

# ANALYSING THE EFFECTIVENESS OF MONETARY POLICY IN THE BAHAMAS (1974-2005)

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## *ABSTRACT*

*This paper uses an unrestricted vector auto regression (VAR) approach to analyse the effectiveness of monetary policy in The Bahamas during the period 1974 to 2005. Quarterly trade data are used to proxy the supply and demand sides of the economy. The main findings are that capital and exchange controls allowed monetary policy to have significant success in managing short-run balance of payments trends. Direct credit controls have been the most effective tool for the Central Bank of The Bahamas. Policies appear to work exclusively on the demand side of the economy, often in anticipation of the impact of fiscal and external shocks. There is no significant evidence that monetary policy has any influence on the domestic inflation rate.*

**Keywords:** Bahamas, monetary policy, unrestricted VAR, Caribbean  
JEL Classification Numbers: E52, F32, F41

## 1.0 Introduction and Motivation

This paper uses an unrestricted vector auto regression (VAR) approach to analyze the effectiveness of monetary policy in The Bahamas during the period 1974 to 2005. The Bahamas is a former colony of Britain, having gained its independence in 1973. The Central Bank of The Bahamas was legally established one year later, taking over the policy responsibilities of the Bahamas Monetary Authority which had existed since 1966. The Authority was a transition from a currency commission, modelled after arrangements that existed throughout the British territories.<sup>1</sup> This inherited institutional structure, including a system of exchange controls and a fixed exchange rate, continues to define the monetary policy framework in The Bahamas. Nevertheless, the economy has been more stable than most other Anglophone Caribbean countries, avoiding severe balance of payment crises that led to forced abandonment of fixed exchange rates and the adoption of more liberal capital account polices.<sup>2</sup> The Bahamas benefited from having a narrow, albeit tourism-based, economy in close proximity to the US. This contrasts with the greater (at least initial) dependence on agriculture, manufacturing and minerals in most of the other former colonies of Britain.

While there have been many descriptive accounts of monetary operations in The Bahamas, very few, if any, comprehensive studies have been done to formally quantify the impact of policy on the economy, or to address whether policy has any effectiveness independent of the fiscal and external sectors. Our initial impression is that the Central Bank has tended to react to, as opposed to lead, fiscal and external sector trends and that the sum of these latter two forces dictated the relative balance of payments success of The Bahamas. To frame this analysis, we use a variant of the monetary approach to the balance of payments model for a small open economy, emphasizing the relationships among official foreign reserves, interest rates and inflation, relative to separate trends on the demand and supply sides of the economy. We also draw inferences about

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<sup>1</sup> These accounts are found in Clarke and Dadds (1997).

<sup>2</sup> Jamaica, Guyana, Trinidad and Tobago.

the relative effectiveness of the direct and indirect tools used by the Central Bank.

The main findings are that because of the capital and exchange controls, monetary policy has had significant effectiveness in affecting short-run balance of payments trends in The Bahamas. By far, direct intervention through selective credit controls has been more important than the indirect channels of short-term interest rates. Policies seem to work exclusively on the demand side of the economy, often in anticipation of the impact of fiscal and external shocks on the balance of payments. There is no significant evidence that policy has any effect on the domestic inflation rate, or on the supply side of the economy. The main driving force for inflation is the prevailing rate in the US.

The rest of the paper is organized as follows. Section 2 presents a brief review of the open economy macro-economics literature used to frame the discussion on the effectiveness and appropriateness of monetary regimes such as The Bahamas'. This is followed in Section 3 by a brief description of the Bahamian economy and the monetary policy experience since the 1970s. Section 4 outlines the econometric model and analysis of data, while the results are presented and discussed in Section 5. Section 6 concludes with final comments on the study's finding and identifies some issues for further research.

## **2.0 A Review of the Literature**

Existing theories identify a number of ways through which monetary policy can be effective in the short run in small open economies. In addition to the distinction between whether countries adopt fixed or flexible exchange rates regimes, effectiveness depends on the channels through which policy works, given assumptions about the structure of the economies.

