



## 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), has adopted the managed float exchange rate regime since 1990. Therefore, the exchange rate movement plays an important role in stimulating the Vietnamese export activities. By using the long-run SVAR model, pioneered by *Blanchard and Quah (1989)*, this study examines how the real and nominal shocks impact the nominal and real exchange rate (USD/VND) in Vietnam. We use monthly data on the USD/VND exchange rate, 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 of 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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**Keywords:** The state bank of Vietnam, USD/VND, Real exchange rate, Nominal exchange rate, Stationary, Unit root test, SVAR, Impulse response function.

**JEL Classification:** E600, E690.

### Contribution/ Originality

The paper's primary contribution is to decompose the sources of exchange rate fluctuation in Vietnam into real and nominal shocks. Real shock has permanent effect on both the real and nominal exchange rate. Nominal shock has temporary effect on the real exchange rate.

## 1. INTRODUCTION

Vietnam has been famous for being one of the fastest-growing economies in Asia since integrating into the World Trade Organization (WTO) in 2007. 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 drives the Vietnamese's exporting activities. Additionally, it is clear that understanding of the sources of the exchange rate variation becomes a crucial issue. It enables the SBV to manage the exchange rate properly under the managed floating exchange rate regime. Therefore, the objective of this study is to decompose the variation of exchange rate in Vietnam into the real and nominal shocks. This study employs the method, which is used by [Clarida and Gali \(1994\)](#); [Enders and Lee \(1997\)](#), [Chen and Wu \(1997\)](#); [Dibooglu and Kutan \(2001\)](#); [Ok et al. \(2010\)](#).

We assume that the real and nominal exchange rates are subjects to the real and nominal shocks. [Ha et al. \(2007\)](#) say that term of trade, productivity, and government spending are the real shocks. [Ok et al. \(2010\)](#), however, argue that the change in technology and preference are the real shocks.

On the other hand, the change in the nominal macroeconomic variables, such as money supply, would be considered as the nominal shocks. In this study, we will define the real shocks as the change in productivity, technology and economic structure. Meanwhile, the change in price level, money supply could be defined 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 the long-run SVAR, [Ender \(2010\)](#). In this study, therefore, we will apply the [Blanchard and Quah \(1989\)](#) to examine how the real and nominal exchange rate in Vietnam respond to the real and nominal shocks. This method is also widely applied in many previous studies ([Clarida and Gali, 1994](#); [Chen and Wu, 1997](#); [Enders and Lee, 1997](#); [Dibooglu and Kutan, 2001](#); [Ok et al., 2010](#))

To best of our knowledge, in Vietnam, the fluctuation in exchange rate has not been widely studied. Therefore, this study would be one of the first attempts 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 both the real and nominal exchange rate to fluctuate over time. Meanwhile, the nominal shock has a temporary effect on the movement of the real exchange rate in Vietnam. Our research implication is in favor of the key classical macroeconomic hypothesis, which indicates that permanent movements of nominal variables do not impact real economic variables in the long run, [King and Watson \(1997\)](#). Moreover, our study also finds no clear evidence supporting the existence of the long-run Purchasing Power Parity (PPP) in Vietnam.

The paper is organized as follows: the Section Two introduces the development in Vietnam since 1989. The Section Three describes the empirical procedure for analyzing the movement of the real and nominal exchange rate in Vietnam. Finally, the Section Four explains our research conclusion.

## 2. RECENT DEVELOPMENT IN VIETNAM

In 1986, the Vietnamese government started implementing the Revolution policy<sup>1</sup>, in which they shifted from the central-planning economy<sup>2</sup> to the market-oriented economy. Thank to this policy, the Vietnamese economy reached an average growth of 6.6% per year from 1986 to 1996. We especially witnessed that the inflation plummeted 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 was higher than the inflation rate of 4.5%. From 2007 to 2013, however, the inflation increased to 11.8%, which was approximately twice as high as the GDP growth of 6.2%. To support the export-oriented economy, the SBV has implemented the exchange rate managed floating regime without predetermining the change in the exchange rate (USD/VND) since 1990<sup>3</sup>. Figure 1 shows the movement of 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<sup>4</sup>. The price level in Vietnam increases properly between 1995 and 2008. However, the higher inflation in Vietnam during the period from 2008 to 2012 contributes to the depreciation of DONG (See Figure 2). Such a high inflation leads the real exchange rate (USD/VND) to decline during this period.

