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Inflation Threshold in Vietnam and Financial Stability's Implication

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To date, paramount efforts have been put into investigating the inflation-growth relationship. While the results are various, the threshold effect has been widely accepted. The first objective of this paper is to test hypothesis that the growth-inflation relationship in Vietnam is non-linear. Threshold Auto Regression (TAR) model is employed to estimate the inflation threshold with time series data of Vietnam over the period 2000-2014. We also use the Bootstrap method introduced by Hansen (2000) to test the statistical significance of the threshold effect. Findings indicate that there exists a statistically significant negative relationship between growth and inflation for inflation rates above the threshold level of 4.8%. The second objective of this paper is to test whether the State Bank of Vietnam ('SBV') has to accept a lower level of inflation threshold when taking financial stability into consideration. We develop the deviation of credit growth from its trend as proxy of financial stability index then incorporate it into the extended-TAR model. The study finds that in this case, the monetary policy space will be narrowed with a lower level of inflation threshold (3.9%). Financial stability will, however, mitigate the negative effect of inflation on growth when inflation exceeds the threshold level.

JEL Codes: C32, E31, O40

1. Introduction

The inflation-growth relationship in Vietnam is complicated (Appendix A). Vietnam had enjoyed the strong economic performance and low inflation over the period 2000-2007. The positive relationship between growth and inflation was experienced when growth increased from 6.7% (2000) to 8.46% (2007) and inflation increased from a slight deflation point in 2000 (due to weak demand resulted from adverse effects of Asian financial crisis in 1997) to a two-digit figure of 12.63% in 2007. In 2008, as a consequence of negative supply shock (oil and food price in the international market sharply peaked up) and the lasting easy monetary policy during the previous period, the Philips curve shifted upwards, causing more sacrificed trade-off between economic performance and inflation. While economic growth felt down to 6.18%, there was a significant increase in inflation (up to 19.89%). In the following year, the spillover effects of the global financial crisis and economic recession started adversely affecting Vietnam's economy. The economy moved downward along the Philips curve 2008-2009 with the deep decrease in both inflation (6.52%) and growth (5.32%). In 2010, there was a turning point in the change of monetary regime and reverse in the transition of Philips curve. To specify, during the first half of the year 2010, the monetary condition was maintained as tightened, then being switched to loosening status for the rest of year. As a result, the economy which had been on the road toward the Philips curve 2000-2007 changed its direction backward to the Philips curve 2008-2009. The sacrifice ratio of the Philips curve 2011-2012 became even greater than

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that of the Philips curve 2008-2009. This clearly was a valuable lesson for Vietnam's policy makers about the patience required in controlling the economy's inflation expectation. Since 2012, the macroeconomic stability (rather than economic growth as the previous period) has been prioritized as the first objective and the economy has gradually come back to the status of the Philips curve 2000-2007. The intuitive existence of threshold effect of inflation on growth in Vietnam as illustrated in the movement of the Philips curve is to be tested by econometric model in the following sections.

Since global financial crisis, the role of central banks has entered into new normal. There has been an increasing trend in emphasizing the implication of financial stability on monetary policy. A telling example of this trend is the introduction of the Inflation Target incorporating Financial Stability framework that covers financial stability objective in the central bank's loss function. As suggested by Aydin and Volkan (2011), four systemically important financial stability indicators that central bank should pay attention on are nonfinancial sector's borrowings spread, bank leverage, credit volume and house prices. While such an idea is widely accepted, more importantly, which financial stability indicator to be selected and its implication to traditional growth-inflation relationship are the further questions. As for Vietnam, though not stating clearly any change in monetary framework, the SBV has recently taken many first steps to take financial stability into account (IMF 2016). In the context of a bank-based economy, economic operations in Vietnam have relied significantly on the supply of bank credit. Credit volume-to-GDP ratio at some point reached more than 120% while security market has still been at the early stage of development. Hence, the bank credit channel plays the critical role in transmitting the monetary condition into market participants' behaviors. That is why credit crunch at the downside time and credit booming at the upside wing of economic cycle have exaggerated the complication of the growth-inflation relationship. Based on this ground, we develop the deviation of credit growth from its trend as proxy of financial stability then incorporate it into estimation (Appendix B).