As extended by Dornbush (1976) to include short-run price rigidities, the Mundell-Fleming (IS-LM) framework, with perfect capital mobility, departs from the classical assumption of flexible prices and allows the liquidity effects of monetary policy to have real short-run

effects through the interest rate channel. Building on the micro foundations of new-Keynesian economics Obstfeld and Rogoff's (1995) Redux model replicates these results in an inter-temporal optimization framework, permitting inferences about the welfare implications of monetary and fiscal policies. The perfect capital mobility assumption with fixed exchange rates, however, requires that the link between domestic and foreign interest rates be maintained, leaving monetary policy ineffective in small open economies (Mark 2005). As in the Mundell-Fleming model, the small country Redux results rely on rigidities originating in the non-tradeable goods sector.<sup>3</sup> While fiscal policy is the channel through which effectiveness is achieved, expansionary policies in the short run lead to deterioration in the trade balance (reduced net exports). In both the static and inter-temporal frameworks the main reason this happens is because government spending on non-tradeables drives up average wages and forces profit maximizing price takers in the export sector to reduce their output (Prachowny 1981; Casseli 2001).

Although capital controls can restore the short-run policy effectiveness under fixed exchange rates, very small economies such as those in the Caribbean are also peculiar in that they face foreign exchange constraints that re-introduce limitations on policy (Lewis 1950; Bourne 1989). Such economies have a high dependency on export earnings, which finance imported goods for which limited or no domestic substitutes exist. Alternatively, the production of domestic substitutes uses imported intermediate inputs and takes costs as given. For flexible regimes where inflation can still be an important concern, the exchange rate pass-through in import prices can also limit policy independence, since it gives countries an incentive to maintain stable exchange rates to minimize pass through risks (Calvo and Reinhart 2002).

As regards imperfect capital mobility, recognizing the foreign exchange constraint means that although the risk of official reserve losses may not originate from short-term capital flows, they can arise because of

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<sup>3</sup> As the survey by Fendel (2002) reveals, the imperfect competition outcome in the Redux model can also result from monopoly power among labour unions, which is a very realistic assumption for very small economies.

trade imbalances, when short-run policies are unable to stimulate exports. Treating money as wealth, as in the portfolio balance model of Dornbusch and Fisher (1980), suggests that given short-run price rigidities, boosts in real balances can still stimulate increased consumption on imports and cause deterioration in the current account. This framework therefore can alternatively re-introduce the policy ineffectiveness, which the basic Mundell-Fleming model predicts would occur in the fixed regime when capital is perfectly mobile (Mark 2005).

If scope for policy flexibility is limited under both fixed and flexible exchange rates then other rationales must underline the appropriateness of the exchange rate regimes adopted by very small economies. In some economies support might be advanced on the basis that fixed regimes prevent exchange rate fluctuations from adversely affecting the debt service burden of firms that have a significant overhang of foreign currency liabilities (Choi and Cook 2004). Depreciation-driven increases in debt service costs can reduce profitability, discouraging investments and having a negative effect on growth. Similarly, adherence to fixed exchange rates might permit countries to pursue more gradual and credible capital account liberalization (Flood and Marion 2001; Edwards 2002). In particular, it is theorized that non-credible liberalization can lead to self-fulfilling speculative runs on currencies when investors anticipate future policy reversals by governments to pre-empt crises (Dellas and Stockman 1993). In Stiglitz's (2002) view, this potential exposure to volatile capital flows justifies ongoing maintenance of controls in developing countries, and with them a compatible system of fixed exchange rates. However, his requirement for fixed regimes is more stringent than a 100% hard currency backing for the demand liabilities of the monetary authority—as is the currency board prescription. He also favours having sufficient external assets to cover the regimes' total short-term foreign currency debt. While there is ample evidence that capital controls are relatively ineffective,<sup>4</sup> Stiglitz argues that their more

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<sup>4</sup> For example the studies by Cooper et al. (1999); Edwards (1999); Edwards (2002).

important purpose should be to permit countries to manage short-term adjustments in a gradual, less destabilizing fashion.

