

## UNDERSTANDING MONETARY POLICY OF BAHRAIN

*Bassim Shebeb\* and Ashraf Nakibullah\*\**

**Abstract:** Bahrain has maintained *de facto* fixed exchange rates against the US dollar from the beginning of 1980 and made it officially fixed (*de jure*) from 2003. It has unrestricted capital movements. These two conditions restrict independent monetary policy or independent nominal interest rates policy. However, the goal of the Central Bank of Bahrain (CBB) has been to maintain stable domestic prices. Empirical results for the period 1991:1 – 2013:4 show that the CBB has been using sterilized foreign exchange intervention to attain the goal of price stability.

**Key Words:** Trilemma, sterilization, 3SLS, rolling recursive regression

**JEL Classification:** E52, E58, F41.

### 1. INTRODUCTION

In a series of papers Obstfeld *et al.* (2004, 2005, and 2010), writing on international reserves, (fixed) exchange rates, capital mobility, and monetary sovereignty, have emphasized on Trilemma. According to the Trilemma a country can choose at *most two* elements of the Trilemma: free capital movements, a fixed exchange rate, and an independent monetary policy (Obstfeld *et al.*, 2004, 2005, and 2010). Bahrain has continuously maintained tightly fixed exchange rates against the US dollar, first unofficially (*de facto*) and then officially (*de jure*) from 2003. The country has no restriction on capital movements. This means Bahrain, being a tiny country with free capital movements and tightly fixed exchange rates, seems to present an example of the Trilemma.

These conditions certainly restrict the Central Bank of Bahrain (CBB) to conduct an independent monetary policy. An independent monetary policy here would be interpreted as an ability to set its own nominal interest rates (Frankel *et al.*, 2004). The stated goal of the CBB has been to maintain stable domestic prices. Given the restriction on independent monetary policy, macroeconomic management of Bahrain, like other GCC countries<sup>1</sup>, is to achieve a balance between price stability and economic growth (Espinoza and Prasad, 2012).

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\* Dean - Faculty of Business Studies, Arab Open University, E-mail: bshebeb@yahoo.com

\*\* Faculty of Business Studies, Arab Open University, Kuwait

The objective of the paper is to evaluate empirically the CBB's monetary policy goal of price stability. Empirical results for the period 1991:1 – 2013:4 show that the CBB has been using sterilized foreign exchange intervention to attain price stability. Like other GCC countries all economic activities of Bahrain are evolved around the hydrocarbon (oil) sector. The world oil price is the main determinant of foreign reserves of Bahrain and the rise in oil price is always feared to create inflationary pressure. Thus, like other GCC countries the monetary policy of the CBB is essentially to manage the liquidity that mainly fluctuates with international reserves or capital inflows (Nakibullah, 2011, Espinoza and Prasad, 2012).

The price stability is attained by sterilizing the impact of the international reserves on money supply. However, one must realize the limitation of the policy to impact interest rates given the restriction imposed by the fixed exchange rates and capital mobility. The vital interest rates of Bahrain are expected to converge quickly to the corresponding interests of the USA. However, we find that interest rates of Bahrain follow the corresponding interests of the USA but are not equalized and diverged more during the recent episode of higher inflation experienced in the GCC countries including Bahrain.<sup>2</sup>

Recent papers have analyzed the sterilization policy undertaken by many countries of the world (Aizenman and Glick, 2009 and Ouyang *et al.*, 2010). Nakibullah (2011) and Hassan *et al.* (2013) presents evidence of partial and full sterilization by the GCC countries. Hassan *et al.* (2013), using single equation seeming unrelated regression (SUR), found that the point estimates of the sterilization differ for most of the GCC countries whether the sample period ends in 2006:1 or 2008:3 (the last observation used in their paper). This means they failed to trace out the dynamic path of the sterilization coefficient, especially for the turbulent period of the world oil price hike that culminated in 2007 – 2008. Nakibullah (2011) has used a simultaneous equations system and used the sample period 1992:1 – 2009:3. This paper extends the sample period to 1991:1 – 2013:4 to see how monetary policy goal of a representative GCC country has been maintained. Bahrain is chosen because quarterly data are easily available for Bahrain. Moreover, this paper uses a single equation and a different specification to see whether results obtained in Nakibullah (2011) are replicated.