There are two research questions addressed in our paper: *'Does the non-linear relationship between growth and inflation exist in Vietnam?'* and *'What are the financial stability's impacts on the level of threshold and implications for central banks when they consider to take financial stability into account?'.* Although the first question has been addressed by some previous studies, to our best knowledge, there is very few study on financial stability and its implication on inflation threshold in Vietnam. Hence, more than verifying the non-linear effect, our paper is also among the first attempts to develop financial stability index and evaluate its impact on monetary policy. It is the new contribution of our study in comparison with previous studies.

The remainder of our paper is as follows. The next section briefly presents previous literature review. Section 3 outlines the empirical estimation framework. Section 4 presents the data and estimated results. Section 5 concludes the study with policy recommendations.

2. Literature Review

What level of inflation is detrimental to economic performance? There seems a doubt in empirical studies conducted before 1993 that high inflation is bad for growth. Wai's (1959) research argues that there is no relationship between inflation and growth. Similarly, Johnson's (1967) paper finds no clear evidence about the direction of inflation's effect on growth. Another study of Levine and Renelt (1992) concludes that the validity of empirical research and the growth-inflation relationship is not sustainable and subjects to the selected model's specification. These results are line with the complication of the growth-inflation relationship and the practice of employing traditional linear model.

Until 1993, the seminal work by Fischer is among the first to investigate the possible non-linear effect of inflation on growth. Subsequently, many empirical studies on inflation threshold use a large panel data across countries. Although the level of inflation threshold proposed by different empirical researches varies case by case, the threshold effect of inflation on growth is widely accepted. In addition, the level of inflation threshold in advanced countries is much lower than that in developing and transitional nations. For examples, Khan and Senhadji (2001) employ threshold estimation technique for a data panel of 140 countries comprising both developed and developing countries for the period of 1960-1998. The results argue that the optimal level of inflation in advanced countries should be within the range of 1-3%, while the number for developing countries being of 7-11%. In addition, López-Villavicencio and Mignon (2011) estimate the growth effect of inflation on a sample of 44 countries in the period of 1961-2007. Based on PSTR and GMM models, they find inflation threshold level of 5% for whole sample, 1.23% for developed countries, 14.54% for emerging countries, 10.273% for upper middle countries and 19.64% for lower middle and low countries, respectively. A similar study is carried by Eggoh and Khan (2014), who examine the inflation-growth nexus by a panel of 102 developed and developing countries over the period of 1960-2009. The estimation suggests a threshold level of 10.5% for global, 3.4% for high-income countries, 10% for upper middle-income countries, 12.9% for lower middle-income countries and 19.5% for lower income countries, respectively.

Despite some consensus and achievement, researches using large panel data sometimes fail to take each country's unique characteristics into estimation model. As a result, there was a spectrum of researches focusing on time series data of a specified country such as Pakistan (Mubarik 2005 using data from 1973-2000 and proposing threshold of 9%; Hussain 2011 using data from 1973-2005 and arguing threshold of 4-6%), India (Mohanty et al. 2011 advocating threshold of 4-5.5%), Nigeria (Sitikantha and Nadhanael 2012 finding no statistically significant threshold; Doguwa 2012 using quarterly data from 2005Q1 to 2012Q1 and proposing threshold of 10.5%). Further investigating the different level of inflation threshold of countries, Eggoh and Khan (2014) indicate that the inflation's effect on growth is subject to certain macroeconomic conditions that can vary substantially from one country to another.

Many studies in Vietnam have suggested the existence of inflation threshold in Vietnam. For examples, using data for the period of 1987-2010, Ngan et al. (2013) find the inflation threshold in Vietnam for this period of approximately 5-6%. Thanh's (2015) study using panel data of ASEAN-5 countries (including Vietnam) over the period

1980-2011 and Penal Smooth Transition Regression (PSTR) model has indicated the optimal level of inflation of 7.84%. Thu (2015) employs ECM, VECM and CLS to estimate the effects of inflation on growth for the period of 1989-2014 and concludes the inflation threshold at 6.6%. However, the limitation of previous studies is to focus solely on testing inflation threshold with traditional economic variables. None of researches captured the new trend of central banking in respective of the need to consider financial stability's implication on inflation threshold. Furthermore, none of studies paid attention on building financial stability index that is reflective to Vietnam economy-specific characteristics. These create a gap in the empirical research in Vietnam with the international trend. Our paper is one of the first attempts to investigate this perspective and close this gap.

