Namibian Foreign Exchange Market: The Degree of Sterilisation

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ABSTRACT— *This paper examines the size of the degree of sterilization in Namibia. The study uses the ordinary least squares method to estimate the regression based on monthly data covering the period 2000:01 to 2013:03. The variables, net foreign assets and money supply were use in the OLS estimation. The results of this study show an almost near full sterilization with the value of 0.211. This suggests that monetary authorities do intervene in the foreign exchange markets to correct for the deviations in money stock, as this is important for monetary policy actions.*

Keywords— sterilization, foreign exchange, net foreign assets, money supply, ordinary least squares, Namibia

1. INTRODUCTION

Sterilization can be defined as a process by which monetary authorities warrant that foreign exchange interventions do not affect the domestic monetary base (Qayyum and Khan, 2003). It is generally known that monetary base is one component of the overall money supply. Usually, foreign exchange market intervention takes a form of government trying to influence the value of the currency on the foreign exchange market either by selling or purchasing domestic currency in exchange for a foreign currency. There are two possibilities. In an event where monetary authority sells domestic currency that was not previously in circulation, the intervention will expand the domestic money base. Likewise, in an event where monetary authority purchases more of its domestic currency and takes the receipts out of circulation, the intervention will have a contractionary effect on the domestic money base (Isberg and Petursson, 2003).

Neely (2000) argue that sterilized intervention operations involve domestic asset transactions that restore the monetary base to its original size. For example, a nonsterilized sale of foreign currency on the open market operations results in a reduction in the central bank's net foreign assets (NFA) and a contraction of the domestic monetary base (MB). Similarly, purchasing of a foreign currency results in an increase in the central bank's NFA and an expansion of the MB. This operation can be sterilized, or neutralized, by an offsetting purchase of domestic currency that increases the central bank's net domestic assets (NDA) and returns the monetary base to its original level. Alternatively, by an offsetting selling of domestic currency that reduces the central bank's NDA and returns the MB to its original level (Bofinger, 2011; Islam, 2009 and Dominguez, undated).

The process of sterilization in developing countries is a challenge to monetary authority to fully offset the effects of a change in net foreign assets. It is due to the fact that financial markets in these countries are less developed. Hence, the ability to sterilize may be inhibited by the size and depth of the domestic bond market (Islam, 2009). Obstfeld (1982) further argue that monetary authorities may not be able to sterilize intervention operations in fixed exchange rate systems with some degree of capital mobility. For example, selling of domestic currency assets will attract a capital inflow, "forcing the authorities to buy more foreign assets in order to maintain the fixed value of the currency, thereby offsetting any attempt to sterilize the original open-market asset sale". It is in the context of the above that this subject become of interest to Namibia since it operates under a fixed exchange rate regime. Hence, there is a need to empirically ascertain the degree of sterilization. The article is organized as follows: the next section presents a literature review. Section 3 discusses the methodology. The empirical analysis and results are presented in section 4. Section 5 concludes the study.

2. LITERATURE REVIEW

2.1 Theoretical Literature

Given that the impact of sterilized intervention on monetary base which is a component of domestic money supply is neutralised, the question arises as to how sterilized intervention can affect exchange rates. Theoretical propositions postulate that sterilization is capable to move exchange rates through various channels. In addition, the purpose of

sterilization may not be purely to stabilize exchange rate but also to reduce its impacts of volatile exchange rates on price level as it is the case in developing countries. Finger and Reitz (2012) identified three channels as discussed below.