Although legitimate concerns about exposure to volatile short-term capital inflows might therefore justify a continuance of fixed regimes in small economies such as The Bahamas, this brief survey of the literature above still discounts the possibility that either monetary or fiscal policies will retain much flexibility in the presence of the foreign exchange constraint. This makes demand management policies of the nature recommended by Polak (1957) and still applied within the financial programming framework of the IMF, the adjustment route that very small economies have to take when encountering negative external shocks. The experience in The Bahamas indicates that this has indeed been the case. Meanwhile, one can draw on the optimal currency framework developed by (Mundell 1961) to rationalize the historical peg of the Bahamian currency to the US dollar, since the economies are closely linked.

### **3.0 The Bahamas' Experience**

Effectively, exchange controls do not equate with more capital controls in The Bahamas. Under the present system there is no evidence of lack of regime credibility as might be inferred from a black market premium on foreign exchange. Purchasing US dollars on the informal market only saves on the commission and Government stamp taxes charged by commercial banks.<sup>5</sup> The exchange control system is typical only in the terms of the surrender requirements for export proceeds. On the current account, the regime serves mainly as a monitoring device, as The Bahamas' obligation under Article VIII of its IMF membership agreement requires that residents have unrestricted access to foreign exchange for current account transactions.<sup>6</sup> For capital transactions, however, residents are severely restricted in their access to external portfolio and direct

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<sup>5</sup> According to a study by the Central Bank of The Bahamas (2005) these costs impose an average surcharge on most foreign exchange purchases of 2.75%, including the government stamp tax rate of 1.5%.

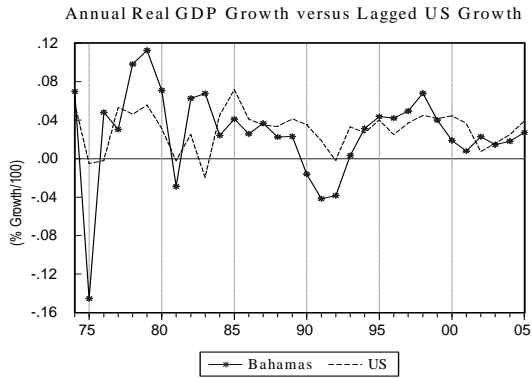
<sup>6</sup> A summary of the Exchange Control regime is provided on the Central Bank's website: [http://www.centralbankbahamas.com/exchange\\_objectives.php](http://www.centralbankbahamas.com/exchange_objectives.php).

investments. As of 2007, inward portfolio investments are still not permitted beyond some provisions which the government has approved (but not yet implemented) for transactions across Caribbean stock exchanges.

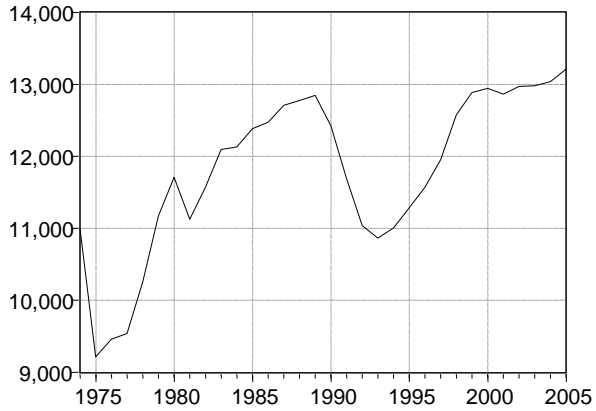
Punctuated by a series of recessions that were correlated with trends in the US, the Bahamian economy grew at a healthy average pace during 1974-2005 (see Figure 1a). These all corresponded to cycles in tourism sector performance, and the occasional upswing in foreign investments in the hotel sector (Craig et al. 1997). The sharpest output contraction (almost 16%) occurred in 1975, in response to the global recession brought on by the OPEC oil shock of 1973. The brief recession in 1981 also featured an oil price shock. The 1990-1993 contraction followed gradually slowing growth which began in 1987 after the bursting of the US stock market bubble. This then turned into a recession in 1990, given the shock to tourism at the start of the first war in Iraq. After 1999, the economy started to slow again, and the situation worsened following the September 2001 terrorist attacks in the US. Nevertheless, the swings in real per capital GDP (Figure 1b) indicate that the economy never fully recovered from the first oil shock until 1980, and that the slump in per capita income during the 1990s did not completely reverse itself until 2000.