3. Methodology

3.1. Granger Causality Analysis

One of the most important tasks for empirical analysts is to find evidence that any specified relationship discovered between inflation and economic growth is more than a correlation (Juhasz 2008). Granger's (1969) theorem of causality is used as a means of examining the direction of causality between paired combinations of the time-series variables employed in the study. Granger (1969) starts from the premise that the future cannot cause the present nor the past. If a series Y_t contains information in past terms that help in the prediction of another time series X_t and if this information is contained in no other time series used in the predictor, then Y_t is said to cause X_t (Granger 1969). Only when inflation has causal effect on growth does identification of inflation threshold become meaningful.

3.2. TAR Model and Bootstrap Test

To detect potential non-linear relationship between inflation and growth, we use TAR model developed by Hansen (2000) with the non-linear function assumption as follow:

$$Y_t = \beta_{i1} X_t I.\{\tau \leq \pi^*\} + \beta_{i2} X_t I.\{\tau > \pi^*\} + \varepsilon_t \quad (1)$$

Where Y_t represents a vector measuring the growth rate of GDP, X_t is the vector of control variables including the inflation threshold variable τ with π^* denoting its threshold estimate. The autoregressive slopes denoted by the 'β_1' parameters when $\tau \leq \pi^*$ will switch to 'β_2' when $\tau > \pi^*$. The error term ε_t is assumed to be an i.i.d. $N(0, \sigma^2)$ process.

Another intuitive way of writing equation (1) is:

$$Growth_t = \beta_0 + \beta_1 Inflation_t + \beta_2 D_{\pi^*}(Inflation_t - \pi^*) + Matrix\ X_t + \varepsilon_t \quad (2)$$

Where $D_{\pi^*} = 1$ if $Inflation_t > \pi^*$. Then, instead of testing the null hypothesis of linearity i.e. $\beta_{i1} = \beta_{i2}$, we expect that $\beta_1 > 0$ (statistically significant or not) and $\beta_2 < 0$ (statistically significant). In this paper, equation (2) is employed for estimation because it facilitates the incorporation of financial stability proxy into extended-TAR model (section 3.3).

As the inflation threshold is unknown a-prior, different values of π^* chosen from an ascending range of possible threshold values are used to estimate regression of equation (2). In order to determine the value of threshold, least square is suggested by Hansen (2000) and the threshold is the value that maximizes the explanatory power of the regression (it means – minimizing the residual sum of square):

$$\widehat{\gamma} = \arg\min S_1(\gamma) \quad (3)$$
$$\gamma \in (\gamma, \overline{\gamma})$$

Due to the fact that nuisance parameter problem makes the distribution of threshold estimate non-standard, test for the hypothesis $\gamma = \gamma_0$ (in which, γ_0 is the true value of γ) is necessary. Hansen (2000) also suggests that using the 'no-reject region' method with a likelihood ratio (LR) statistic to construct the confidence interval is the best approach. The likelihood ratio is constructed as follows:

$$LR_1(\gamma_0) = \frac{S(\gamma_0) - S(\hat{\gamma})}{\hat{\sigma}^2} \quad (4)$$

To test for the existence of a threshold effect, the F statistic in the likelihood ratio test under H_0 of no threshold effect is constructed as follows:

$$F_1 = \frac{S_0 - S_1}{\hat{\sigma}^2} \quad (5)$$

The distribution of F_1 is non-standard, Hansen (2000) recommends a bootstrap approach to simulate the asymptotic distribution of the likelihood ratio test. If the p-value for F_1 under H_0 is smaller than critical value, the null hypothesis is rejected.

