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SOURCES OF EXCHANGE RATE FLUCTUATION IN VIETNAM: AN APPLICATION OF THE SVAR MODEL

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Abstract

Vietnam has been implementing the export-oriented economy, in which the central bank of Vietnam, well-known as the State Bank of Vietnam (SBV), adopted the managed float exchange rate regime in 1990. Therefore, the exchange rate movement plays an important role in stimulating the Vietnamese export activities. By applying the long-run SVAR model, pioneered by Blanchard and Quah (1989), this research examines how the real and nominal shocks impact the nominal and real exchange rate (USD/VND) in Vietnam. Based on monthly data concerning USD/VND exchange rate and, the price levels in Vietnam and the United States from May 1995 to December 2013, our empirical results reveal that: the real shock primarily leads the real and nominal exchange rate (USD/VND) to fluctuate over time. Meanwhile, the nominal shock has a temporary effect on the movement in the real exchange rate in Vietnam. Our research also finds that the long-run Purchasing Power Parity (PPP) does not hold in Vietnam.

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1. An introduction and literature review

Vietnam has been famous for being one of the fastest-growing economies in Asia since integrating into the World Trade Organization (WTO) in 2005. Taking advantage of this integration, the Vietnamese government implemented the export-oriented economy policy to improve the trade balance. Therefore, the exchange rate is treated as one of the most important monetary policy tools of the SBV, which drive Vietnamese's exporting activities. Additionally, it is clear that understanding the sources of the exchange rate variation becomes a crucial issue, which helps the State Bank of Vietnam to manage the exchange rate properly under the managed floating exchange rate regime. Therefore, the purpose of this paper, is to decompose the variation of exchange rate in Vietnam into the real and nominal shocks, which follows the method used by Clarida and Gali, 1992; Ender and Lee (1997), Chen and Wu (1997); Kutan and Dibooglu (2001); Kakinaka, Miyamoto, and Ok (2010).

We assume that the real and nominal exchange rates are subject to the real and nominal shocks. Ha et al (2007) say that term of trade, productivity, and government spending are the real shocks. Kakinaka, Miyamoto, and Ok (2010), however, argue that the change in technology and preference are the real shocks, whereas, the change in the nominal macroeconomic variables, such as money supply, would be considered as the nominal shock. In this paper, we will define the real shocks as the change in productivity, technology and economic structure. On

the other hand, the change in price level, money supply could be considered as the nominal shocks.

Blanchard and Quah (1989) develop the long-run restriction to obtain a structural vector autoregression (SVAR) model from the vector autoregressive (VAR) model in standard form. Moreover, a series can be decomposed into its short-run and long-run components via applying the long-run SVAR, Ender (2010). In this paper, therefore, we will apply the Blanchard and Quah method (1989) to examine how the real and nominal exchange rate in Vietnam responds to the real and nominal shocks. This method is also widely applied in many previous researches (Clarida and Gali, 1994; Ender and Lee, 1997; Chen and Wu, 1997; Kutan and Dibooglu, 2001; Kakinaka, Miyamoto, and Ok , 2010)

In Vietnam, the fluctuation in exchange rate has not been widely researched. The exchange rate - inflation tradeoff in Vietnam is conducted by Nguyen (2012). However, the empirical evidence to reveal this relationship was not provided. Dao, Pham, and Hoang (2014) applied the vector autoregressive (VAR) model to examine the exchange rate-inflation tradeoff in Vietnam. The VAR model in standard form, however, cannot capture the realization of the policy shock (Sim, 1986; Ender, 2010). Therefore, this study would be the first one in Vietnam to examine the exchange rate movement by decomposing it into real and nominal shocks through the long-run SVAR model, Blanchard and Quah (1989). Our empirical results reveal that: the real shock primarily leads real and nominal exchange rate to fluctuate over time. Meanwhile, the nominal shock has a temporary effect on the movement in the real exchange rate in Vietnam. Our

research implication favors the key classical macroeconomic hypothesis, which indicates that permanent movements in nominal variables do not impact real economic variables in the long run (King and Watson, 1997). Moreover, our research also finds that the long-run Purchasing Power Parity (PPP) does not hold in Vietnam.

The paper is organized as follows: Section two introduces the development in Vietnam since 1989. Section three describes the empirical procedure used to analyze the movement in the real and nominal exchange rate in Vietnam. Finally, section four explains our research conclusion.