The weak periods of each economic cycle corresponded to increases in the fiscal deficit to GDP ratio, and growth in the domestic banking sector's (including the Central Bank) net claims on government (Figure 1c). Deficits became permanent features after 1986, with the shortfalls becoming more extended in the immediate years surrounding 1990, and during 2002 to 2005. Not co-incidentally, these were also periods when direct credit controls were used most aggressively to protect the foreign reserves.

**Figure 1**  
**The Bahamas Selected Economic Trends**  
**Figure 1a**



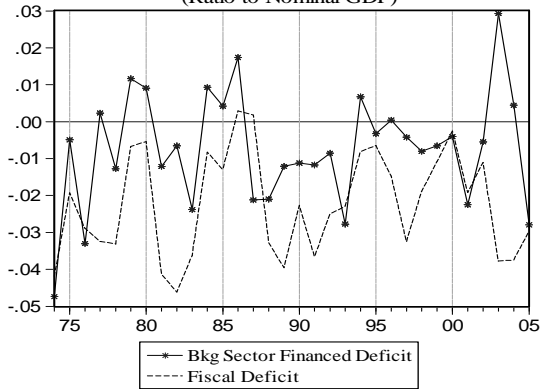
**Figure 1b**  
**US\$ Real per Capita GDP (2000 dollars)**





**Figure 1C**

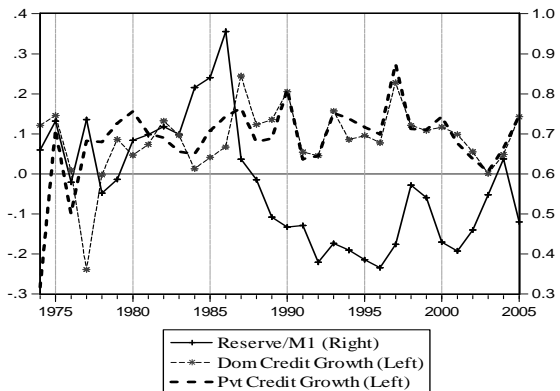
Annual Fiscal Balance vs Bkg sector Financing  
(Ratio to Nominal GDP)



*Note: Bank financing is annual change in net claims on Govt.*

**Figure 1d**

Domestic Credit Expansion vs External Reserves / M1



**Sources:** IMF, International Financial Statistics, and UN National Accounts Database. Growth estimates are ratios relative to 100%.

**Note:** \*US GDP growth is lagged one period.

Measured as a ratio of M2, the official foreign reserves were higher in 1986 than in any other point in the study period. Graphically, the evolution since the late 1970s shows a more discernible pattern relative to domestic credit trends (and notably private credit), corresponding to when monetary policy started to become more active (Figure 1d). The authorities' first direct attempt to discourage credit expansion, which helped with the stabilization after the 1973 oil crisis, was to pay interest on the excess reserve balances that commercial banks were encouraged to hold at the Central Bank. The Central Bank's narrative does not indicate when this ceased, but it is clear that it was no longer in practice by 1979 when the authorities relaxed their credit posture.<sup>7</sup> However, faced with another adverse shock, the bank tried to slow credit expansion once more from 1980 to 1981, this time doubling (from 1% to 2%) the surcharge that was levied on frequent use of its discount window by commercial banks. Immediately, the Central Bank shifted its focus to managing interest rate pressures and to diffusing competition for scarce resources, through direct placements of its own funds, and later deposits of the National Insurance Board,<sup>8</sup> with selected commercial banks. However, the frequent borrowing surcharge had to be reinstated in 1982.