The rest of the paper is organized as follows. Section 2 provides background information about Bahrain discussing how price level, exchange rates and interest rates are evolved. Section 3 discusses sterilization issues relevant to Bahrain and presents empirical evidence of sterilized intervention for the period 1991:1-2013:4. It also traces the dynamic path of the sterilization coefficient. Section 4 concludes the paper.

## 2. EXCHANGE RATES, INTEREST RATES AND THE PRICE LEVEL

The currency of Bahrain (Bahrain dinar, BD) from the beginning of 1980 was officially pegged to the SDR basket but was *de facto* pegged to the US dollar. From 2003 Bahrain has formally pegged its currency to the US dollar. Because of the fixed exchange rates against the US dollar and free capital movements, the Bahraini interest rates have basically shadowed the US dollar interest rates. The CBB's interest rate policy in the 1980s was to set a recommended maximum interest rate for the Bahraini Dinar customer. Recognizing the negative effects of such an interest rate policy, the CBB abandoned the ceiling rate policy on June 1990. In abandoning the ceiling rate, the CBB declared that the policy was not very conducive to encouraging domestic saving and it did not discourage outflow of capital. From the third quarter of 1990, the CBB did not impose any ceilings on interest rate. Thus, the sample period of this study starts from the first quarter of 1991.

In a world of perfect capital mobility with domestic and foreign assets are perfect substitutes (equally desirable), no risk of any sorts, and no differences in liquidity, the (uncovered) interest parity condition would hold and the condition can approximately be written as:

$$R \approx R^* + \hat{e} \quad (1)$$

where  $R$  is the domestic nominal interest rate and  $R^*$  is the foreign nominal interest rate,  $\hat{e} = (E^e - E)/E$ , is the expected change of the exchange rate over the holding period, where  $E$  is the nominal exchange rate (home currency units per unit of foreign currency) at the end of the period. In case of Bahrain  $E = \text{BD}0.377$  per US dollar and remained fixed since the beginning of 1980s. Then for Bahrain, with no restriction on capital movement, the term  $\hat{e}$  in equation (1) is zero and the interest rate differential ( $dR$ ) between Bahrain ( $R$ ) and the US ( $R^*$ ) is expected to be zero:

$$dR_t \equiv R_t - R_t^*.$$

To see the trend of the interest rates differentials  $dR_t$ , we have consider two short-term (annualized) interest rates of federal funds rates and three-month Treasury bills rates. We have considered these two rates because they are readily available in both countries and they are comparable. The federal funds rate, the overnight inter-bank interest rates on bank reserve loans, is one of the three main instruments of a monetary policy. That is, it is the primary indicator of the stance of monetary policy. It is known as the money market or call rate in Bahrain. The money market rates as well as the Treasury bills rate are indicators of general interest rate movements. However, market participants watch the money market rates more closely because it affects interest rates throughout the economy.

Figure 1 plots the quarterly series of money market rates (Bahrain) and the US federal funds rates (left axis) and their differentials (right axis). Figure 2 plots the

quarterly series of treasury bills rates of Bahrain and the USA (left axis) and their differentials  $dR_t$  (right axis). Figures 1 and 2 show both interest rates of Bahrain had consistently been higher than the comparable US interest rates. Throughout the sample period large discrepancies remain for both nominal interest rates. Sometimes (especially the second half of the last decade) interest rates differentials were more than 250 basis points (for treasury bills) and 350 basis points (for money market rates). We may also mention that the discrepancies are even larger for prime rates (or lending rates) of Bahrain and the USA (not shown here). The prime rates represent cost of business borrowing from banks. For most of the sample period the prime rates differentials were more than 400 basis points. This means the pass-

