Efficiency of Sterilization Policies by the State Bank of Vietnam

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Abstract

This study aims to evaluate the effectiveness of sterilization in Vietnam. We estimate a simultaneous equation by using Two-Stage least squares (2SLS) regression analysis. The time-series data was collected for the first quarter of 2004 to the fourth quarter of 2018. In particular, the effectiveness of sterilization is considered in terms of dollarized economy, since making the transition from a centrally planned to a market economy system, the Vietnamese economy has remained in a state of dollarization. In addition, we also assess whether the global financial crisis had an impact on the sterilization effectiveness of the State Bank of Vietnam (SBV). On the basis of the estimated sterilization and offset coefficients, our results suggest that the State Bank of Vietnam (SBV) has not been able to fully neutralize the impact on the domestic money supply when intervening in the foreign exchange market, and the capital inflows respond strongly to changes in domestic monetary conditions. The results also show that the global financial crisis has changed the effectiveness of these sterilization policies. An analysis of this study’s empirical findings provides the opportunity to derive some recommendations that may assist in increasing the effectiveness of the State Bank of Vietnam’s sterilization policies in the process of accumulating international reserves.

Keywords: Sterilization Efficiency, Sterilization Coefficient, Offset Coefficient, Global Financial Crisis, Dollarization

JEL Classification Code: E58, F31, G51

1. Introduction

Financial globalization and the expansion of international capital flows have benefited nations such as helping them to allocate resources more efficiently, by improving risk-sharing and transferring technology more quickly. However, these also increase the risk of exposure to the financial crisis. The severity of crises and dependence on the external financial sector have led governments to increase insurances for their own countries (Denbee, Jung, & Paternò, 2016). International reserves are always an important matter for any governments in the world (Tran & Le, 2020). Developing countries have accumulated a significant amount of international reserves in response to a series of financial crises. High international reserves help these countries reduce the impact of the crisis on economic growth in emerging markets (Moghadam, Hagan, Tweedie, Vinals, & Ostry, 2010). However, the central bank’s accumulation of foreign reserves may lead to an increase in money supply, causing inflation without proper neutralizing intervention (Heller, 1979; Steiner, 2009; Aizenman & Glick, 2009). Sterilization involves the central bank performing simultaneous transactions on foreign assets and domestic assets to neutralize the effects of foreign exchange market intervention on the domestic money supply (Krugman, Obstfeld, & Melitz, 2012).

In Vietnam, inflation and the money supply tend to fluctuate in the same direction for the period from 2004 to 2018. The increase in money supply is one of the causes of inflation (Nguyen, 2015). Most notably, during the period of the global financial crisis from 2007 to 2008, the money supply increased sharply, followed by a sharp increase in inflation. The State Bank of Vietnam (SBV)’s purchase of foreign currencies does have a significant effect on the money supply, and consequently inflation in Vietnam (Trinh,
2. Literature Review

Empirical studies on the effectiveness of sterilization can be divided into two main approaches.

The first approach considers the relationship between Net Domestic Assets (NDA) and Net Foreign Assets (NFA) of the SVB and capital-flows in the context of dollarized economies. This study focuses on the effectiveness of SBV’s sterilization and capital flows in the context of a dollarized economy. In addition, we use interactive variables in the model to consider whether the global financial crisis had an impact on the effectiveness of the SBV’s sterilization.

We use 2SLS estimates derived from a simultaneous equation model to estimate the sterilization and offset coefficients. The simultaneous equations are constructed from the Central Bank loss function in the context of the dollarization of the economy. We use interactive variables in the model to consider whether the global financial crisis will change the effectiveness of SBV’s sterilization. The research results show that neutralization interventions in Vietnam have not been effective and that the global financial crisis has affected the effectiveness of these interventions by the SBV. These results suggest some policy implications that may enable the SBV to improve the effectiveness of sterilization in the monetary policy management process.

3. Research Methods and Data

3.1. Conceptual Model

For the reasons outlined above, this study’s analysis of the effectiveness of sterilization policies uses a simultaneous equation model based on equations (1) and (2) above. To identify the control variables X1 and X2 to be used in the system of equations in the context of Vietnam’s economy, we use a modified version of the models developed by Brissimis, Gibson, and Tsakalotos (2002) and Ouyang and Rajan (2011). Using this approach, we first determine the loss function of the SBV in accordance with its operating monetary policy management objectives. Controlling inflation is a key objective in monetary policy management of the SBV, and this variable is included in the loss function and adjusted to allow for the impact of dollarization on inflation. Most developing countries have had a limited, informal form of dollarization, and in Vietnam, the SBV has implemented a variety of measures to combat dollarization (Goujon, 2006). On the other hand, the crisis also affects emerging economies through many different channels (Lin & Wang, 2005). For example, exports are affected significantly by a global financial crisis (Meyn & Kennan, 2009) or the crisis...
has a significant effect on bank efficiency in Bangladesh (Banna, Ahmad, & Koh, 2017). We use a dummy variable CS with a value of 1 for the data from 2007-2008 and zero for the remaining years in the studies’ time period to assess the impact of the crisis on the effectiveness of neutralization interventions by the SBV.

