The source of real and nominal exchange rate fluctuations in Thailand: Real shock or nominal shock

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Abstract

This paper examines the source of exchange rate fluctuations in Thailand. We employed a structural vector auto-regression (SVAR) model with the long-run neutrality restriction of Blanchard and Quah (1989) to investigate the changes in real and nominal exchange rates from 1994 to 2015. In this paper, we assume that there are two types of shocks which related to exchange rate movements: real shocks and nominal shocks. The empirical analysis indicates that real shocks are the fundamental component in driving real and nominal exchange rate fluctuations.

Keywords: Thailand, real and nominal exchange rates, long run restriction, SVAR

1.Introduction and literature review

Thailand is one of the famous emerging countries in Asia. This country is an open economy, which almost depends on the external trade. Therefore, exchange rate fluctuations become important to Thailand. Thus, in this paper, we want to examine these shocks which affecting real and nominal exchange rate fluctuations in Thailand.

Real and nominal exchange rates are closely related and their movements are important to assess the economic conditions in emerging countries. We assume that there are two types of shocks which affecting the real and nominal exchange rates: a real shock and a nominal shock. The real shock is related to the change in technology and preference whereas the nominal shock can be defined as the change in nominal money supply and exchange rate devaluation (Ok, Kakinaka, Miyamoto (2010)). My paper will explain the source of real and nominal exchange rate fluctuation by applying the SVAR model.

Recently, the SVAR model has been widely used in empirical research macroeconomics. First of all, Blanchard and Quah (1989) develop a bivariate VAR model in which real GNP is affected by aggregate supply shock and aggregate demand shocks. Aggregate supply shocks are assumed to have permanent effects on real GNP while aggregate demand shocks are assumed to have only temporary effect on real GNP. VAR estimations with restrictions imposed are employed to identify the type of shocks. Then, analyzing the impact of one shock to real GNP depends on impulse response and forecast error variance.

Following Blanchard and Quah (1989), numerous studies have examined the source of exchange rate fluctuations. For example, Ender and Lee (1997) decompose the exchange rate series into the components induced by real and nominal factors. In order to investigate the exchange rate movements, structural VAR model with long run neutrality restriction is employed. The SVAR decomposition implies that (i) a real shock can be expected to influence real and nominal exchange rates in the long run whereas (ii) a nominal shock has only short-run impact on real exchange rates. This method is widely applied by Clarida and Gali(1994), Chowdhury(2004), Ok, Kakinaka, Miyamoto (2010).

There are some studies about the source of exchange rate fluctuations in Thailand. Huang and Suchada (2003) employed a structural VAR analysis of real and nominal exchange rates for Thailand and Mexico. Their model's structural shocks are demand, supply, money and capital flow. They found that demand shock is the main source of exchange rate fluctuations in Thailand. On the other hand, Wanaset (2008) applied VAR analysis to investigate the pass through effect of key macroeconomic variables, including GDP, CPI, money supply and oil prices on exchange rates in Thailand. The fundamental effect to exchange rate fluctuations in this paper is CPI shock. To be best of our knowledge, my study is the first one in Thailand to examine the exchange rate movements by decomposing into the real shocks and nominal shocks.