Figure 1: Money Market Rates and their Differentials

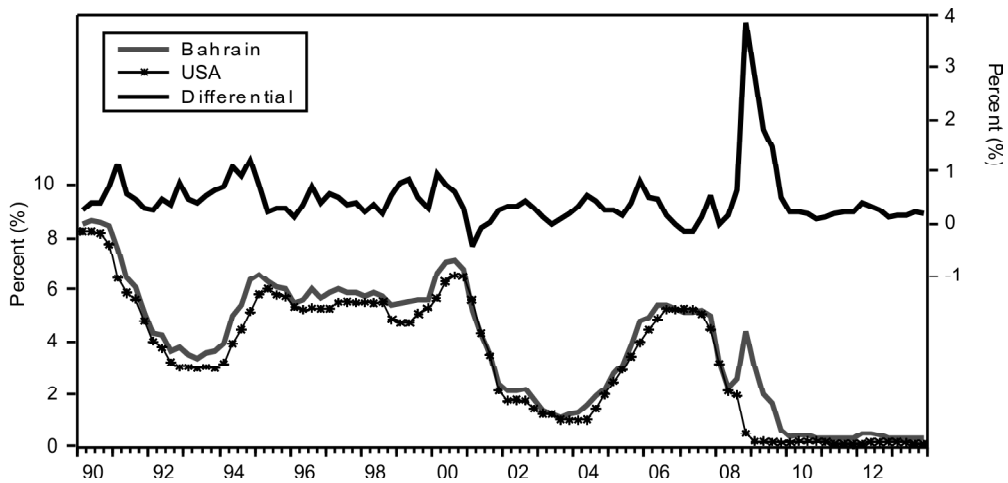
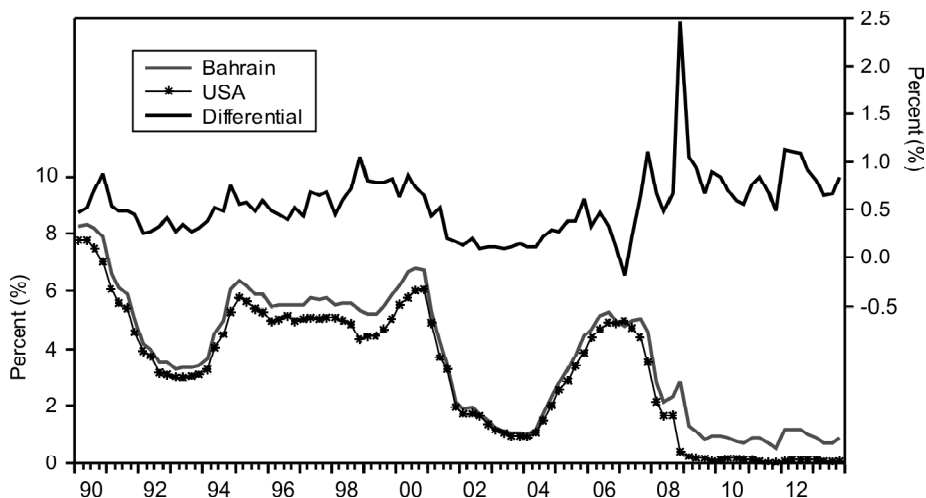