On the basis of these considerations, assessment of the SBV’s sterilization policies proceeds within the following simultaneous equation model:

\[
\Delta NDA_i = \alpha_0 + \alpha_1 \Delta NFA_i + \alpha_2 \Delta MM_i + \alpha_3 \Delta CPI_i + \alpha_4 Y_i + \alpha_5 CA_i + \alpha_6 (r_i^* + Ee_{t-1}) + \alpha_7 \Delta DL_i + \alpha_8 CS + \alpha_9 (d_{i-1}) + \alpha_{10} u_i
\]

(3)

\[
\Delta NFA_i = \beta_0 + \beta_1 \Delta NDA_i + \beta_2 \Delta MM_i + \beta_3 \Delta CPI_i + \beta_4 Y_i + \beta_5 CA_i + \beta_6 (r_i^* + Ee_{t-1}) + \beta_7 \Delta DL_i + \beta_8 CS + \beta_9 (d_{i-1}) + \beta_{10} v_i
\]

(4)

where MM is the money multiplier; CPI is the rate of inflation; Y is aggregate output; DL is the rate of dollarization of the economy; CA is the current account balance; \( r_i^* + Ee \) is the foreign interest rate plus the expected nominal exchange rate; \( \sigma \) is an indicator of the interest rate volatility; \( \sigma_e \) measures exchange rate volatility and CS is the financial crisis dummy variable.

The interrelated manner in which the control variables in equations (3) and (4) are likely to affect NDA and NFA, together with expected coefficient signs, can now be considered.

When the monetary multiplier (MM) increases, the domestic money supply increases, causing the Central Bank to implement a tight monetary policy, causing NDA to decrease (\( \alpha_2 < 0 \)). In addition, capital flows tend to flow abroad due to lower interest rates, causing NFA to decline (\( \beta_2 < 0 \)).

When inflation (CPI) increase, the Central Bank’s implementation of tight monetary policy causes NDA to decrease (\( \alpha_3 < 0 \)). When inflation is high, the domestic currency depreciates, leading to a decrease in capital inflows, thus reducing NFA (\( \beta_3 < 0 \)).

When the output is higher than potential output, the Central Bank often introduces counter-cyclical monetary policy measures, so the NDA decreases (\( \alpha_4 < 0 \)). At the same time, higher output growth is conducive to investment opportunities in the economy, boosting foreign investment and capital inflows, leading to an increase in NFA (\( \beta_4 > 0 \)).

If the current account is in surplus, the domestic currency is likely to appreciate, and, in order to reduce pressure on the domestic currency, the Central Bank tends to implement an expansionary monetary policy, causing NDA to increase (\( \alpha_9 > 0 \)). When foreign interest rates increase, and the domestic exchange rate is expected to increase, the domestic currency is likely to depreciate. As a result, investment capital flows tend to flow abroad, reducing the accumulation of international reserves. To stabilize the domestic exchange rate, the Central Bank may react by implementing a tight monetary policy. Therefore, this control variable is expected to have a negative impact on NDA (\( \alpha_9 < 0 \)) and NFA (\( \beta_9 < 0 \)).

In cases where the dollarization level is high, the demand for foreign currencies is high, pushing up the exchange rate. To neutralize this situation, the Central Bank would have to increase domestic currency interest rates relative to interest rates on foreign currencies so as to encourage people to convert foreign currencies into domestic currency. The increase in domestic interest rates indicates monetary policy tightening, causing NDA to fall (\( \alpha_6 < 0 \)). High dollarization is likely also to place pressure on the SBV to intervene in the foreign exchange market, leading to a decline in NFA (\( \beta_9 < 0 \)). It is difficult to predict the likely domestic monetary policy actions and the movement of capital flows in the context of the financial crisis, and as a result, the expected values of the \( \alpha_9 \) and \( \beta_9 \) coefficients are difficult to ascertain prior to estimation.