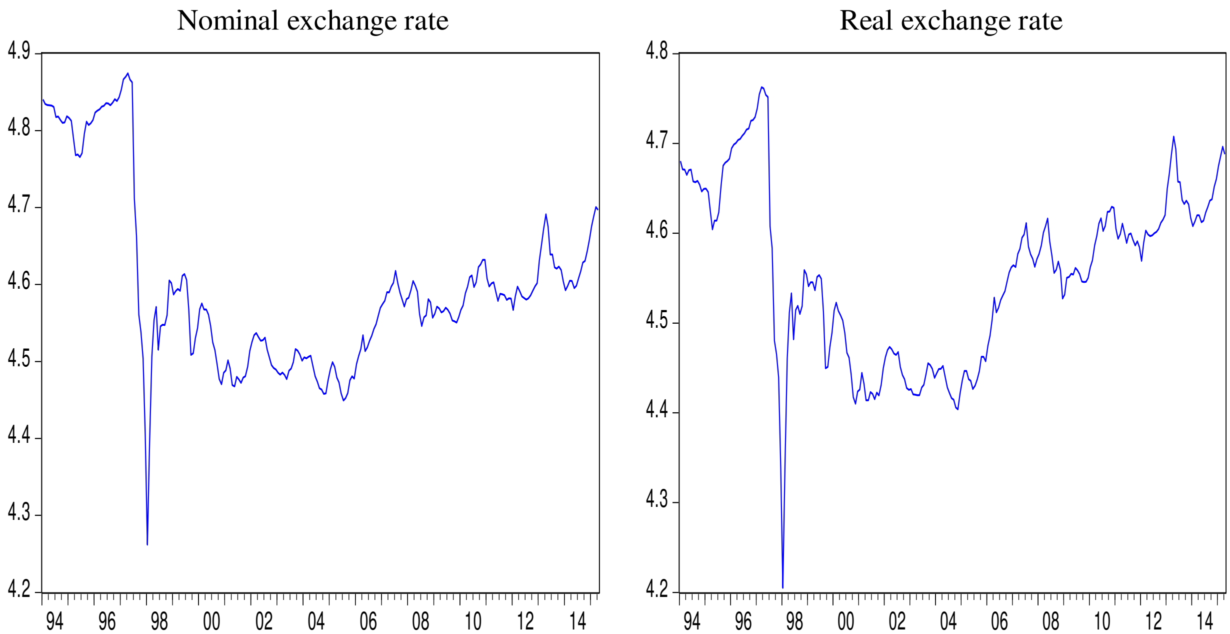
My paper constructs a bivariate SVAR model in order to assess the relative important of a real shock and a nominal shock. In this paper, we use the effective exchange rate of Thailand since the effective exchange rate reflects a country's international competitiveness in terms of its foreign exchange rate. This form competitiveness cannot be understood by simply examining the individual exchange rates between home currency and the currencies of other countries. My result shows that real shocks induce real and nominal depreciation in the long-run. This research also finds that nominal shocks lead to short-run real appreciation and long-run nominal deprecation. Furthermore, by using variance decomposition, we realize that real shocks play a dominant role in the exchange rate movements. An analysis of the sources behind the exchange rate fluctuations are discussed in my paper.

My paper is organized as follows. Section 2 represents the exchange rate movements in Thailand since 1994. Section 3 introduces the empirical research to examine the source of exchange rate fluctuations in Thailand. Section 4 indicates some conclusions.

2. Recent development in Thailand

Before Asian crisis, according to International Monetary Fund (IMF) classification, Thailand was considered to be pegged to composite basket of currency. Since June 1997, Thailand exchange rate regime has changed from a fixed exchange rate to a managed float. Thus, there is a fluctuation of exchange rate under a managed floating system. On the other hand, the Bank of Thailand (BOT) could intervene in the market to avoid excessive volatilities and achieve economic policy target. The intervention schemes are demonstrated on restraining short term movements and keeping regional development, whereas maintaining the exchange rate adjusted with economic principles in medium and long term. Figure 1 illustrates nominal and real exchange rate of the Thai baht against the US dollar. As can be seen from these figures, the Thai baht lost its value remarkably against the US dollar during the period 1997 to 1998, because of the changing from pegging to float exchange rate system. After that, the Thai baht has slightly fluctuated in both nominal and real term.

Figure 1: Nominal exchange rate and real exchange rate



Note: the line indicates the log of nominal and real exchange rate.

3. Empirical analysis

3.1. Model specification

Consider the following infinite-order vector moving average (VMA) model:

$$\Delta x_t = C(L)\, \varepsilon_t \quad (1)$$

Where L is a lag operator, Δ is a difference operator, $\Delta x_t = [\Delta r_t\ \Delta e_t]'$ is a (2x1) vector of endogenous variables, $\varepsilon_t = [\varepsilon_{rt}\ \varepsilon_{nt}]$' is a (2x1) vector of structural shocks with covariance matrix $\sum$. r_t and e_t are the natural log of real exchange rate and nominal exchange rate in period t, respectively. ε_{rt} is the real shock in period t, ε_{nt} is the nominal shock in period t. The Blanchard and Quah approach assumes that real shock and nominal shock are not correlated. Hence, $\sum$ is a diagonal matrix.