Figure 2: Treasury Bills and their Differentials



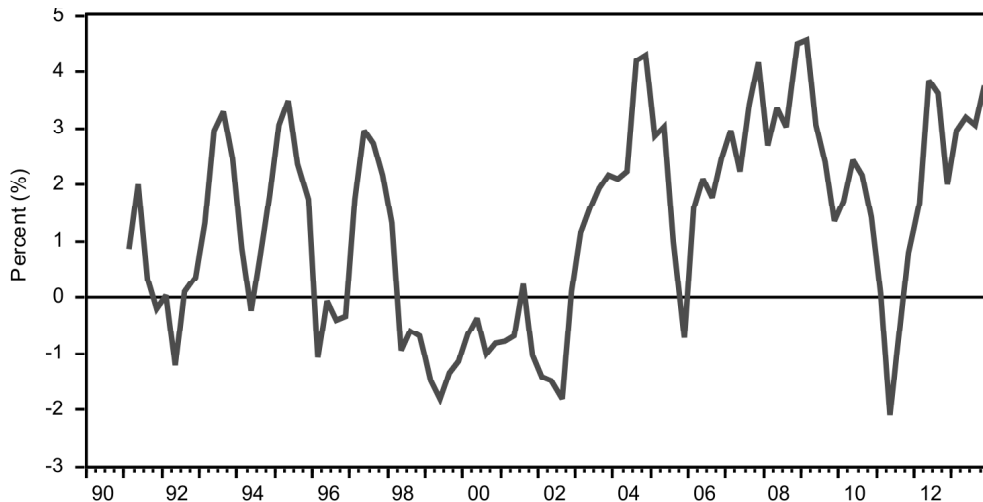
through of changes in the money market rates to local deposits and lending rates is less than complete (Espinoza and Prasad, 2012).

This causal observation indicates the existence of obstacles to the movements of funds (not perfect substitutes) between Bahrain and the US, even though there are no official restrictions on capital movements. This means interest rates differentials can be written as  $dR_t = \rho_t > 0$ , where  $\rho_t$  represents country and other risks and liquidity differences. This allows the CBB to sterilize the impact of capital flows on monetary base.<sup>3</sup>

We may also relate the monetary policy is consistent with its goal of price stability. Bahrain economy started to heat up from 2006 when oil price started to increase and reached its unprecedented high at the end of 2008. Along inflation of other GCC countries, inflation of Bahrain started to increase (figure 3) and reached its highest level during the end of 2008 and early 2009. The GCC countries including Bahrain (figure 3) experienced higher inflation in the last decade when the average inflation for the region increased from 1.5 percent in 2003 to about 7 percent in 2007 during which the US dollar depreciated about 40 percent against the major currencies of the world. The dollar depreciation during this period was blamed for the imported inflation in the GCC countries and questioned the fixed exchange rates system. However, empirical evidence show that the claim of imported inflation is a bit exaggeration, especially for Bahrain (Hasan and Alogeel, 2008, Kandil and Morsy, 2009, and Hasan and Nakibullah, 2014).

We have seen from figures 1 and 2 that interest rates differentials were the highest during this period. This means the CBB used interest rates to control the inflation during this period. This implies, even for a tiny country like Bahrain, its

Figure 3: Inflation Rates of Bahrain



central bank retains some monetary independence which seems impossible according to the Trilemma.

### 3. LIQUIDITY MANAGEMENT AS MONETARY PERFORMANCE

The monetary policy goal of the CBB, as mentioned above, is to maintain price stability and coordinate other macroeconomic policy objectives so that a balance between price stability and economic growth is attained. This goal is equivalent to manage the liquidity that mainly fluctuates with international reserves. The liquidity, in turn, is managed by sterilizing the impact of the international reserves on monetary base. To see how it works we look at the balance sheet of the CBB presented in table 1. Let us define net foreign assets (NFA) as  $NFA \equiv FA - FL$  and

**Table 2**  
**The Balance of the Central Bank of Bahrain (CBB)**

<i>Assets</i>	<i>Liabilities and equity</i>
Foreign Assets (FA)	Monetary Base (MB)
Domestic Assets (DA)	Time and saving Deposits (TS)
Claims on Central Government	Central Government Deposits (GS)
Claims on Banking Institutions	Foreign Liabilities (FL)
	Capital Accounts (K)
	Other (Net)

*Source:* International Financial Statistics (IMF)

domestic credit (DC) as domestic assets (DA) net all other items on the liabilities and equity side except monetary base (MB). This means the balance sheet can be summarized as:

$$MB = DC + NFA. \quad (2)$$

Equation (2) shows how the CBB can manage the MB following external shocks that affect NFA. Suppose NFA increases, say, due to a positive oil price shock. Given DC, this will increase MB that may feed into higher price level. To prevent this, the CBB can change (decrease) DC so that the impact on MB is neutralized (or sterilized). In case of full sterilization, monetary base will be unchanged ( $\Delta MB = 0$ ) which means an increase in NFA will be followed by an equal decrease in DC ( $\Delta NFA = -\Delta DC$ ). A partial sterilization would result in a non-zero change in monetary base.