Finally, a higher degree of interest rate fluctuations is likely to lead to a greater level of intervention by the Central Bank (\( \alpha_7 \) expectation < 0). Similarly, the more exchange rates fluctuate, the higher the likelihood of intervention by the Central Bank (\( \beta_7 < 0 \)).

3.2. Estimation Method

The study estimates sterilization and offset coefficients from a simultaneous equation system using 2SLS. This estimation method was originally proposed by Theil (1953) and Basmann (1957). Next, after estimating 2SLS, if the residuals of the equations in the model are correlated, we proceed to estimate 3SLS to address this problem. The 3SLS method was proposed by Zellner & Theil (1962) on the basis of extending 2SLS estimates. According to Kapteyn and Fiebig (1981), when the residuals of equations are not correlated at all, the 2SLS is not different from 3SLS. The 3SLS method combines the estimation of residual regression (SUR estimate) and 2SLS.

3.3. Variable Calculations and Data Sources

We use Vietnam’s quarterly data from the first quarter of 2004 to the fourth quarter of 2018. Data sources are mainly from International Financial Statistics (IFS) 2018 and Thomson Reuter Data Stream. The calculation of variables and data sources are shown in Table 1.
4. Results and Discussion

4.1. Testing Data for Stationary

Before performing the 2SLS estimation with time-series data, we conduct unit root tests to ensure that the data series is stationary. The two methods used for unit root test are Augmented Dickey – Fuller (ADF) and Phillips - Perron (PP). The results show that \( Y_{t-1} \) and \( CA_{t-1} \) are stationary at level, while the remaining variables are stationary at first difference with a significance of 10%. This means that the data series has no unit roots, and the data is stationary.

Table 1: Variables and Data Sources of the Model Which Evaluates the Effectiveness of the SBV’s Sterilization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Symbol</th>
<th>Calculating method</th>
<th>Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted NFA</td>
<td>NFA_t</td>
<td>( NFA_t = NFA_{t-1} + \frac{e_{t} - e_{t-1}}{e_{t-1}} )</td>
<td>IFS 2020</td>
</tr>
<tr>
<td>Adjusted NDA</td>
<td>NDA_t</td>
<td>NDA_t = (MB_t /GDP_t) - NFA_t</td>
<td>IFS 2020</td>
</tr>
<tr>
<td>Money multiplier</td>
<td>MM_t</td>
<td>Ln(MM_t /MB_t)</td>
<td>IFS 2020</td>
</tr>
<tr>
<td>Inflation</td>
<td>CPI_t</td>
<td>Ln(CPI_t)</td>
<td>IFS 2020</td>
</tr>
<tr>
<td>Output Gap</td>
<td>Y_t</td>
<td>Ln(GDP_t) – Ln(GDP_p)</td>
<td>Thomson Reuters</td>
</tr>
<tr>
<td>Current account</td>
<td>CA_t</td>
<td>CA/GDP_t</td>
<td>IFS 2020</td>
</tr>
<tr>
<td>Foreign interest rate plus the expected nominal exchange rate.</td>
<td>( r_{t}^{*} + \text{ln}(E_{t}) )</td>
<td>IFS 2020</td>
<td></td>
</tr>
<tr>
<td>Time Series Interest rate volatility</td>
<td>( \sigma_{r,t} )</td>
<td>( \hat{\sigma}<em>{r,t} = \left( \frac{1}{5} \right) \sqrt{\sum</em>{i=-2}^{2} (\Delta r_{t+i} - \hat{r})^2} )</td>
<td>IFS 2020</td>
</tr>
<tr>
<td>Exchange rate volatility</td>
<td>( \sigma_{e,t} )</td>
<td>( \hat{\sigma}<em>{e,t} = \left( \frac{1}{5} \right) \sqrt{\sum</em>{i=-2}^{2} (\Delta e_{t+i} - \hat{e})^2} )</td>
<td>IFS 2020</td>
</tr>
</tbody>
</table>

4.2. Results and Discussion

We now begin the 2SLS estimation process, next testing for the possible existence of autocorrelation (Breusch-Godfrey Serial Correlation LM Test), heteroskedasticity (Heteroskedasticity Test) and stationarity of residuals. The results show that equation (3) has no autocorrelation, equation (4) has a lag 1 autocorrelation. So that the AR (1) process is added to the equation (4) to overcome the autocorrelation. The residuals of two equations have no heteroskedasticity and are stationary. Therefore, we can now proceed with the estimation of the model.
After estimating 2SLS, the correlation coefficient of the residuals of the two equations is 0.431 (closer to the value 0 than 1). Thus, the residuals of the two equations are not correlated. Therefore, we do not need to estimate 3SLS as in the studies of Brissimis et al. (2002) and Ouyang and Rajan (2011).