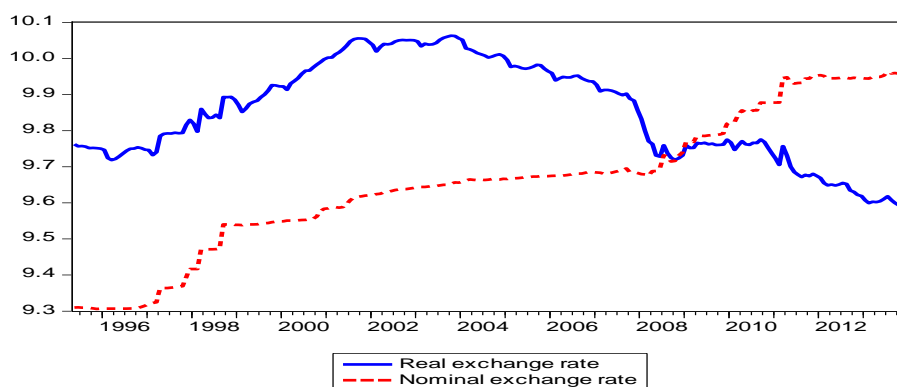


Figure-1. The movement in the real and nominal exchange rate in Vietnam

<sup>1</sup> The Revolution policy is well-known as the DOI MOI policy.

<sup>2</sup> 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.

<sup>3</sup> Before 1990, The State Bank of Vietnam (SBV) implemented the fixed exchange rate regime.

<sup>4</sup> This policy aims to support Vietnam's export activities

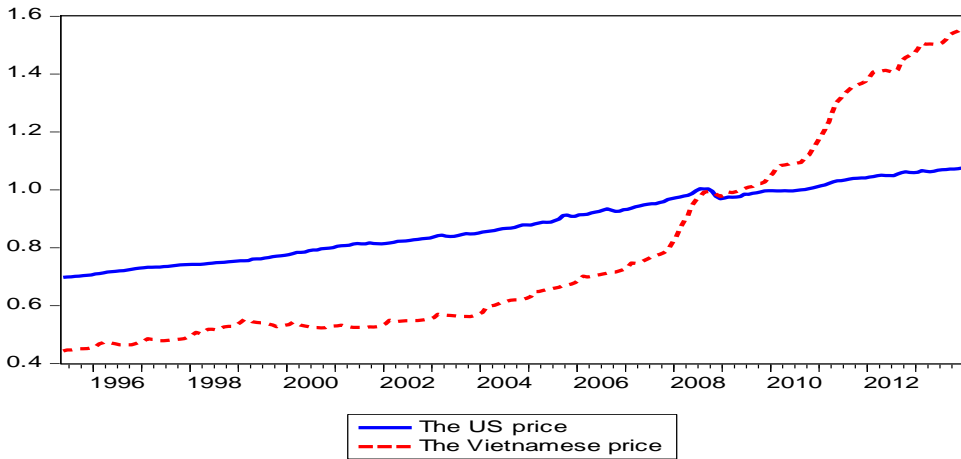


Figure-2. The price level in Vietnam and the United State

### 3. EMPIRICAL ANALYSIS

#### 3.1. Model Identification

To analyze the movement of the real and nominal exchange rate (USD/VND) in Vietnam, we will apply the long-run SVAR model, which is developed by Blanchard and Quah (1989). This model is also widely applied in many previous researches (Clarida and Gali, 1994; Chen and Wu, 1997; Enders and Lee, 1997; Dibooglu and Kutun, 2001; Tao, 2005; Ok *et al.*, 2010). We have the bivariate 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

$$\begin{aligned} \Delta RER_t &= \sum_k^{\infty} c_{11}(k) \varepsilon_{rt-k} + \sum_k^{\infty} c_{12}(k) \varepsilon_{nt-k} \\ \Delta NER_t &= \sum_k^{\infty} c_{21}(k) \varepsilon_{rt-k} + \sum_k^{\infty} c_{22}(k) \varepsilon_{nt-k} \end{aligned}$$