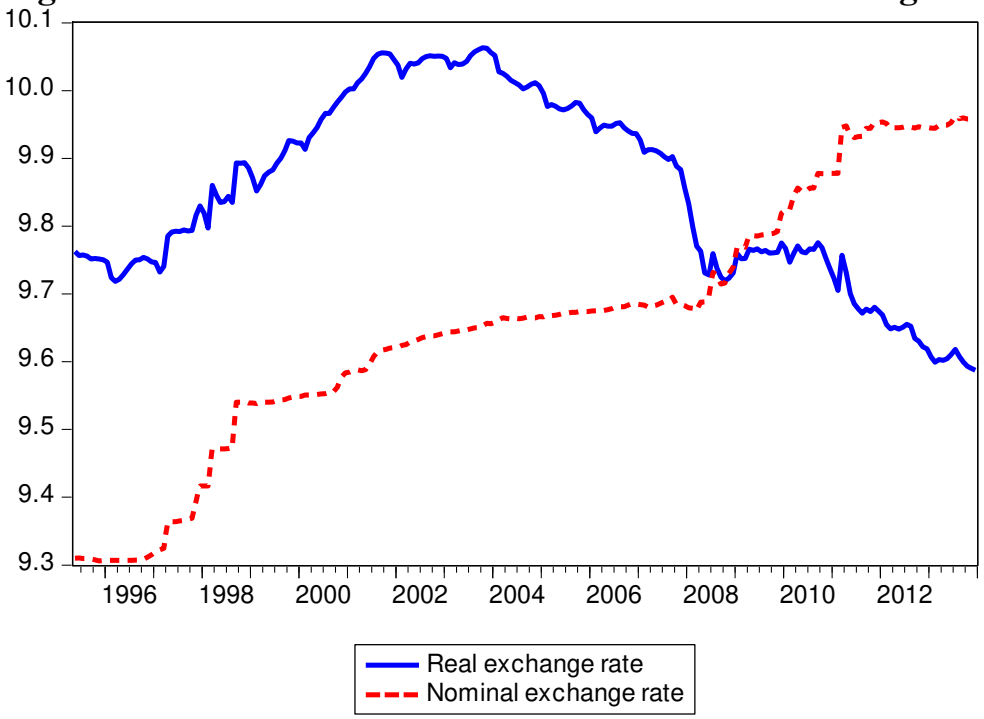
2. Recent development in Vietnam

In 1986, the Vietnamese government started implementing the Revolution policy[2], in which they shifted from the central-planning economy[3] to the market-oriented economy. Due to this policy, the Vietnamese economy reached an average growth of 6.6% per year from 1986 to 1996. We especially witnessed, the inflation plummet from a three-digit level to a two-digit level (12.7% in 1995, and 4.5% in 1996). In 1997, the Vietnamese economy slightly grew due to the Asian financial crisis. From 1997 to 2006, the gross domestic product (GDP) growth was an average of 7.1%, which is higher than the inflation rate of 4.5%, prior to the crisis. Later, however, the inflation increased to 11.8%, which was approximately double the 6.2% GDP growth between 2007 and 2013.

[2] The Revolution policy is well-known as the DOI MOI policy.
[3] In which the Vietnamese government controls all economic sectors by establishing the state-owned companies. The private companies are not encouraged to run their own business.