The balance sheet in table 1 indicates how the CBB can manage the MB by changing the components of DC so that the undesirable impact of NFA on MB and price is avoidable. Nakibullah (2011) has pointed out the CBB uses more varied indirect monetary instruments compared to other GCC countries. Among the instruments are open market operations using government development bonds

and treasury bills and the certificate of deposits on the liability side of its balance sheet. The CBB has also been using the foreign exchange swap operations and repos with the commercial banks to manage short-term liquidity (Nakibullah, 2011).

### 3.1. Empirical Specification of Sterilization

Empirically three different approaches have been used to estimate the extent of sterilization. Ouyang *et al.* (2010) summarizes these three approaches. First approach estimates a single equation reaction function of a central bank where NFA is treated as an exogenous variable (see, for example, Aizenman and Glick, 2009, among others). The second approach uses the vector autoregression (VAR) models to estimate the lagged effects of net domestic assets (NDAs) which is equivalent to DCs in our specification and NFAs (see, for example, Cavoli and Rajan, 2006).<sup>4</sup> A third approach uses simultaneous equations system using two equations for NDAs and NFAs (see, for example Ouyang *et al.*, 2010 and Nakibullah, 2011).

Nakibullah (2011) has used the third approach of simultaneous equations system involving NDAs and NFAs to estimate the sterilization coefficients (related to NDAs) and offsetting coefficients (related to NFAs) for the GCC countries. In this paper we have used the first approach of single equation. This is motivated by the following reasons. We extend the sample period that ends in 2013:4 (compared to 2009:3 in Nakibullah, 2011). More importantly, we would like to compare results obtained using a single equation and a simultaneous equations system. Our results in his paper (especially for the sterilization coefficient) do not differ whether a single equation or a simultaneous equations system is used. It is clear from equation (2) that we may specify a reaction function of a central bank, consistent with the workings of the banking system as whole, as follows:

$$\Delta DC_t = \alpha_1 \Delta NFA_t + \alpha_2 \Delta mm_t + B'Z + u_t \quad (3)$$

where  $mm_t$  is M2 money multiplier and the variable  $Z$  may include both contemporaneous and lagged variables that may be relevant to policy makers. Equation (2) shows that change in DC is negatively related to changes in NFA. The coefficient of  $\Delta NFA$  ( $\alpha_1$ ) measures the extent of sterilization; it can take any value between 0 and -1 ( $-1 \leq \alpha_1 \leq 0$ ). When  $\alpha_1 = 0$ , we have a case of no sterilization means changes in foreign reserves are allowed to feed into MB as in the case of a closed economy open market operations. On the other hand when  $\alpha_1 = -1$ , we have a case full sterilization, that is, the impact of the changes in NFA are completely neutralized. The partial sterilization may also occur when  $-1 < \alpha_1 < 0$ .

The sign of the coefficient of  $\Delta mm_t$  is expected to be negative ( $\alpha_2 < 0$ ). An increase in the money multiplier would induce a decrease in the monetary base so that the overall money supply growth is stabilized. It is customary to include policy

variables such as output gap and inflation rate in  $Z$  (see, for example, Aizenman and Glick, 2009, Ouyang *et al.*, 2010, among others). However, as mentioned above, stabilizing business cycles is not relevant for the CBB. Moreover, quarterly data for Bahrain GDP are not available, so we have avoided GDP gap. We have included inflation rates in  $Z$ .