In which,  $\Delta RER_t$  is the natural log of the real exchange rates at time t.  $\Delta NER_t$  is the natural log of the nominal exchange rates at time t.  $\varepsilon_{rt}$  is the real shock and  $\varepsilon_{nt}$  is the nominal shock.

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

#### 3.2. Data

The monthly data includes the nominal exchange rate (USD/VND) and the consumption price index (CPI) as the price level in Vietnam and the United States. The period is between May 1995 and December 2013. We collect data from Vietnam's General Statistic Office, the SBV and Federal Reserve (FED). The real exchange rate is then computed mainly based on the following formula (1) From PPP formula

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

Take logarithm both side of the above equation

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

Where, RER is the logarithm of the real exchange rate. NER is the logarithm of the nominal exchange rate, USD/VND. P\* is the logarithm of the foreign price level, the US CPI. P is 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	
$\Delta P$	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 condition for estimating the SVAR model is that the underlying variables must be stationary without cointegration among them, [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% significant 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 \(2010\)](#). This finding is consistent with that in previous studies in China, Cambodia, and Lao ([Tao, 2005](#); [Ok et al., 2010](#)).

**Table-3.** The stationary and cointegration test

	Level	First difference
<i>NER</i>	-0.889	-14.439
<i>RER</i>	+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 \(2010\)](#)<sup>5</sup>. Firstly, we generate the residual from the estimated equation of the nominal exchange rate (USD/VND) on the real exchange rate (USD/VND). Then, 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% significant level. This result implies that a long-run relationship between the nominal and real exchange rate (USD/VND) in Vietnam does not exist. In other word, there is no evidence in favor of 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 can apply the SVAR model to investigate how the nominal and real exchange rates (USD/VND) respond to the nominal and real shocks over time in Vietnam. Before estimating the SVAR model, the next step is to choose the optimal lag length of the SVAR via the Vector Autoregressive (VAR) model. Table 4 indicates that the first-order lag length should be selected because of the lowest Akaike information criterion (AIC) and Schwarz information criterion (SIC), ([Hill et al., 2012](#)).

**Table-4.** The Akaike information criterion (AIC) and Schwarz information criterion (SIC)

Lag	AIC	SIC
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

Then, following the restriction developed by [Enders and Lee \(1997\)](#), the result of estimation of the long-run SVAR model is presented as follows:

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

<sup>5</sup> Ender proposes the method to test the existence of the long-run PPP in his book, Applied Econometric Time Series, Third edition, p.211.

$$\begin{aligned} & \text{Se} \quad (0.000714) \\ \Delta NER_t &= 0.004\varepsilon_{rt-1} + 0.009\varepsilon_{nt-1} \quad (2) \\ & \text{Se} \quad (0.000637) \quad (0.000430) \end{aligned}$$

All coefficients in the bivariate moving-average (BMA) system are significant at the 1% level. Thus, the estimation of the SVAR based on the Vietnamese data is statistically significant.

### 3.3.1. Impulse Response Analysis

The impulse response function plays a role in representing the effects of a one-time shock. Therefore, after estimating the long-run SVAR model, we compute the impulse response function (IRFs). The IRFs enables us to examine how the nominal and real exchange rates (USD/VND) respond to the nominal and real shocks<sup>6</sup>. 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.