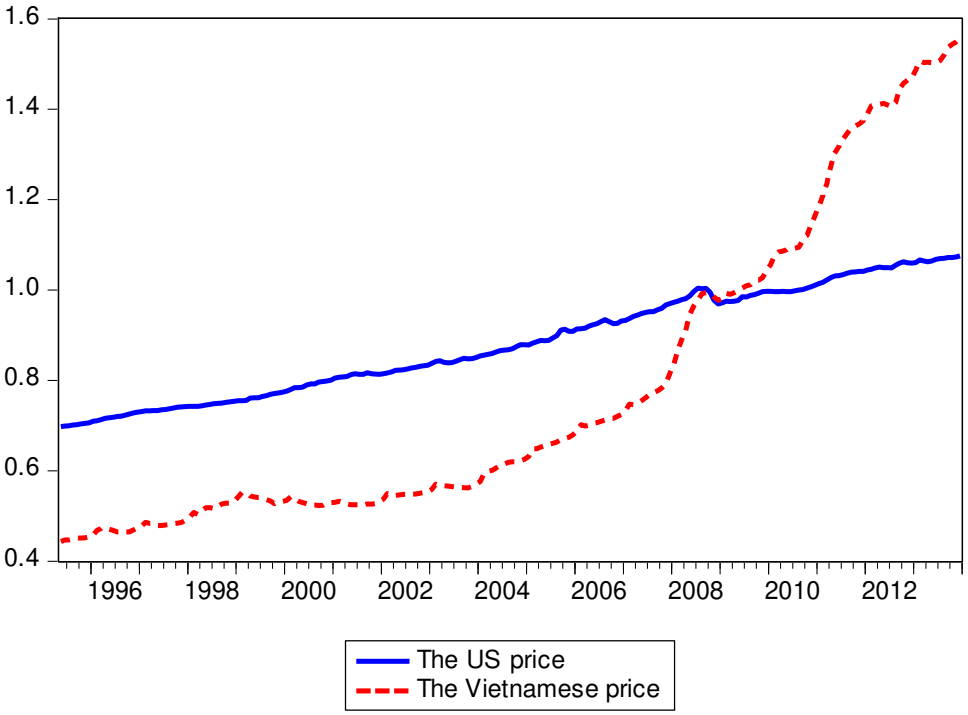
To support the export-oriented economy, the SBV implemented the exchange rate managed floating regime without predetermining the change in the exchange rate (USD/VND) since 1990[4]. Figure 1 shows the movement in the exchange rate of Vietnamese Dong against the US dollar. There is a nominal depreciation of DONG against USD mainly due to Vietnamese government's DONG under-devaluated policy[5] . The price level in Vietnam increases properly between 1995 and 2008. However, the higher inflation in Vietnam from 2008 to 2012 contributes to the depreciation of DONG (See Figure 2). Such a high inflation led the real exchange rate (USD/VND) to decline during this period.

Figure 1: The movement in the real and nominal exchange rate in Vietnam



[4] Before 1990, The State Bank of Vietnam (SBV) implemented the fixed exchange rate regime.
[5] This policy aims to support Vietnam's export activities

Figure 2: The price level in Vietnam and the United State



3. Empirical analysis

3.1. Model identification

To analyze the movement in the real and nominal exchange rate (USD/VND) in Vietnam, we will apply the long-run SVAR model, developed by Blanchard and Quah decomposition (1989). This model is also widely applied in many previous researches (Clarida and Gali, 1994; Enders and Lee, 1997; Chen and Wu, 1997; Dibooglu and Kutan, 2001; Wang, 2005; Kakinaka, Miyamoto and Ok, 2010). Below, we have the biavariate moving-average (BMA) system as follows:

$$\begin{bmatrix} \Delta\, RER_t \\ \Delta\, NER_t \end{bmatrix} = \begin{bmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{rt} \\ \varepsilon_{nt} \end{bmatrix}$$

Or

$$\Delta\, RER_t = \sum_k^{\infty} c_{11}(k)\, \varepsilon_{rt-k} + \sum_k^{\infty} c_{12}(k)\, \varepsilon_{nt-k}$$

$$\Delta NER_t = \sum_k^{\infty} c_{21}(k)\, \varepsilon_{rt-k} + \sum_k^{\infty} c_{22}(k)\, \varepsilon_{nt-k}$$

In which:

ΔRER_t: the natural log of the real exchange rates at time t.

ΔNER_t: the natural log of the nominal exchange rates at time t.

ε_{rt}: the real shock.

ε_{nt}: the nominal shock.

The restriction is that the nominal shocks have no long-run effect on the real exchange rate (King and Watson, 1997; Ender and Lee, 1997). Therefore, $C_{12}(L)$= 0 or $\sum_k^{\infty} c_{12}(k) = 0$. This implies that the cumulative effect of ε_{nt} on ΔRER_t is zero. Consequently, the long-run effect of ε_{nt} on the level of RER_t is also zero.