3.3. Extended-TAR Model

As an attempt to investigate further the financial stability's implication on the monetary policy space, we introduce a method of approximating financial stability index, then incorporate it into the model. In this paper, the financial condition is defined as stable when the credit growth cycle-to-trend ratio lies within the boundary of one standard deviation around the mean value. The dummy variable $\mathbf{D_{FS}}$ is set to be equal 1 for financial stability and 0 for financial instability. The equation (2) becomes as follows:

$$Growth_t = \beta_0 + \beta_1 Inflation_t + \beta_2 D_{\pi^*}(Inflation_t - \pi^*) + \beta_3 D_{FS} D_{\pi^*}(Inflation_t - \pi^*) + Matrix\ X_t + \varepsilon_t \quad (6)$$

The difference between the inflation thresholds estimated from equation (2) and equation (6) tells us the impact of financial stability on monetary policy space and the sign of coefficient β_3 will illustrate the attribute of financial stability on the effect of inflation on growth when inflation exceeds the optimal level. Rather than using directly credit growth variable, the way of using dummy variable to capture financial stability index is a guiding way for other studies with other variables specific to researched countries.

4. Regressions and Findings

4.1. Data and Variables

Data over the period 2000-2014 is used to analyze the inflation-growth relationship in Vietnam. We collect dataset from General Statistic Office ('GSO') of Vietnam, the SBV and World Bank (Table 1). The choice of our variables are based on a set of the most important control variables found in previous empirical studies such as Khan and Senhadji (2001), López-Villavicencio and Mignon (2011), Vinayagathasan (2013), Baglan and Yoldas (2014), Eggoh and Khan (2014), and the availability of database of Vietnam. We use credit growth as input to measure the status of financial condition. In addition, government consumption captures the level of government involvement in the economy, and measured by the percentage of GDP. Trade openness is also included to represent the level of an economy's liberalization to trading partners, and measured by the ratio of imports and exports to GDP. The explanatory power of other omitted variables is covered by the lag of growth.

Table 1: Variables and Resources

Variable	Definition	Source
Growth	The annual GDP growth rate (%)	GSO
Inflation	Inflation rate y-o-y (%)	GSO
Credit growth	Credit growth y-o-y (%)	SBV
Gexp	Total expenditure of government as a share of GDP (%)	World Bank
Gtrade	Growth of sum of exports and imports as share of GDP (%)	GSO

Statistics in Table 2 show that Vietnam has a strong performance in its economic operation with the average growth over the period 2000-2014 being 6.7% and the highest growth being 8.5% in 2006-2007. However, the inflation seems to be more fluctuated with the highest inflation being approximately 30% while the average rate being only 7.6%. These movements of growth and inflation in Vietnam are in line with the conventional wisdom about the transitional economy.

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
growth	60	6.729801	1.209064	3.856987	8.52417
inflation	60	7.684571	6.527707	-2.4	27.9
gtrade	60	14.28333	13.66065	-20	39
gexp	60	21.49645	10.26129	8.199759	42.97729
fsindex	60	.7166667	.4544196	0	1

Source: Authors' computation using STATA 14

To avoid the problem of spurious regression results, tests for multi-collinearity and stationarity are needed. Analysis of correlation among explanatory variables shows that there is no concern about multi-collinearity when the correlations are relatively low (Table 3).

Table 3: Correlation of Explanatory Variables

Correlation	growth(-1)	inflation(-2)	gtrade(-2)	dgexp(-2)
growth(-1)	1	-0.338176	0.186981	-0.032979
inflation(-2)	-0.338176	1	0.501696	0.072315
gtrade(-2)	0.186981	0.501696	1	0.1311
dgexp(-2)	-0.032979	0.072315	0.1311	1

Source: Authors' computation using STATA 14

We use ADF procedure to examine the stationarity of time series data (Table 4). The results indicate that INFLATION and GTRADE are stationary in the level at 1% and 5% significance level, respectively. GEXP is stationary at the first difference at 1% level of signification. Although GROWTH is non-stationary in the level, we use directly GROWTH (rather than change of growth) as dependent variable in the model to preserve the relation between growth and inflation. This practice would not cause spurious regression as long as there exists a long-term relationship between growth and inflation.