The results of estimating sterilization coefficients (equation 3) and offset coefficients (equation 4) are shown in Table 2.

The estimation results of the monetary response function (equation 3) in table 2 show that the sterilization coefficient from the first quarter of 2004 to the fourth quarter of 2018 is 72.1% with a significance level of 1%. This can lead to an expansion of money supply, affecting inflation when the SBV accumulates international reserves. The estimation results of capital-flow equation (equation 4) in table 3 show that the offset coefficient in the research period is 72.1% with a significance level of 1%. This can lead to a downward trend. The estimated coefficient of the current account variable (CA) is statistically significant and has becoming increasingly effective. In order to sterilize, the main tool used by Central Banks in most countries is Open Market Operations (OMO). In Vietnam, OMO was officially launched by the SBV on July 12th, 2000. Since then, the SBV has continuously improved OMO activities in many aspects, meaning that the OMO has become a key tool of monetary policy to regulate the available capital of credit institutions, contributing to the control of inflation. The offset coefficient of Vietnam is also very high. This demonstrates that Vietnam has liberalized capital transactions, making the capital inflow respond strongly to changes in domestic monetary conditions. However, this indicates that Vietnam has open capital inflows but has no appropriate control measures, making them fluctuate sharply. When we combine the results emerging from the system of equations, the research results show that not only the sterilization coefficient is quite high but also the offset coefficient is very high. This demonstrates that sterilization by the SBV has not been effective. Sterilization can only be effective when the sterilization ratio is high and the offset ratio is low.

Regarding the control variables, it can be observed from equation (3) that almost all of the coefficients for these variables are not statistically significant. The exceptions are the MM variable and interest rate fluctuation (σ) coefficients, which have negative impacts on the NDA. Thus, when the MM increases, the SBV may implement a tight monetary policy in response to the expansion of the money supply. The variables which are not statistically significant indicates that the SBV has not responded directly to changes in macroeconomic factors in the domestic and foreign economy (CPI, Y, CA, r*, Ee, DL, CS). This may be because the SBV has not been completely independent to implement monetary policy, so it has not actively responded to the immediate changes in the economy. The SBV is limited autonomy which is the lowest level of autonomy. Therefore, the SBV’s monetary management efficiency is not high. According to the State Bank’s 2010 Law, the SBV only proposes annual monetary policy but the National Assembly decides and organizes the implementation of monetary policy. The Prime Minister and the Governor of the SBV decide on executive tools and measures to realize the national monetary policy objectives according to the Government’s regulations. Therefore, in the context of Vietnam, it is difficult to enhance the autonomy of the SBV.

In equation (4), it can be observed that most of the estimated coefficients of the control variables are statistically significant. The estimated coefficient of the MM variable is statistically significant, which indicates that the change in the domestic currency multiplier affects capital inflow with a downward trend. The estimated coefficient of the current account variable (CA) is statistically significant and has

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation (3)</th>
<th>Equation (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔNDA*_t-1</td>
<td>-</td>
<td>-0.896*** (0.054)</td>
</tr>
<tr>
<td>ΔNFA*_t-1</td>
<td>-0.721*** (0.161)</td>
<td>-</td>
</tr>
<tr>
<td>ΔMM_t</td>
<td>-0.394*** (0.045)</td>
<td>-0.370*** (0.050)</td>
</tr>
<tr>
<td>ΔCPI_t-1</td>
<td>-0.018 (0.184)</td>
<td>-0.069 (0.161)</td>
</tr>
<tr>
<td>Y_t-1</td>
<td>-0.353 (0.327)</td>
<td>-0.460 (0.284)</td>
</tr>
<tr>
<td>CA_t-1</td>
<td>-0.043 (0.075)</td>
<td>0.098* (0.051)</td>
</tr>
<tr>
<td>Δ(r_t-1 + Ee_t)</td>
<td>0.008 (0.126)</td>
<td>0.136 (0.099)</td>
</tr>
<tr>
<td>ΔDL_t-1</td>
<td>-0.024 (0.068)</td>
<td>-0.136*** (0.049)</td>
</tr>
<tr>
<td>CS</td>
<td>0.007 (0.244)</td>
<td>0.050*** (0.111)</td>
</tr>
<tr>
<td>(d1-1)e_t-1</td>
<td>-0.208* (0.107)</td>
<td>-</td>
</tr>
<tr>
<td>(d2-1)σ_t</td>
<td>-</td>
<td>-0.627 (0.407)</td>
</tr>
</tbody>
</table>