3.2. Data

Monthly data was collected from Vietnam's General Statistic Office, the SBV and Federal Reserve (FED). Data concerning the nominal exchange rate (USD/VND) and the consumption price index (CPI) as the price level in Vietnam and the United States between May 1995 and December 2013 have been employed in the following research. The real exchange rate is then computed mainly based on the following formula (1):

From PPP formula:

$$Real\ exchange\ rate = (Nominal\ exchange\ rate) * \frac{The\ foreign\ price\ level}{The\ domesic\ price\ levl}$$

Take logarithm both side of the above equation:

$$RER = NER + P^* - P \qquad (1)$$

In which:

RER: the logarithm of the real exchange rate.

NER: the logarithm of the nominal exchange rate, USD/VND.

P*: the logarithm of the foreign price level, the US CPI.

P: the logarithm of the domestic price level, Vietnam's CPI.

Table 1 shows the descriptive statistic about the change in the logarithm of the nominal and real exchange rate, USD/VND

Table 1: The descriptive statistic of the nominal and real exchange rate

	$\Delta\, NER$	$\Delta\, RER$
Number of observation	223	223
Mean	0.0029019	-0.00079855
Standard deviation	0.0093629	0.0124736

$\Delta\, NER$, $\Delta\, RER$: The change in the logarithm of the nominal and real exchange rate, USD/VND

Based on the Table 1, we see that the mean of nominal depreciation is larger than that of real depreciation. This means that the price level in Vietnam is higher than that in the United State. The high inflation period from 2004 – 2012 was the primary cause of the big difference between the mean of nominal and real depreciation in Vietnam.

Table 2: Correlation matrix

	$\Delta\, NER$	$\Delta\, RER$	$\Delta\, P$
$\Delta\, NER$	1		
$\Delta\, RER$	0.7344	1	

ΔP	0.0026	-0.6395	1

The table 2 summarizes the correlation among the change in the logarithm of the nominal and real exchange rate, and the inflation rate in Vietnam. The nominal exchange rate has highly positive correlation with the real exchange rate, but an insignificantly positive correlation with the inflation. Meanwhile, the inflation rate is highly negative correlation with the real exchange rate in Vietnam

3.3. Estimation procedure

The conditions for estimating the SVAR model are that the underlying variables must be stationary without cointegration among the underlying variables, Ender (2010). Given this, we will conduct the unit root test for the real and nominal exchange rate (USD/VND) via the augmented Dickey-Fuller (ADF) method. The test result indicates that both the log-level of the nominal and real exchange rate are not stationary at the 5% significance level. Meanwhile, their first-differences are stationary at the 5% significant level (Table 3). The non-stationarity of the real exchange rate reveals that the long-run PPP does not hold in Vietnam, Ender (2010). Previous studies have shown that this condition is the same as in other countries in China, Cambodia, and Lao (Wang, 2005; Kakinaka, Miyamoto, and Ok, 2010).

Table 3: The stationary and cointegration test

	Level	**First difference**
NER	-0.889	-14.439
RER	+0.541	-13.262
u_t	-2.105	-14.855
NER = 13.81 - 0.422 RER + u_t (0.848)*** (0.086)*** R2: 0.098		

*The 5% critical value of unit root test: -2.87; ***: significance at the 1% level*

Secondly, we conduct the cointegration test for the log-level of the nominal and real exchange rates by applying the method proposed by Ender (2010)[6]. After generating the residual from the estimated equation of the nominal exchange rate (USD/VND) on the real exchange rate (USD/VND), we apply the augmented Dickey-Fuller (ADF) method to test whether the residual is stationary. Table 3 reveals that the residual is not stationary at the 5% significance level. This result implies that a long-run relationship between the nominal and real exchange rate (USD/VND) in Vietnam does not exist. Simply put, there is no evidence in favor to the existence of the long-run PPP in Vietnam.

To sum up, the nominal and real exchange rates are I(1) and there is no cointegrating equation between them. Therefore, we will then apply the SVAR model to investigate how the nominal and real exchange rates (USD/VND) responds to the nominal and real shocks over time in Vietnam.

The next step is to choose the optimal lag length of the SVAR via the Vector Autogressive (VAR) model. Table 4 indicates that the first-order lag length should be chosen based on the lowest Akaike information criterion (AIC) and Schwarz information criterion (SIC), (Hill, Griffiths, and Lim, 2012).