First, the portfolio-balance channel hypothesize that interventions by the monetary authorities (MA) alter the relative demand and supply of imperfectly substitutable foreign and domestic assets. However, if domestic and foreign assets are not viewed as perfect substitutes, investors will not re-arrange or rebalance their portfolios. They will opt to absorb the change with no effect on the exchange rate (King, 2002). Obstfeld and Rogoff (1996) argued that imperfect substitution between domestic and foreign securities is not a sufficient condition for sterilized interventions to affect exchange rates. They alluded to the fact that the central bank balance sheet is part of the overall government balance sheet. For instance, an upsurge in the central bank's holdings of domestic assets ensuing from sterilized interventions implies a reduction in public sector debt, leading to a lower expected tax burden in the future, assuming that government spending remains unchanged. With this in mind of the economic agents, the domestic currency need not depreciate despite the increase in private agent's holdings of domestic assets, since their net future tax burden will decrease correspondingly (Isberg and Petursson, 2003). This channel is regarded as a representation of direct effect since it is assumed that investors change their holdings of domestic and foreign assets in response to sterilized intervention.

Second, a potential channel through which sterilized purchases and sales of foreign currencies by the MA may influence market expectations and the exchange rate has been considered by Mussa (1981). The signaling channel hypothesize that sterilized interventions by the MA provides new information to the market by signalling future changes in the monetary policy (King, 2002). For example the MA will "announce" a monetary contraction in the future when selling foreign currency (equivalent to buying domestic currency) or monetary expansion when buying foreign currency (equivalent to selling domestic currency) (Vitale, 1998). Such an action is more credible in a sense that the central bank will incur a net loss if selling of foreign currency is accompanied by a monetary expansion instead and the opposite applies. Hence, for exchange rate to remain unchanged central bank affirm its announcement with actions geared towards its announcements.

Third, the coordination channel which leans more towards real-world market perspective. Sarno and Taylor (2001) proposed an additional channel of influence, the coordination channel which postulates that the MA interventions are merely regarded as resolving a coordination failure in the foreign exchange market. This is due to the fact that there are obviously prevalence of non-fundamental influences in the foreign exchange market such as (backward looking) technical analysis. Furthermore, there may be times in which the exchange rate moves strongly and persistently away from its long-run equilibrium (Seerattan, 2006). It is against this background that in circumstances like these, traders who do not observe this reversion might lose confidence and therefore leave the market. Hence, the MA intervention could restore this confidence and therefore facilitate and increase the speed of adjustment towards the long-run equilibrium state. The effect of the coordination channel is also dictated by the size of the misalignment, because only if the misalignment is strong the confidence should be affected.

2.2 Empirical Literature

In general there are quite a number of studies that have looked at sterilization but there are few that have explicitly estimated the degree of sterilization. Since the subject of this study is on the degree of sterilization the focus of the empirical literature will be geared in that direction.

In Turkey, Altinkemer (1998) estimated the sterilisation coefficient, by dividing the estimation period into two sub-periods, February 1990-October 1993 and April 1994-June 1998. Using OLS technique, the sterilisation coefficient was found to be 1.04 and 0.93 for the first and second periods respectively. Another study on the same subject is by Celasun and Denizer (1999) who computed the sterilisation coefficients based on the methodology of Cumby and Obstfeld (1983). They estimated NDA by using 2SLS for the period February 1990 to June 1996. The sterilisation coefficient was found as –0.37, which indicated partial sterilisation of 37 percent of reserve inflows.

In Pakistan, Jah, Elahi and Zahid (2005) used monthly data for period of July 2000 to December 2003. OLS method was used. However, other techniques such as unit root tests, stability tests were also applied to check the robustness of estimated models, while residual tests were used for analysing white noise properties of the estimated coefficients. The sterilisation coefficient was estimated as –0.87 which, indicates that 87 percent increase in NFA, was effectively sterilised.

In China, Wu (2006) performed a Johansen cointergration test on changes in NFA and NDA. The results revealed that the coefficient of NDA in response to one unit change in NFA is -0.41. This is called the sterilization coefficient and a coefficient of -1 implies complete sterilization, since a unit increase in NFA is then fully offset by a contemporaneous decrease in NDA. A coefficient of 0, on the other hand, indicates zero sterilization. In the case of Wu, the result implies incomplete sterilization.

Ouyang, Rajan and Willett (2007) also estimated a sterilization coefficient for the period of 1999 to 2005 in China. A two-stage least squares (2SLS) was employed to estimate two simultaneous equations. The estimated sterilization coefficient ranged from -0.5 to -0.92, which implies a close to full sterilization.