Quarterly data for the period 199:1 – 2013:4 are taken from the publications of the CBB and the International Financial Statistics. Following Ouyang *et al.* (2010) and Nakibullah (2011), we define  $\Delta DC_t \equiv (DC_t - DC_{t-4}) / MB_{t-4}$ ,  $\Delta mm_t \equiv \ln(mm_t / mm_{t-4})$ , and  $\Delta NFA_t = (NFA_t - NFA_{t-4}) / MB_{t-4}$ . Inflation rate, included in  $Z$ , is calculated as  $\pi_t \equiv 100 * \ln(P_t / P_{t-4})$ , where  $P_t$  is the quarterly CPI of Bahrain. Results are reported with inflation rate and lagged inflation rate ( $\pi_{t-1}$ ).

Following New Zealand in 1990 many central banks around the world have recently adopted inflation targeting. It is a strategy of announced commitment to achieve the targeted inflation rate by the central banks (see, for example, Svensson, 2007). Obviously, it is strategy of a central bank to achieve price stability. Given its success around the world in achieving price stability, many other central banks may have been practicing it without announcing it formally. The CBB may have followed an implicit inflation targeting policy. One way to test this is to include an inflation differential variable defined  $(\pi_t - \pi_t^*)$  where  $\pi_t^*$  is the targeted inflation rate. We have used linear trend inflation as a measure of targeted inflation  $\pi_t^*$ . One would expect that the coefficient of the inflation differential to be negative. This is because if the actual inflation rate above the targeted inflation, domestic credit to be reduced to bring the inflation rate back to its targeted level.

In estimating equation (4), a constant and three quarterly dummies were also included in  $Z$ . However, none of the quarterly dummy variables was found to be significant and were dropped. There is one important estimation issue. The net foreign asset (NFA) can also be sensitive to a central bank's domestic credit policies, that is, the NFA can itself be endogenous which is evident from equation (2) which summarizes the balance sheet of the central bank. Note that changes in DC would change domestic interest rates. Changes in interest rates, in turn, would change capital flows and NFA. This means NFA is an endogenous variable. In this case estimating equation (3) by the ordinary least squares (OLS) would produce inconsistent estimates because the error term ( $u$ ) will be correlated with the NFA variable. To avoid this problem we have estimated equation (3) using the most efficient estimator, namely, the three-stage least squares (3SLS) rather than the two-stage least squares (2SLS) method. Note that the 3SLS is an appropriate technique not only when the right-hand side variables are correlated with the error term but also when there are heteroskedasticity and autocorrelation in the residuals.



**Point Estimation Results**

Three autoregressive (AR) terms are included to correct serial correlation problems because initial estimates show the presence of contemporaneous correlation in the residuals. The results from estimating equation (3) are reported in table 1. Results are presented with different specifications with no inflation rate, contemporaneous and lagged inflation and the deviation of the HP-trend inflation from the actual inflation rate.

Results presented under model (1) without inflation rate show that changes in net foreign asset ( $\Delta NFA$ ) and money multiplier ( $\Delta mm$ ) explains almost all of the changes in the domestic credit of Bahrain as adjusted  $R^2 (\bar{R}^2)$  is 0.893. Results excluding any inflation rate variable show that the estimated sterilization coefficient is about -1 ( $\hat{\alpha}_1 = -1.0537$ ) and it is highly statistically significant. This results would imply that the CBB has been sterilizing fully its reserve accumulation on monetary base for the sample period 1991: 1 – 2013: 4. Note that the estimated sterilization coefficient remains stable whether inflation rate is included or excluded