Table 4: Results of Unit Root Test

	Level			First order difference		
Variables	t-Statistic	Test critical values	Status	t-Statistic	Test critical values	Status
growth	-1.97598	-2.91173**	Nonstationary			
gexp	0.12484	-2.91765**	Nonstationary	-4.17658	-3.56001***	Stationary
inflation	-3.98720	-3.54820***	Stationary			
gtrade	-4.59062	-3.54820**	Stationary			

Source: Authors' computation using STATA 14

To verify such a growth-inflation relationship in the long run, we use Johansen test for co-integration (Table 5) between growth and inflation. As suggested by test result, the hypothesis that there is no relationship between inflation and economic performance in the long term is rejected at 5% significance level.

Table 5: Johansen Test for Co-integration

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.333829	29.13409	15.49471	0.0003
At most 1 *	0.091630	5.573977	3.841466	0.0182

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.333829	23.56012	14.26460	0.0013
At most 1 *	0.091630	5.573977	3.841466	0.0182

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

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

Source: Authors' computation using STATA 14

4.2. Findings

Granger Causality Test Analysis

Granger causality tests (Table 6) show that while growth has causal effect on inflation only in the short-term, inflation has causal effects on economic performance in both short-term and long-term when the null hypothesis of no causality is significantly rejected at 1% level of significance. It means that the identification of inflation threshold is meaningful in the efforts of controlling inflation within favorable range to support the economic growth.

Table 6: Granger Causality Tests

Pairwise Granger Causality Tests
Sample: 2000Q1 2014Q4

Lags: 1	**Obs**	**F-Statistic**	**Prob.**
INFLATION does not Granger Cause GROWTH	59	15.7894	***0.0002******
GROWTH does not Granger Cause INFLATION		8.44873	***0.0052******
Lags: 2			
INFLATION does not Granger Cause GROWTH	58	7.29442	***0.0016******
GROWTH does not Granger Cause INFLATION		0.51332	0.6015
Lags: 3			
INFLATION does not Granger Cause GROWTH	57	5.74602	***0.0019******
GROWTH does not Granger Cause INFLATION		0.73642	0.5353
Lags: 4			
INFLATION does not Granger Cause GROWTH	56	3.79507	***0.0094******
GROWTH does not Granger Cause INFLATION		1.18450	0.3299

*** *denotes that the null hypothesis of no causality is significantly rejected*

Source: Authors' computation using STATA 14

TAR Model and Bootstrap Test Results

Table 7: TAR Model

Source	SS	df	MS		
				Number of obs	= 57
				F(5, 51)	= 61.32
Model	73.5034915	5	14.7006983	Prob > F	= 0.0000
Residual	12.2258677	51	.239722896	R-squared	= 0.8574
				Adj R-squared	= 0.8434
Total	85.7293591	56	1.53088141	Root MSE	= .48962

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
growth_l1	.8518507	.0630834	13.50	0.000	.7252054	.978496
inflation_l2	.0474688	.0375065	1.27	0.211	-.0278285	.1227662
inf5_l2	-.0895502	.0429851	-2.08	0.042	-.1758465	-.003254
gtrade_l2	-.0147386	.0061823	-2.38	0.021	-.0271502	-.002327
dgexp_l2	.0409541	.0172954	2.37	0.022	.0062321	.0756761
_cons	1.171824	.4535808	2.58	0.013	.2612227	2.082426

Likelihood ratio test: LR (τ) = 4.66 [0.0310] **

Source: Authors' computation usingSTATA14

The regression estimation of equation (2) shows that the coefficient $\beta_2 D_{\pi^*}(Inflation_t - \pi^*)$ is negative (-0.0896) and statistically significant at 5% level while the coefficient $\beta_1 Inflation_t$ is positive but statistically insignificant (Table 7). This accepts the hypothesis that there is the existence of inflation threshold. This result is consistent with previous studies in Vietnam about the existence of non-linear relationship between inflation and growth. Moreover, the result that inflation coefficient is positive but not statistically significant for the low inflation regime is similar with suggestion of Thanh's (2015) study.

The likelihood ratio test and bootstrap method proposed by Hansen confirm the validity of threshold effect (Table 8).