Since the structural shocks in (1) are not directly observable, we need to estimate the following infinite-order model

$$[1 - \phi(L)]\, \Delta x_t = u_t \quad (2)$$

Where ϕ(L) is a finite-order matrix polynomial in the lag operator and u_t is a vector of disturbances. We can transfer equation (2) to VMA representation if the stationary conditions are satisfied.

$$\Delta x_t = \text{A(L)}\ u_t \quad (3)$$

Where A(L) is a lag polynomial

From equation (1) and (3), we have a linear relationship between ε_t and u_t:

$$u_t = C_0\ \varepsilon_t \quad (4)$$

Where C_0 is a (2x2) matrix representing the contemporaneous effect of the one standard deviation shocks on the two variables. We need four parameters to convert the residuals from the estimated VAR into original shocks that drive the behavior of endogenous variables. Three of them are given by the element of $\sum = C_0\ C_0{}'$. Therefore, we need another identifying restrictions to obtain the forth. The Blanchard and Quah method imposes the restriction by defining that nominal shocks do not have any long run effect on real exchange rate. It implies that the nominal shock has only short-run effects on the real exchange rate.

Following Ender and Lee (1997), equation (1) can be written, as follows,

$$\begin{bmatrix} \Delta r_t \\ \Delta e_t \end{bmatrix} = \begin{bmatrix} C_{11}\ (L) & C_{12}\ (L) \\ C_{21}\ (L) & C_{22}\ (L) \end{bmatrix} \begin{bmatrix} \varepsilon_{rt} \\ \varepsilon_{nt} \end{bmatrix} \quad (5)$$

where $C_{ij}\ (L)$ is polynomial in the lag operator L.

The long-run neutrality restriction that the nominal shocks have no long-run effect on the real exchange rate is represented by the restrictions that the coefficient in $C_{12}\ (L)$ is sum to zero

$$\sum_{k=0}^{\infty} C_{12}\ (k) = 0 \quad (6)$$

where $C_{12}\ (k)$ is the kth coefficient in $C_{12}\ (L)$ and represents the effect of nominal shock, ε_{nt}, on the first difference of real exchange rate, Δr_t, after k period.

3.2. Data

The data is obtained from International Financial Statistic (IFS) of International Monetary Fund (IMF) and Bank for International Settlements (BIS). We collect monthly nominal effective exchange rate (NEER) and real effective exchange rate (REER) of Thailand from 1994M1 to 2015M4. The natural log of NEER (e_t) and the natural log of REER (r_t) are used as estimable data.

Table 1: Descriptive Statistics of Nominal and Real Exchange rates

	Δr_t	Δe_t
Average	0.0000297	-0.0005629
Standard Deviation	0.0231217	0.0232883

Note:
Δr_t is the first difference of log of the real exchange rate and Δe_t is the first difference of log of the nominal exchange rate

Table 1 indicates the descriptive statistics of the first difference of log of nominal and real exchange rate for Thai baht against the US dollar. The change of real exchange rate is smaller than that of nominal exchange rate. On the other hand, the average real depreciation rate is larger than the average nominal depreciation rate.

3.3. Estimation

In order to apply SVAR model, all variables are stationary and there does not exist the cointegration among them (Ender (2015)). First, we test the unit root for the real and nominal exchange rate. The augmented Dickey fuller test (ADF) test indicates that the log-level of real and nominal exchange rates are not stationary, but the first difference of them is stationary (Table 2). Because we do not see the trend in this series, the auxiliary regressions include only the constant term.

Table 2: Unit root tests for Stationary (ADF-test)

Variable	Specification	t-statistic	p-value
r_t	Const	-2.572130	0.1001
e_t	Const	-2.704752	0.0746
Δr_t	Const	-11.69161	0.0000*
Δe_t	Const	-11.14999	0.0000*

Note: (*) denotes significance at the 5% level

Afterwards, we use Johansen's co-integration test to check whether or not two non-stationary series of r_t and e_t are co-integrated. By employing Akaike information criterion (AIC) in order to determine the optimal number of lags, we choose second order. Table 3 shows that there is no co-integration relationship between r_t and e_t. Therefore, we can apply SVAR in this case.

Table 3: Cointegration test

Ho: number of CE	Eigen value	Trace statistic	0.05 critical value	p-value
None	0.027563	12.20183	15.49471	0.1475
At most 1*	0.020074	5.130432	3.841466	0.0235

Note: (*) denotes rejection of the hypothesis at the 5% level

In the next step, we will choose the optimal lag length of SVAR for the VAR model. The optimal lag length is the first-order because of the lowest AIC and SIC (Table 4).