Table 4: The Akaike information criterion (AIC) and Schwarz information criterion (SIC)

Lag	AIC	SIC

[6] Ender proposes the method to test the existence of the long-run PPP in his book, Applied Econometric Time Series, Third edition, p.211.

0	-13.137	-12.105
1	-13.372*	-13.778*
2	-13.371	-13.214
3	-13.345	-13.125
4	-13.313	-13.031
5	-13.291	-12.946
6	-13.360	-12.952
7	-13.350	-12.880
8	-13.345	-12.812

Based on the long-run restriction developed by Ender and Lee (1997), the result of estimation of the long-run SVAR model with the first-order lag length is presented as follows:

$$\Delta RER_t = 0.015\varepsilon_{rt-1} \qquad (1)$$

$$(0.000714)$$

$$\Delta NER_t = 0.004\varepsilon_{rt-1} + 0.009\varepsilon_{nt-1} \qquad (2)$$

$$(0.000637) \qquad (0.000430)$$

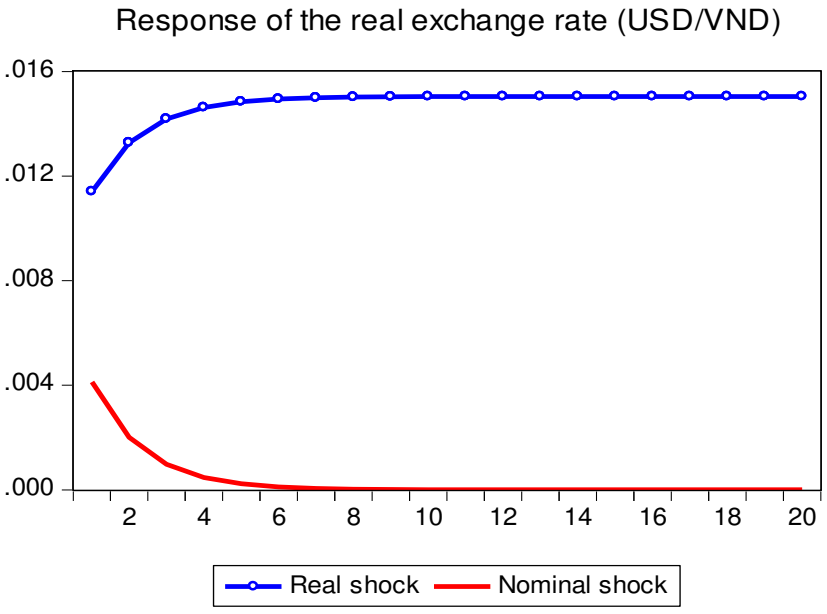
All coefficients in the biavarate moving-average (BMA) system are significant at the 1% level.

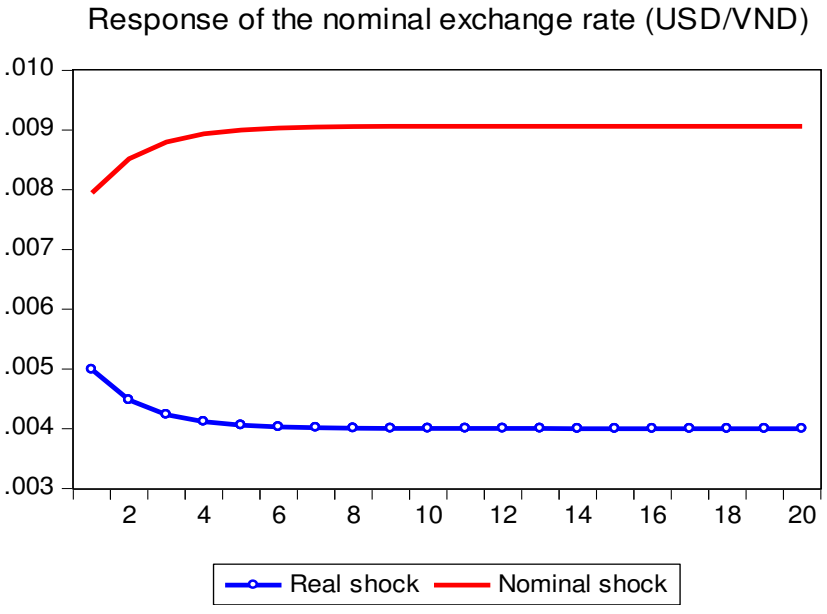
3.3.1. Impulse response analysis

The impulse response function plays a role by representing the effects of a one-time shock. Therefore after estimating the long-run SVAR model, we compute the impulse response function (IRFs) to examine how the nominal and real

exchange rates (USD/VND) respond to the nominal and real shocks[7]. The response of the nominal and real exchange rates (USD/VND) to the nominal and real shocks over 20 months is presented in the Figure 3. The responsive level in Figure 3 shows the accumulative responses and a positive response of exchange rate to the shock. The real shock leads the nominal and real exchange rates (USD/VND) in Vietnam to depreciate.