Table 8: Bootstrap Method

```
Bootstrap replications (300)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
..................................................   100
..................................................   150
..................................................   200
..................................................   250
..................................................   300

Linear regression                               Number of obs     =         57
                                                Replications      =        300
                                                Wald chi2(5)      =     378.59
                                                Prob > chi2       =     0.0000
                                                R-squared         =     0.8574
                                                Adj R-squared     =     0.8434
                                                Root MSE          =     0.4896
```

growth	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
growth_l1	.8518507	.0613722	13.88	0.000	.7315634	.972138
inflation_l2	.0474688	.0387352	1.23	0.220	-.0284508	.1233884
inf5_l2	-.0895502	.0493881	-1.81	0.070	-.1863492	.0072488
gtrade_l2	-.0147386	.0068272	-2.16	0.031	-.0281197	-.0013575
dgexp_l2	.0409541	.0183428	2.23	0.026	.0050029	.0769053
_cons	1.171824	.4538183	2.58	0.010	.2823566	2.061292

Source: Authors' computation using STATA 14

Extended-TAR Model Taking Financial Stability in to Consideration

Regression estimates below (Table 9) show the coefficient of $\beta_3 D_{FS} D_{\pi^*}(Inflation_t - \pi^*)$ is positive (0.0379) and statistically significant at 10% level while the coefficient of $\beta_2 D_{\pi^*}(Inflation_t - \pi^*)$ is still statistically negative. It implies that when inflation goes beyond the optimal level, its negative effect on growth will be mitigated in the context of financial stability.

Table 9: Extended-TAR Model

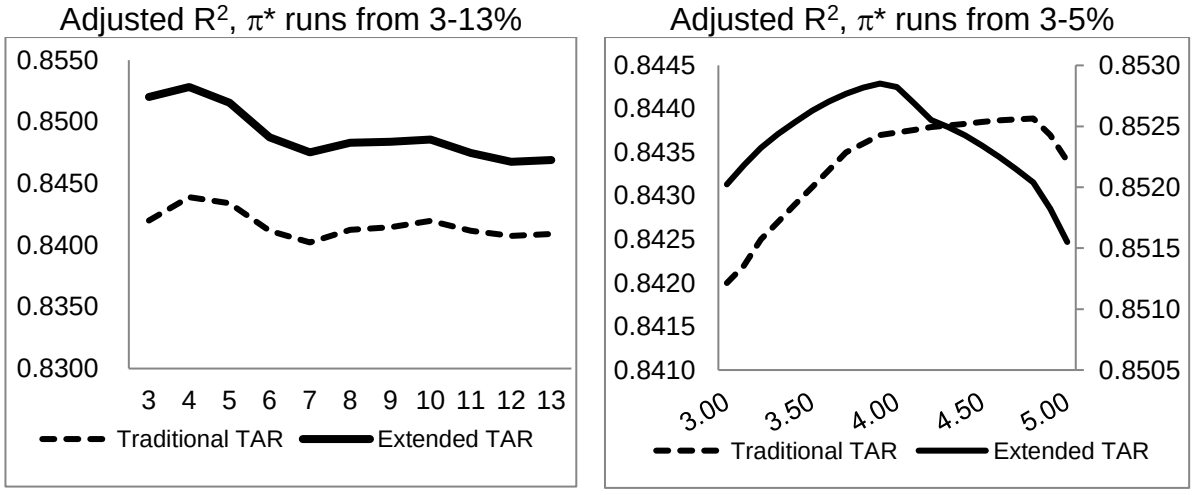
Source	SS	df	MS	Number of obs =	57
				F(6, 50) =	54.54
Model	74.3664514	6	12.3944086	Prob > F =	0.0000
Residual	11.3629077	50	.227258154	R-squared =	0.8675
				Adj R-squared =	0.8516
Total	85.7293591	56	1.53088141	Root MSE =	.47672