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

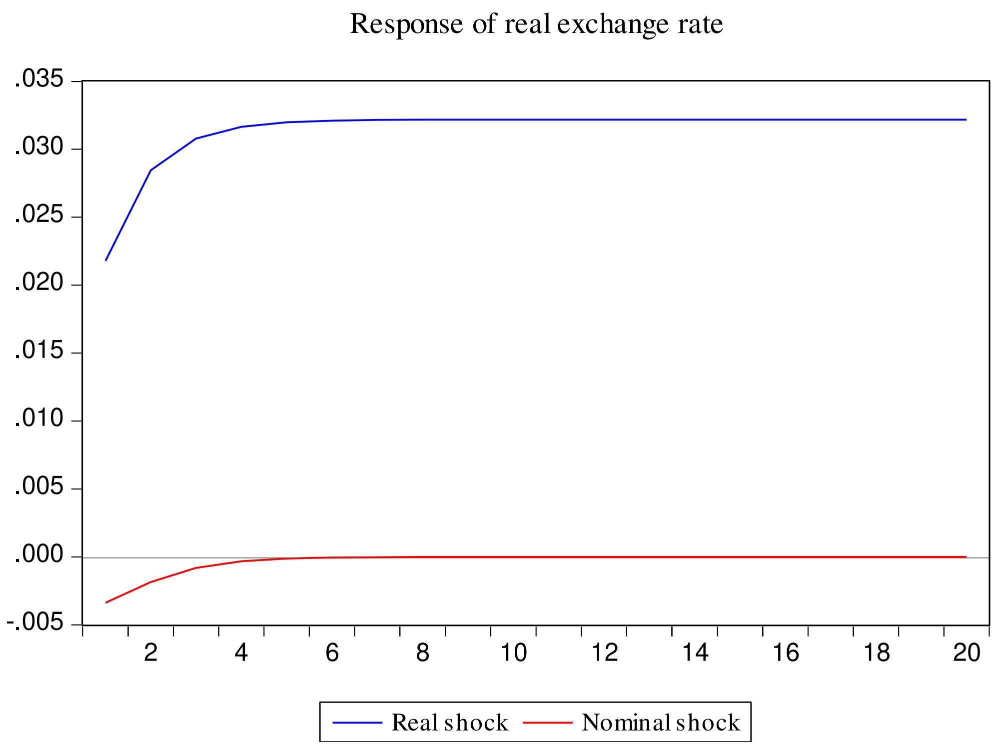
Lag	AIC	SIC
0	-12.57894	-12.55068
1	-12.74134*	-12.65658*
2	-12.73908	-12.59781
3	-12.73336	-12.53559
4	-12.71449	-12.46022
5	-12.70527	-12.39449
6	-12.73363	-12.36634

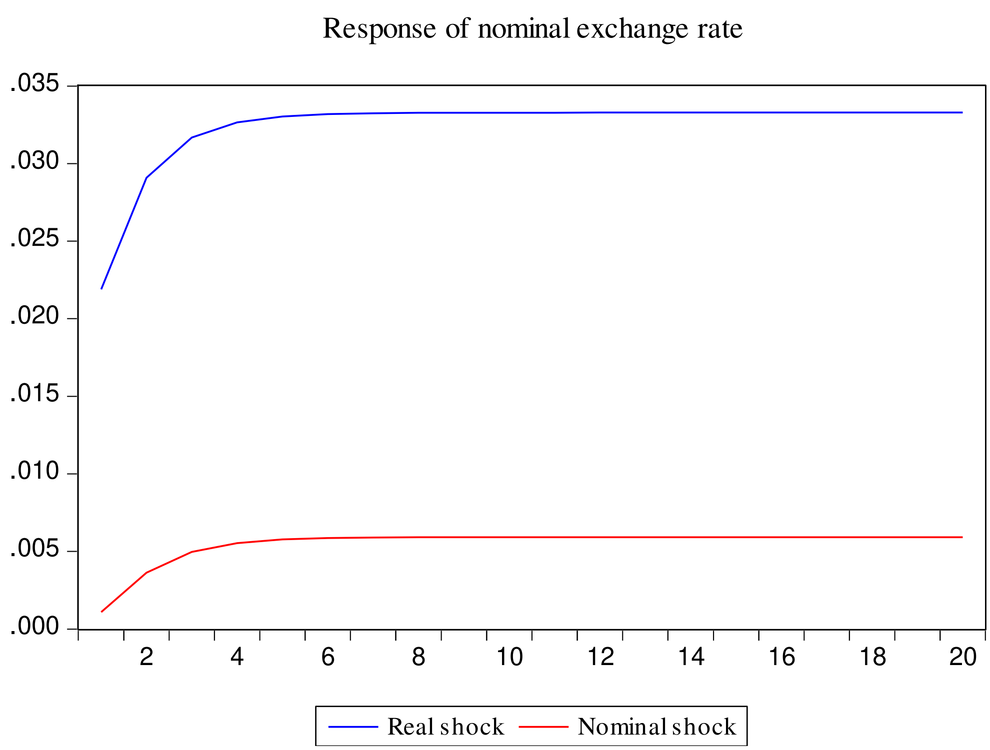
Note: (*) indicates lag order selected by the criterion