**Table 1**  
**Three Stage Least Squares (3SLS) Estimates**

Dependent Variable $\Delta DC_t$	Sample Period 1991:1 – 2013:4			
	(1)	(2)	(3)	(4)
Constant	0.1223 (0.030)**	0.1150 (0.0309)**	0.1161 (0.0304)**	0.1258 (0.0304)**
$\Delta NFA_t$	-1.0537 (0.0555)**	-1.0572 (0.0564)**	-1.0714 (0.0565)**	-1.0699 (0.0558)**
$\Delta mm_t$	-1.1605 (0.0578)**	-1.1618 (0.0588)**	-1.1767 (0.0593)**	-1.1745 (0.0588)**
$\pi_t$	-	0.5613 (0.6608)	-	-
$\pi_{t-1}$	-	-	0.7458 (0.6706)	-
$(\pi_{t-1} - \pi_{t-1}^*)$	-	-	-	0.5893 (0.6942)
AR(1)	1.1547 (0.1009)**	1.1467 (0.1006)**	1.1627 (0.1076)**	1.1715 (0.1072)**
AR(2)	-0.4032 (0.1477)**	-0.3950 (0.1470)**	-0.4025 (0.1546)*	-0.4109 (0.1547)*
AR(3)	0.0342 (0.0995)	0.0263 (0.0994)	0.0122 (0.1015)	0.0213 (0.1010)
	$\bar{R}^2 = 0.8930$	$\bar{R}^2 = 0.8918$	$\bar{R}^2 = 0.8852$	$\bar{R}^2 = 0.8850$
	D-W = 1.949	D-W = 1.944	D-W = 1.999	D-W = 2.002

Note: Standard errors are in parentheses. (\*\*) Significant at more than 1% level and (\*) significant at 5% level.

from the estimation. Money multiplier is another important variable. In all specifications the coefficient of money multiplier has expected negative sign and more importantly they are all highly statistically significant. The estimated value of the money multiplier (little more than -1) indicates that the CBB coordinates the sterilization policy with other policies so that money multiplier is changed to achieve the desirable changes in the domestic credit (in an opposite direction).<sup>5</sup>

Equations were estimated with contemporaneous inflation, lagged inflation and lagged deviation of trend inflation from inflation. Inclusion of lagged inflation is motivated by the results obtained in Hasan and Nakibullah (2014). They find that the lagged price level (or expectations) is one of the main determinants of the price level in the GCC countries. However, neither contemporaneous nor lagged inflation rate influence the money reaction function. Results are reported with lagged inflation and lagged deviation of trend inflation from inflation. The coefficients of inflation rates (current or lagged) are all positive, however, they are all statistically insignificant. This result may not be surprising because sterilization itself is performed to stabilize price level. With full sterilization, there is no further impact of inflation rate when included as a separate right hand variable. Interesting including inflation rate variable reduced the adjusted  $R^2$  marginally.

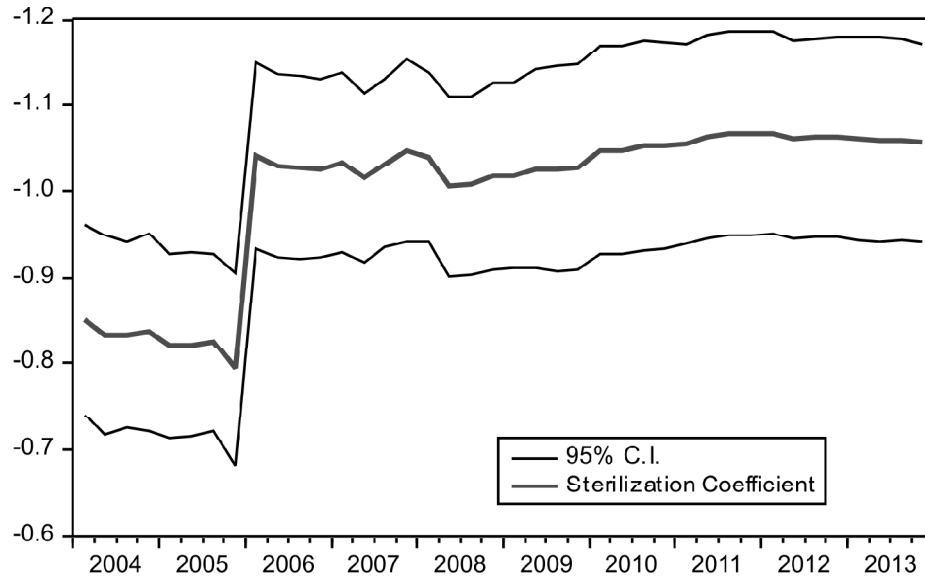
### ***Rolling Regression Results***

Results presented in table 1 are point estimates unable to trace out the dynamic path of the sterilization coefficient. That is, point estimates fail to trace out any behavioral of the CBB, especially, following the recent dollar depreciation and the oil price hikes. The rolling recursive regressions would capture those changes if happened.