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
growth_l1	.8527033	.061423	13.88	0.000	.7293315	.9760751
inflation_l2	.0442964	.0365546	1.21	0.231	-.0291257	.1177185
inf5_l2	-.110547	.0432174	-2.56	0.014	-.1973518	-.0237422
FS_l2	.0378974	.019448	1.95	0.057	-.001165	.0769598
gtrade_l2	-.0139105	.0060344	-2.31	0.025	-.026031	-.00179
dgexp_l2	.0430163	.016873	2.55	0.014	.009126	.0769067
_cons	1.161612	.4416622	2.63	0.011	.2745076	2.048717

Source: Authors' computation using STATA 14

As shown in the Figure 1, the higher level of the explanatory power (adjusted R^2) of the extended-TAR model (equation 6) in comparison with that of the traditional TAR model (equation 2) has indicated that financial condition better explains the relationship between growth and inflation. However, when taking financial stability into account, the SBV has to accept lower inflation threshold (3.9% according to the extended-TAR model in comparison with 4.8% based on the traditional TAR model) - that means, the space of monetary policy will be narrowed when the central bank pays attention on a broader range of objectives against the restricted resource and policy toolkits.

Figure 1: Explanatory Power and Proposed Inflation Threshold



Source: Authors' computation using STATA 14

5. Conclusion

The growth-inflation relationship is a contentious issue. While the results are mixed, the existence of threshold effect has been widely accepted. Although some studies conducted for Vietnam support this, there is rare paper examining the financial

stability's implication on the inflation-growth nexus. In the context of increasingly important emphasis placed on the interaction between financial stability and monetary policy in the aftermath of global financial crisis, this creates a large gap between the empirical study in Vietnam and the global trend. As one of the first attempts to explore this perspective, after testing the existence of inflation threshold in Vietnam, our study develops financial stability index then incorporates it into estimation model. First, employing TAR model with the time series data of Vietnam over the period 2000-2014, our paper proposes the optimal level of inflation at 4.8% and the bootstrap method confirms the validity of the threshold effect. Second, approximating the extent to which credit growth departs from its long-term trend as financial stability indicator, the extended-TAR model gives some good advice to policy makers. While the growth-inflation relationship will be better explained in the appearance of financial condition index, the central bank has to face challenges as a result of the lower level of inflation threshold (3.9%). Financial stability, however, will mitigate the negative effect of inflation on growth when inflation exceeds the optimal level. Despite some contributions, our paper's limitation is to use a simplified index of financial stability which may not capture comprehensively the financial condition. Structuring a general financial stability index which covers not only credit growth fluctuation but also other aspects of financial sectors such as real estate status, leverage ratio and spreads of government bond would be the guide for future studies.

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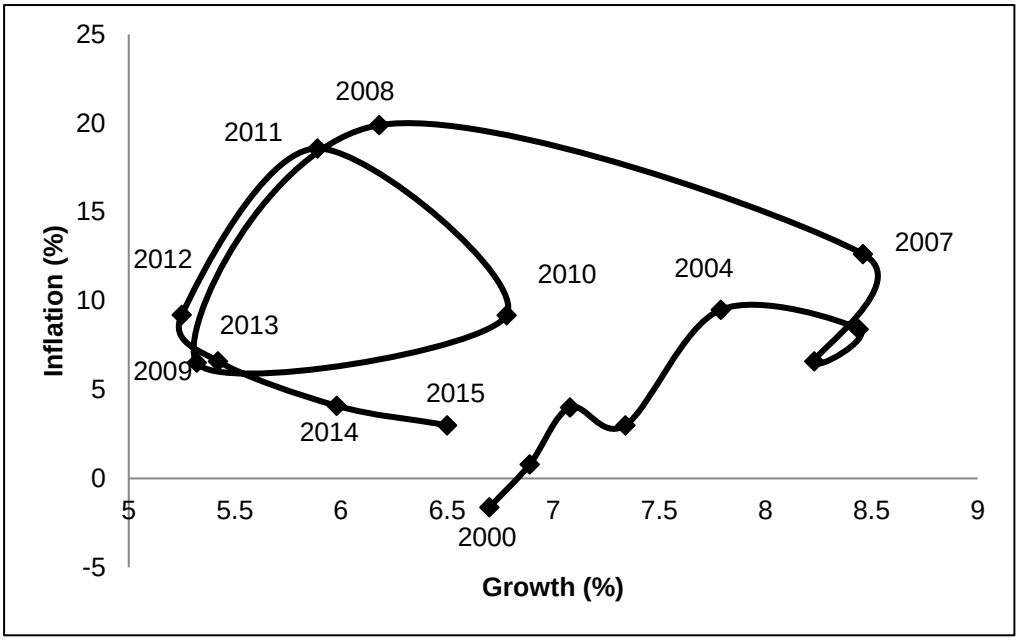
Appendix