Aizenman and Glick (2008) applied simple ordinary least squares (OLS) on quarterly data for the period 2000 – 2006 in China. The sterilization coefficients is ranging from -0.6 to -1.4 during the period of 2000 and 2006, implying some degree of sterilization (or over-sterilization since the coefficient is smaller than -1). The magnitude of sterilization increased after the second quarter of 2002.

Zhang (2010) studied the degree of sterilization and capital mobility in China. This paper adapts a 2SLS method to estimate the extent of China's sterilization using quarterly data from 1995 to 2010. The results suggest a sterilization coefficient between -0.8 and -0.9 and an offset coefficient of around -0.6.

Having reviewed a selection of empirical literature on the estimations of the degree of sterilization in other countries, it is now appropriate to explore existing findings on this subject in Namibia. It appears that there seem to be no study that comes closer to this topic in Namibia. Hence, this calls for a specific study on this matter. Secondly, these studies used a narrow index of sterilization. On the contrary, the study uses the broader measure of sterilization index. This study intends to fill that gap.

3. METHODOLOGY

3.1 Econometric Framework and Model Specification

In ascertaining the degree of sterilization in Namibia, this study adapt the model used by Islam (2009) as suggested by The World Economic Outlook of International Monetary Fund. Specifically, this study uses the OLS. The basic equation for estimating the degree of sterilization can be specified as:

$$\Delta M2_t = \alpha_0 + \alpha_1 \Delta NFA_t + \varepsilon_t$$

…1

Where $M2_t$ represents money supply, NFA_t represents net foreign assets and ε_t represents the error term. The coefficient α_1 measures the degree of sterilization measures how money supply responds to a change in net foreign assets in the long run. α_1 takes a value of 0 indicate full monetary sterilization while a value equal to 1 implies no sterilization at all. This is a broader measure of sterilization index reflects the central bank's effort to prevent an increase in the monetary base from causing an expansion of the money supply. Generally, this occurs through an increase in the reserve requirements for the banking sector, which in turn reduces the money multiplier.

Equation (1) may be estimated using the OLS to obtain the sterilization coefficient. However, it is not automatic, since most macroeconomic data are trended and they are potentially non-stationary. Granger and Newbold (1974), has established that regression analysis from non-stationary variables yield spurious (nonsensical) results. Hence, the first step is to investigate the unit root properties of the variables in question. This suggests that the econometric technique to be used for estimating Equation (1) will be dictated by the properties of time series data. There are numerous tests for unit root namely, tests devised by Augmented Dickey - Fuller (ADF), Philips and Peron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) etc.

If it is established that the series are stationary at levels, Equation 1 will be estimated using Ordinary Least Squares (OLS) technique. But should the series be found non stationary at level, but stationary at first difference, the test of cointegration will be conducted to establish whether or not the pair of the series is cointegrated. If the pair of the first differenced stationary series is not cointegrated, then Equation (1) will be estimated with the first differenced series to avoid the problem of spurious regression.

3.2 Data and Data Sources

This study used monthly time-series data covering the period 2000:01-2013:03. The variables included are money supply and net foreign assets. The data series were obtained from various issues of Bank of Namibia's Quarterly Bulletins and Annual Reports.

4. EMPIRICAL ANALYSIS AND RESULTS

4.1 Unit Root Tests

Testing for unit root is done using the following tests namely, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The results of the unit root test in levels are presented in Table 1. The results show that the series were found to be non-stationary in level form. However, the series became stationary after differencing the data once, meaning the series are integrated of order 1.