Figure 3: Impulse response function





[7] The nominal and real shocks are measured by one standard deviation.

From the impulse response function (See Figure 3), we find that the response of the real and nominal exchange rates to the real shock is permanently positive. Therefore, the long-run depreciation of the real and nominal exchange rates in Vietnam is caused by the real shock. The initially positive response of the real exchange rate to the nominal shock implies that the depreciation of the real exchange rate in Vietnam is associated with the nominal shock. This response, however, converges to zero, six months later. This implies that the nominal shock temporarily impacts the depreciation of the real exchange rate in Vietnam. On the other hand, there is the long-run positive effect of the nominal shock on the variation of the nominal exchange rate in Vietnam. Given this, in Vietnam, the nominal exchange rate is permanently depreciated by the nominal shock. The permanently positive response of the nominal exchange rate to the nominal shock could be due to the violation of the long-run PPP in Vietnam.

In summation, the real shock has a long-run effect on both the movement of the real and nominal exchange rates in Vietnam. However, the nominal shock has only a short-run effect on the change in the real exchange rate and has a the long-run effect on the change in the nominal exchange rate.

3.3.2. Variance decomposition

Analyzing the variance decomposition (VDC) is another way to evaluate the relative contribution of real shock, in order to forecast the error variance of each shock. The result of the variance decomposition is reported in the Table 5. In this table, we can see that the change in the real exchange rate in Vietnam is significantly affected by the 100 percent real shock at the beginning, but then,

decreases to a steady level of 94.258 % three months later. Similar to the real exchange rate pattern, the approximately 62 % change in the nominal exchange rate in Vietnam is initially caused by the real shock before declining to the steady level of 61.68 %.

Table 5: Choleski variance decompositions of the real and nominal exchange rates

Month	**The relative contribution of real shock to**	
	$\Delta\, RER_t$	$\Delta\, NER_t$
1	100	62.102
2	95.544	61.781
3	94.559	61.706
4	94.329	61.688
5	94.275	61.684
6	94.263	61.683
7	94.259	61.683
8	94.258	61.683
9	94.258	61.683
10	94.258	61.683
11	94.258	61.683
12	94.258	61.683
13	94.258	61.683
14	94.258	61.683

20	94.258	61.683

In short, the variation of the real and nominal exchange rates in Vietnam is mainly driven by the real shocks, which come from the change in productivity, and technology innovation. This result is the same as previous studies in other countries (Kutan and Dibooglu, 2001; Kakinaka, Miyamoto, and Ok , 2010).

4. Conclusion

The empirical result indicates that the movement in the nominal and real exchange rate (USD/VND) in Vietnam is significantly contributed by the real shocks, which come from the change in productivity, technology and the economic structure. This research result is consistent with other previous studies in the Asian countries (Wang, 2005; Kakinaka, Miyamoto and Ok, 2010). This research implication follows the key classical macroeconomic hypothesis, which indicates that permanent movements in nominal variables do not impact the real economic variables in the long run (King and Watson, 1997). Our research also finds that the long-run PPP does not hold true in Vietnam, which is the same current condition as in other developing countries, such as Laos and Cambodia (Kakinaka, Miyamoto and Ok, 2010).

Although our research could indicate some important implication on the change in the exchange rate (USD/VND) in Vietnam, in practice, the movement in the exchange rate (USD/VND) in Vietnam is impacted by other exogenous factors. One factor which is especially hard to predict, is the fluctuation of USD/VND is managed by the State Bank of Vietnam. Therefore, our specification in the SVAR could be overly simplified and unable to capture all such kinds of the exogenous

factors. In the future, the research should address these issues in order to fully explain the fluctuation of the exchange rate (USD/VND) in Vietnam.

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