Note: (***): Significance at 1%; (**) : Significance at 5%; (*): Significance at 10%; Data in parentheses () is standard error.
positive signs as expected. Thus, when the CA is in surplus, the capital inflow increases, and the SBV will increase its accumulation of international reserves. Dollarization has no impact on the SBV’s NDA but has a negative impact on the SBV’s NFA. This suggests that when people do not hold much foreign currencies, dollarization decreases, as they sell foreign currencies back to credit institutions. Credit institutions also trade with the SBV. Thus, the accumulated international reserves of the SBV increased. Moreover, as dollarization decreases, demand for foreign currencies decreases and thus the pressure on the foreign exchange market is reduced. Meanwhile, the SBV will have less selling intervention in the foreign exchange market to stabilize the market compared to the case of increasing dollarization, so the NFA is increasing. This is also consistent with the dollarization and accumulation of international reserve of Vietnam recently.

Next, we consider the coefficients of the CS variable in both equations. The CS variable in equation (3) is not statistically significant, however, the CS variable in equation (4) is statistically significant. Therefore, we continue to conduct tests on equation (4) with the CS variable. Because CS is a dummy variable, we need to consider in terms of the whole population whether the CS coefficient is non-zero or not by conducting Wald’s test with this coefficient. The null hypothesis $H_0$ is that the coefficient is equal to 0. The results show that the null hypothesis $H_0$ is rejected (P value = 0.000), indicate that there is a difference in NFA changes in financial and non-financial crisis conditions. To assess whether the global financial crisis affects the offset coefficient or not, we use the CS * NDA interaction variable in equation (4). The estimated results of the relevant coefficients are as follows:

We continue performing the Wald test with the CS variable coefficients and also the interaction variable (CS * NDA). This result demonstrates that during the period of the global financial crisis, the impact of NDA on NFA was more than in the period without the global financial crisis, indicating that the global financial crisis has increased the impact of NDA on NFA. Therefore, it affects the offset coefficient and the SBV’s sterilization coefficient.

### Table 3: Estimation Results of the Offset Coefficient with the Interaction Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \text{NDA}$</td>
<td>-0.755***</td>
<td>0.004</td>
</tr>
<tr>
<td>CS</td>
<td>0.031**</td>
<td>0.012</td>
</tr>
<tr>
<td>CS* NDA</td>
<td>-0.323**</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note: (***) : Significance at 1%; (**) : Significance at 5%; (*) : Significance at 10%

### 5. Conclusions and Policy Implications

When we consider the effectiveness of sterilization in Vietnam in the context of a dollarized economy from Q1/2004 to Q4/2018, we observe that there has been an improvement in the effectiveness of sterilization over this time period. However, the SBV has not been able to neutralize fully the spillover effects on the domestic money supply through its interventions in the foreign exchange market. The analysis of our modeling would suggest that the lack of autonomy of the SBV in its conduct of monetary policy is an important contributing factor in explaining only limited success in the SBV’s sterilization policies. As noted above, the SBV is subject to government control. In addition, the very high offset ratio indicates that the SBV has not been successful in controlling capital inflows with monetary policy instruments. In particular, when the world economy is in crisis, the ability of SBV to control capital inflows and outflows has been adversely affected, causing these capital flows to fluctuate greatly due to changes in domestic monetary conditions. During the time period under consideration, the dollarization rate decreased continuously, which proves that the anti-dollarization process being pursued by the SBV has shown some positive results. When dollarization decreased, the international reserves of the SBV increased, and without appropriate neutralizing intervention, this impacts on the domestic money supply.

Looking towards the future, in order to be more effective in sterilization, we would recommend that the SBV should take the following measures: First, the SBV needs to coordinate the implementation of a more flexible combination of monetary policy instruments, extending beyond open market operations. These may include measures such as supplying refinance rate, exercising more direct influence on interest rates, prudential regulations and guidelines relating to reserve (and other assets) ratio requirements, and the wider usage of instruments such as swap operations. Second, the SBV should have greater autonomy in the formulation and implementation of monetary policy. Many countries’ governments give their monetary authorities higher independence and transparency to achieve the monetary policy’s goal (Nurbayev, 2015). Third, the SBV should increase its focus on analyzing and forecasting market fluctuations, so that appropriate policy responses can be developed proactively in the event of adverse developments in the global economy.

### References