Interest rate controls started to be relaxed after 1985, once credit expansion slowed and the foreign reserve balances recovered. This relaxation led to accelerated credit expansion and immediately contracting levels of reserves that continued through the 1987 economic slowdown. As the depletion of reserves continued, and confronted with the negative tourism shock from the Iraq war, in 1990 the Central Bank imposed a 35% borrower equity requirement on all consumer lending, and was given

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<sup>7</sup> See Central Bank of The Bahamas (2006).

<sup>8</sup> The National Insurance Board manages the national social security fund that is funded by a payroll tax.

legal authority to begin fining banks for incurring deficits in their secondary reserve requirements.<sup>9</sup> Mostly because of the consumer credit controls, the foreign reserves stabilized. The controls were lifted in 1993 and the interest rate ceiling one year later.

Once more, economic slowdown at the end of the 1990s preceded any adjustment in credit policies, with the reserves consequently declining even prior to the September 2001 negative shock. Then the authorities resorted again, with success, to mandatory equity requirements on consumer borrowing, and imposed a moratorium on private credit growth that was not lifted until 2004.<sup>10</sup>

The actual experience therefore shows that the Bahamian monetary authorities actively worked to stabilize the official reserves during economic slowdowns, and that demand management policies were often explicitly targeted at the private sector. Demand management focused on total domestic credit from the consolidated banking system, going beyond the traditional, narrow textbook focus on fiscal relationships on the central bank's balance sheet.<sup>11</sup> Abstracting from the foreign currency flows on commercial banks' balance sheets,<sup>12</sup> the consolidated banking sector balance sheet illustrates this relationship between domestic credit trends and the reserve:

$$DC_g + DC_p + NIR = C + D = M ,$$

where the sum of the central bank's net international reserves (NIR) and consolidated local currency claims on government ( $DC_g$ ) and the private

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<sup>9</sup> Under the Secondary Reserve Requirements commercial banks must hold liquid assets in cash, balances at the Central Bank and government securities that equate to an average 15% of demand deposit plus 20% of savings and fixed deposits.

<sup>10</sup> The Central Bank provided an accounting of this decision in its Annual Report (2004).

<sup>11</sup> See, for example, Dornbush (1976); Dornbush (1980); Mark (2005).

<sup>12</sup> This approach is justified, since over the study period Bahamian Exchange Controls Regulations limited currency mismatches on each commercial bank's domestic balance sheet to no more than \$0.5 million.

sector ( $DC_p$ ), finance the money supply ( $M$ )—that is, the sum of the central bank's currency liabilities ( $C$ ) and commercial banks' deposit liabilities ( $M$ ), to the private sector. Rearranging this gives an expression for external reserves coverage as a proportion of the money supply that is useful for econometric analysis of the form

$$\log\{NIR/M\} = \log\{1 - (DC_g + DC_p)/M\}.$$

These accounting identities have theoretical counterparts that can be developed in the monetary model of the balance of payments.<sup>13</sup> A standard specification of real money therefore identifies output and prices, along with interest rates as variables that determine real money demand, relative to the supply, and highlights channels through which variations in the external reserves are expected to occur.

#### **4.0 Econometric Specification and Data**

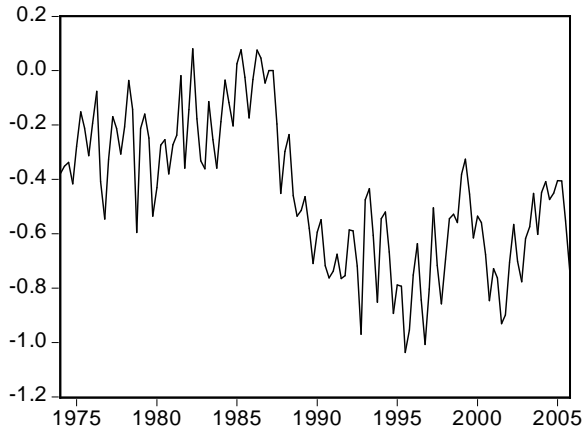
The econometric specification is an unrestricted VAR model in four endogenous variables: the ratio of reserves to the broad money supply (COV), the domestic inflation rate (INFL), real output growth proxy (GROWTH), and interest rate changes (D\_TBILL). Each equation was augmented with a set of exogenous variables which included a dummy proxy of the direct stance of monetary policy (POLICY), the US inflation rate (INFL\_US) and growth rate (GROWTH\_US), variations in international crude oil prices (INFL\_OIL), and variations in the domestic fiscal balance (FISC\_SHOCK).