Appendix A: The Inflation-Growth Relationship in Vietnam

The complex relationship between inflation and growth in Vietnam is shown in Figure A. The intuitive existence of threshold effect of inflation on growth in Vietnam as illustrated in the movement of the Philips curve is to be tested by econometric model.

Figure A: Movement of the Philips Curve in Vietnam



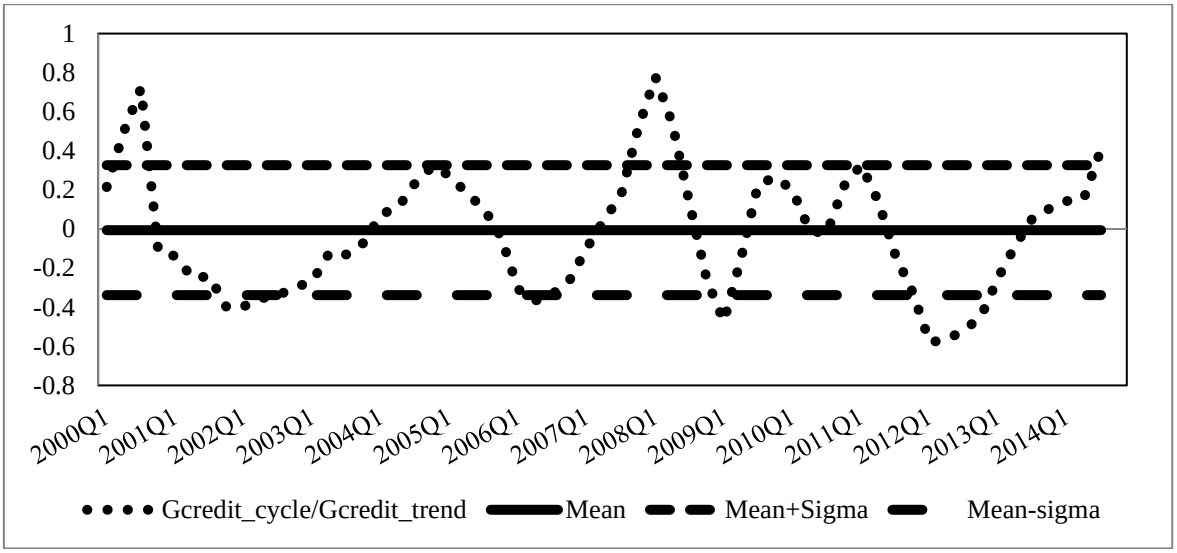
Source: General Statistic Office of Vietnam

Appendix B: Proxy for Financial Stability in Vietnam

To specify, Hodrick-Prescott filter procedure is employed to breakdown quarterly data of credit growth in Vietnam over the period 2000Q1-2014Q4 into the trendy and cyclical factor. The ratio of cycle to trend represents the extent to which credit growth departs from its underlying trend and articulates the proxy of financial stability index. In this paper, the financial condition is defined as stable when this ratio lies within the boundary of a standard deviation (sigma) around the mean value.

Figure B provides some persuasive evidences about the appropriateness of our proxy. Movement of the proxy indicates that the financial instability existed at 2000-end (when credit volume was significantly pumped through the state-owned enterprises to stimulate the post-Asian financial crisis economy), 2007-2008 period (with the highest growth of credit of above 50%) and credit-crunch period during 2001-end to 2013-early. Initiative focusing the highest priority on macro-economic stability since 2012 has facilitated the financial stability index rebound within the stable range.

Figure B: Movement of Credit Growth's Cycle to Trend Ratio, 2000Q1-2014Q4



Source: The SBV's data and authors' computation