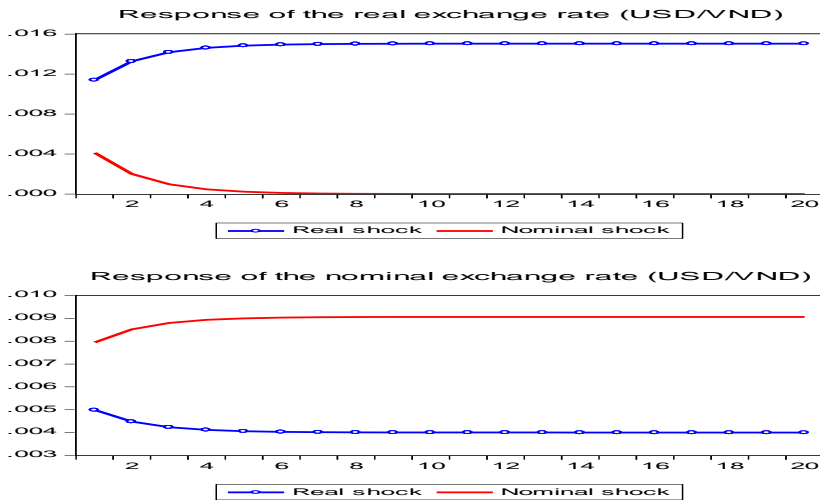


Figure-3. Impulse response function

From the IRFs (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

<sup>6</sup> The nominal and real shocks are measured by one standard deviation

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 movement of both 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 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 VDC 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. However, it then decreases to a steady level of 94.258 % three months later. Similarly, 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 that in previous studies in other countries (Dibooglu and Kutan, 2001; Ok *et al.*, 2010).

## 4. CONCLUSION

The empirical result indicates that the movement of 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 (Tao, 2005; Ok *et al.*, 2010). This research implication follows the key classical macroeconomic hypothesis, which indicates that permanent movements of 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 in Vietnam. This finding is the same current condition as in other developing countries, such as Laos and Cambodia (Ok *et al.*, 2010).

Although our research could indicate some important implication on the change in the exchange rate (USD/VND) in Vietnam, in practice, the movement of the exchange rate (USD/VND) in Vietnam is impacted by other exogenous factors. One of these factors, for example, is the fluctuation of USD/VND managed by the State Bank of Vietnam. Such kind of factor is especially hard to predict. 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.

## REFERENCES

- Blanchard, O. and D. Quah, 1989. The dynamic effects of aggregate demand and supply disturbances. *American Economic Review*, 79(4): 655-673.
- Chen, C.L. and T.L. Wu, 1997. Sources of real exchange rate fluctuations: Empirical from four Pacific Basin countries. *Southern Economic Journal*, 63(3): 776 – 787.
- Clarida, R. and J. Gali, 1994. Sources of real exchange-rate fluctuations: How important are nominal shocks? *Carnegie-Rochester Conference Series on Public Policy* 1994, Elsevier. pp: 1-56.
- Dibooglu, S. and A.M. Kutan, 2001. Sources of real exchange rate fluctuations in transition economies: The case of Poland and Hungary. *Journal of Comparative Economics*, 29(2): 257-275.
- Ender, W., 2010. *Applied econometric time series*. John Wiley & Sons.
- Enders, W. and B. Lee, 1997. Accounting for real and nominal exchange rate movements in the post-Bretton Woods period. *Journal of International Money and Finance*, 16(2): 233-254.
- Ha, I., B. Lee and C. Cheong, 2007. What caused the Korean currency crisis in 1997?\*: Weak fundamentals or self-fulfilling expectations. *Asian Economic Journal*, 21(2): 195 – 206.
- Hill, R.C., W.E. Griffiths and G.C. Lim, 2012. *Principles of econometrics*. NJ: Wiley Hoboken.
- King, R.G. and M.W. Watson, 1997. Testing long-run neutrality. *FRB Richmond Economic Quarterly*, 83(3): 69-101.
- Ok, S., M. Kakinaka and H. Miyamoto, 2010. Real shock or nominal shock? Exchange rate movements in Cambodia and Lao PDR. *The Singapore Economic Review*, 55(04): 685 – 703.
- Tao, W., 2005. Sources of real exchange rate fluctuations in China. *Journal of Comparative Economics*, 33(4): 753 – 771.

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