Table 1: Unit root tests: ADF and PP in levels and first difference

Variable	Model Specification	ADF Levels	PP Levels	ADF First Difference	PP First Difference	Order of Integration
M2	Intercept and trend	-2.38	-2.96	-6.93**	-14.47**	1
	Intercept	-0.28	-0.29	-6.95**	-14.52**	1
NFA	Intercept and trend	-2.04	-2.10	-4.81**	-16.38**	1
	Intercept	-2.05	-2.22	-4.50**	-15.07**	1

Source:author's compilation and values obtained from Eviews
*Notes:(a) ** means the rejection of the null hypothesis at 5%*

Table 1 shows the results of the unit root test. Both the ADF and PP tests show that the series are non-stationary in level form. After differencing data the unit root test shows that the series became stationary and integrated of integrated of order 1.

At the initial stage of the ARDL procedure, a number of lags on each first differenced variable in equation (3) have to be imposed and carry out F-test. The results depend on the choice of the lag length (Budha, 2012). This is dictated by the Akaike's and Schwarz's Baysian Information Criteria. Furthermore, the Langrange Multiplier (LM) test has been used to test the serial correlation in residuals.

4.2 Testing for Cointegration

Table 2 presents the results for the Johansen cointegration test based on trace and maximum eigen value test statistics. The results for both the maximum eigen values and trace test statistic reveals that there is at least one cointegration equation.

Table 2: Johansen Cointegration Test Based on Trace and Maximum Eigen Values of the Stochastic Matrix

Maximum Eigen Test				Trace Test			
H₀: rank = r	Hₐ: rank = r	Statistic	95% Critical Value	H₀: rank = r	Hₐ: rank = r	Statistic	95% Critical Value
r = 0	r =1	5.82	14.26	r = 0	r >=1	8.70	15.49
r <=1	r = 2	2.88	3.84	r <= 1	r >= 2	2.88	3.84

Source: Author's compilation using Eviews.
Note: Both Trace and Maximum Eigen values tests indicate no cointegrating equations at the 0.05 level.

Table 2 above show the results for the Johansen cointegration test. Both the Trace test and Maximum Eigen values test show that there is no cointegration among the variables. Hence, there exists no long run relationship between these variables. These results were also confirmed by the Engle-Granger approach.

4.3 Regression Results and Discussions

In the absence of cointegration, the next procedure carried out is that of estimating equation (1) in first difference despite the fact that the pair of the first differenced are stationary. The results yielded this function :

$$\Delta M2_t = 0.009936 + 0.211279 \Delta NFA_t + \varepsilon_t \qquad \dots 2$$

The resulting function estimated shows that the coefficient 0.21 measures the degree of sterilization. That is, how money supply responds to a change in net foreign assets in the long run. Since this value is almost near 0 it suggest almost near full monetary sterilization.

It should be noted that this is a broader measure of sterilization index that reflects the central bank's effort to prevent an increase in the monetary base from causing an expansion of the money supply. For a country such as Namibia monetary policy had to be implemented in order to maintain the pegged exchange rate. For that reason the money stock growth rate in Namibia had to be maintained at a similar growth rate as in South Africa (SA) (BON, 1996:21-23). Namibian authorities are then required to correct the money stock growth rate if there is deviation so as to support the harmonization of monetary policy of the two countries. However, it should be acknowledged that money stock is influenced by various factors, including open market operations of the central bank and financial flows into and out of the country. Monetary policy is precisely about how the central bank responds to these financial flows through its open market operations in order to achieve the money stock that its policy objective requires. Hence, a high correlation of money stock growth between the two countries would therefore suggest that the Namibian monetary authorities have conducted their open market operations in such a manner that the net effect on the growth of the money stock of Namibia would be for it to grow at more or less the same rate as the SA money stock.

5. CONCLUSIONS

This study looked at the degree of sterilization in Namibia. This was done in order to establish whether monetary authorities do intervene in the foreign exchange markets to correct for the deviations in money stock, as this is important for monetary policy actions. The variables, net foreign assets and money supply were use in the OLS estimation. The results of this study show an almost near full sterilization with the value of 0.211. This is attributed to the fact that Namibia practices fixed exchange rate and that for the sake monetary policy harmonization, monetary authorities in Namibia are compelled to keep money stock in check. Monetary policy is precisely about how the central bank responds to these financial flows through its open market operations in order to achieve the money stock that its policy objective requires.

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