paper also made a further contribution by distinguishing the effects of shocks to capital and recurrent spending on the economy and examining the effects of trend inflation on these effects.

Our result illustrated that trend inflation leads to changes in the effects of monetary and fiscal shocks on the economy. In particular, trend inflation signifies impacts of monetary and fiscal shocks on responses of macroeconomic variables, determinacy region and welfare costs. In other words, trend inflation causes the consequences of policy shocks to be more severe. The empirical results also suggested that with a rise in trend inflation, the money supply might not be an effective tool, and using government budget for recurrent spending produces severe consequences.

Notes

1. Let see the details in [section 5.2](#).
2. See [Le and Wade \(2008\)](#) in the case of Vietnam.

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Further reading

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