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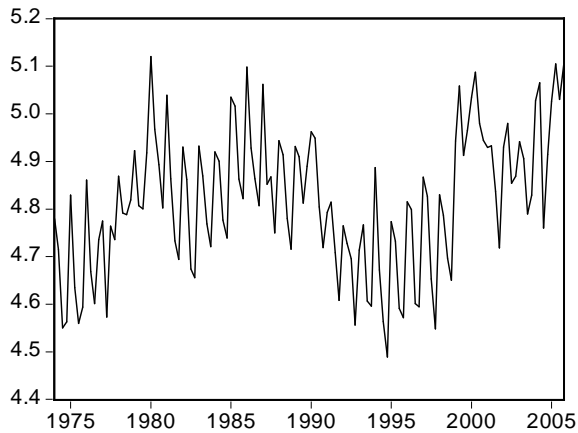
<sup>13</sup> See, for example, Dornbush (1976); Dornbush (1980); Mark (2005).

**Figure 2**  
**Plots of Endogenous Variables**

**Log of Reserves/M2**

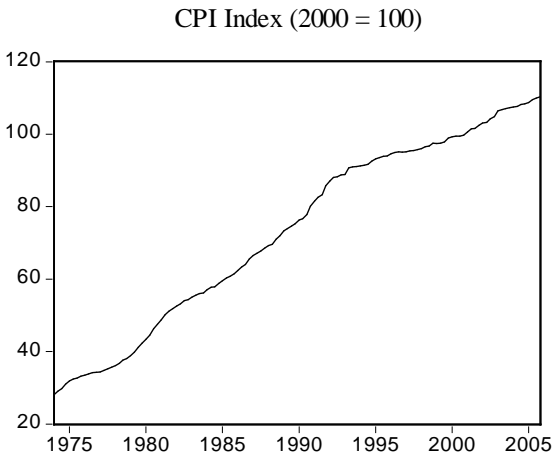
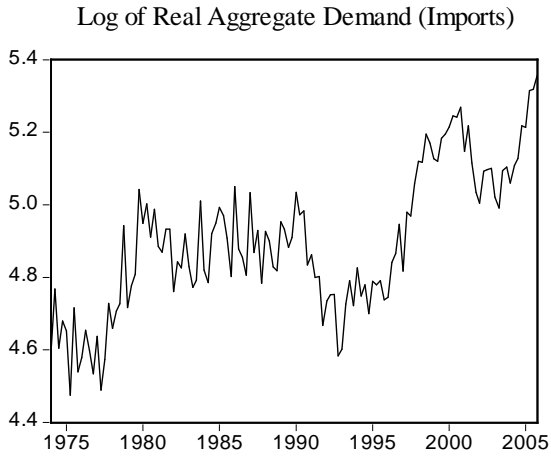


**Log of Real Aggregate Supply (Exports)**

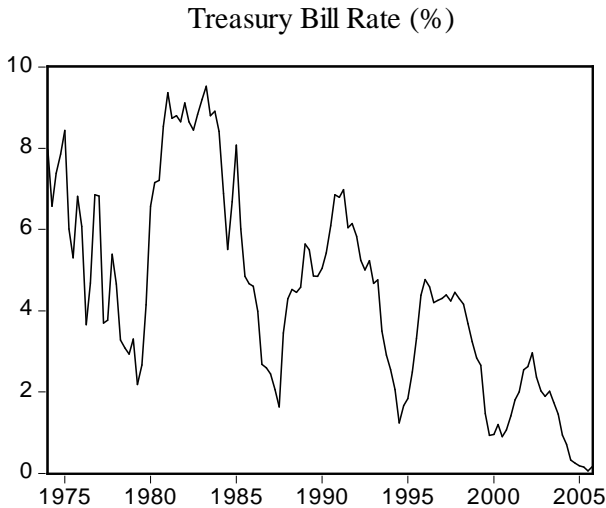


**Sources:** Central Bank of The Bahamas, IMF, International Financial Statistics, and United Nations National Accounts Database.