We have used specification (1) in table 1 without inflation rate variable for our rolling regression. First, we estimate the equation using 3SLS for the sample period 1991:1 to 2004:1. This mean initial period ended with 2003. Note this is roughly the period when dollar started to depreciate and oil prices started to surge that led to an increase in foreign reserves. Given the sample size, this still preserves the meaningful degrees of freedom. In the recursive estimation one data point is added to the sample and re-running the regression. Thus, the last estimated sterilization coefficient is 1.057.

Rolling regressions results are plotted in figure 4. Figure 4 indicates a behavioral change at the end of 2005 or at the beginning of 2006 when we witnessed an unprecedented rise in oil price. Before 2006 in each quarter little more than 80 percent of the change in foreign exchange reserve was sterilized. Then the sterilization behavior changed from the end of 2005 that corresponded to the time when Bahrain experienced one of the highest inflation rates in recent time (see figure 3). This was the time when the effect of dollar depreciation and oil price

Figure 4: Recursive Sterilization Coefficient, 2004: 1 - 2013: 4



hike were also started to show up. However, the expected inflation and increase in the price levels of the foreign trading partners were the main reasons for that recent higher inflation (Hasan and Nakibullah, 2014). So, the CBB did not want to exacerbate the inflation problem from the monetary side and started to neutralize completely the effect of changes in foreign exchange reserve that increased with the oil price hike. The sterilization coefficient increased to about  $-1$  and remained at that level till end of the sample. This shows that tracking the trend of the sterilization coefficient indeed a fruitful exercise.

#### 4. CONCLUSION

Given that Bahrain maintained a pegged exchange rates and no restrictions on capital mobility, Bahrain cannot set independent monetary policy or its own nominal interest rates.. This paper started with the view that Bahrain, being a tiny country, would be the most likely or ideal country to test the complete loss of monetary independence.

Looking at the short-run nominal interest rates differentials between Bahrain and the US, we find that there exists spread between federal funds rates and treasury bills rates and sometimes spreads are quite substantial. This means assets of these two countries are not equally desirable which allows the CBB to sterilize changes in international reserves to affect monetary base in order to stabilize price level.

Using 3SLS method we estimate the sterilization coefficient for the sample period 1991:1-2013:4. The sterilization coefficient has expected negative sign and

it is highly statistically significant. The estimated sterilization coefficient for the whole sample period is about -1 indicating full sterilization of the effects of net foreign asset on monetary base. We have tested whether such behavior changed over the period 2004: 1 – 2013: 4 during which we witnessed a period when dollar depreciated, hike in oil price, and a world-wide recession. Rolling recursive regression results show that from a little above 80% of sterilization in the mid-2000, CBB has moved to full sterilization.

### Notes

1. The Gulf Cooperation Council (GCC) countries include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.
2. Espinoza and Prasad (2012) report that several GCC countries faced with domestic inflationary pressures did not follow the lower US rates but delayed the reduction in the domestic interest rates though they subsequently came down.
3. Hassan, *et al.* (2013) have discussed how the central bank conduct sterilization by keeping the money market equilibrium and the exchange rate fixed.
4. Ouyang *et al.* (2010) discusses potential advantage against non-trivial disadvantages and concluded that 'the model cannot estimate the contemporary effect of variables without restrictions' (p. 958).
5. From the beginning of forming the CBB (used to known as the Bahrain Monetary Agency) maintained a 5% required reserves (a determinant of the money multiplier) out of total deposits. However, with the latest surge of the international reserves the CBB raised the required reserve to 7 percent from the end of 2006.

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