3.3.1. Impulse response function

In order to examine the effect of each type of shock on real and nominal exchange rates, we estimate the SVAR model and compute the impulse response functions (IRF). As the VAR models use first-difference from of real and nominal exchange rates, we have computed the accumulate responses of the changes in two variables to the shocks to see the fluctuations of the variables in their level. Figure 2 shows the dynamics response of real and nominal exchange rates to one standard deviation of both types of shocks over a horizon to up to 20 months.

Figure 2: Impulse response function





As can be seen from figure 2, a real shock immediately increases the real and nominal exchange rate. After six months, both real and nominal exchange rates converge in their new long-run levels. In addition, the dynamics response of both real and nominal exchange rate to a real shock is similar magnitude. This result is similar with Ender and Lee (1997) when they found that a real shock induces a jump in the real and nominal rates of nearly the same magnitude.

In the response to a nominal shock, the real exchange rate is negative with real appreciation in the first stage. However, it converges to zero within six months, which indicates that a nominal shock has no long-run effect on the real exchange rate. On the other hand, the effect of a nominal shock on nominal exchange rate is permanently positive with nominal depreciation.

3.3.2. Variance decomposition

On the next step, we use forecast error variance decomposition to examine the source behind exchange rate fluctuations. Impulse response are suitable for investigate the signs and magnitudes of response to unique shocks by declaring the dynamic effects. On the other hand, variance decomposition is used to measure the relative importance of each shock to the system.

Table 5: Variance decomposition of real and nominal exchange rate

	Relative contribution of real shock to	
Forecast horizon	Δr_t	Δe_t
1- month	97.64014	99.75258
2-month	97.40786	98.57406
4-month	97.19848	98.21809
6-month	97.19092	98.20752
8-month	97.19073	98.20726
10-month	97.19073	98.20726
12-month	97.19073	98.20726
14-month	97.19073	98.20726
16-month	97.19073	98.20726
18-month	97.19073	98.20726
20-month	97.19073	98.20726

Note: contribution of a nominal shock is 100 minus contribution of a real shock

It is evidence that the relative contribution of a real shock explains 97% the variation of real exchange rate in all forecast horizons. Concurrently, 98% of the variation of nominal exchange rate can be interpreted by the relative contribution of a real shock. In short, the relative contribution of a real shock is essential factors to explain the variance of real and nominal exchange rate in Thailand. This result is similar with the important role of real shocks in explaining the real and nominal exchange rates movements (Ender and Lee (1997))

4. Conclusion

My research explores the source behind the real and nominal effective exchange rate movements in Thailand. We employ structural VAR model to investigate the source of the change in real and nominal exchange rates and analyze the dynamics and the forces that have driven these fluctuations. Since the real effective exchange rate represents the performance and competitiveness of an economy, the source of the exchange rate movements becomes crucial to understand.

In this paper, we assume that there are two types of shocks: a real shock and a nominal shock. My results indicate that most of real and nominal depreciation are the result of a real shock while a nominal shock generates long-run nominal depreciation and short-run real appreciation. This result for Thailand is consistent with those for developed countries (Ender and Lee (1997)).

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