**Figure 2 (continued)**



**Sources:** Central Bank of The Bahamas, IMF, International Financial Statistics, and United Nations National Accounts Database.

**Figure 2 (Continued)**

**Sources:** Central Bank of The Bahamas, IMF, International Financial Statistics, and United Nations National Accounts Database.

## 5.0 The Data

The data (for the period 1974-2005) was compiled on a quarterly basis, mainly from the Central Bank's *Quarterly Statistical Digest*, the IMF's *International Financial Statistics* (IFS) Database and the Central Bank's monetary policy narrative. Graphs of the endogenous variables are shown in Figure 2. The fiscal balance ratio was constructed using the total fiscal deficit at the end of each quarter divided by the nominal value of imports of goods and services at the end of each quarter. Since quarterly output indicators were not available, the alternative proxies of output were imports (goods and services and income payments) for the demand side of the economy (GROWTH1) and exports (of similar categories) as an indicator of trends on the supply side (GROWTH2). Both measures are justified on the basis of the extreme openness of the economy and the

foreign exchange constraints referred to earlier. The CPI was used to proxy the GDP deflator and to obtain real values for these estimates. The *IFS* balance of payment series was only available from 1976 onwards. In addition, the series through 1985 overestimated consumption imports by including intermediate inputs used in chemical and petroleum goods re-exported from The Bahamas. Revised data omitting these valuations were obtained from the Central Bank's statistical reports, which also extended the start of both series to 1974.

Instead of the Central Bank's discount rate, the average 3-month Treasury bill rate was used as the interest rate measure. The Central Bank conducts the T-bill auctions for the government and sets the reservation price for issues, based on liquidity and other conditions in the system. Changes in the T-bill rate, which occurred more frequently than in the discount rate, can therefore be interpreted as signals of how the authorities viewed the appropriate levels of other short-term rates in the banking sector.

To address seasonality and non-stationarity, log differencing over four quarter intervals yielded annualized estimates of the growth in the real demand and supply proxies, inflation, growth in official reserves relative to money and changes in interest rates.<sup>14</sup> For the fiscal deficit ratio the differencing provided proxies of annual shocks to the sector. As opposed to focusing on the size of the imbalances, these estimates identified variations which resulted either from exogenous changes in economic conditions or from deliberate policies affecting revenues and expenditures.

Finally, the narrative was the basis for coding the policy dummy. The instances were coded as +1 if the Central Bank tightened credit measures, -1 when measures were loosened and as 0 otherwise.<sup>15</sup>

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<sup>14</sup> The log interest rate measure used is  $\log(1+i/100)$ .

<sup>15</sup> This is similar to the narrative approach of Romer and Romer (1989) that was applied to the US.



## 6.0 Granger Causality Tests

Results of Granger causality tests on the differenced endogenous variables are shown in Table 1 for two and four lags. First we consider the significant causal relationships among variables other than those which proxy changes in aggregate demand and supply.<sup>16</sup> At two lags (top panel), Granger causality runs in both directions between interest rate changes and the foreign reserves coverage. However, at four lags the results only show that the reserves coverage Granger causes changes in the Treasury bill rate. There is also significant one-way Granger causality from official reserve to domestic inflation, and causality is evident at the 10% level (using four lags) from interest rates to inflation. However, domestic inflation rate does not Granger cause any of the endogenous variables.

Next we consider Granger causal links between aggregate demand and supply measures relative to the other endogenous variables. Using two lags, causality runs both ways between changes in the proxied real four lags, significant one way Granger causality runs from demand variations to inflation and there is mild evidence (10% significance) that domestic demand and in the reserves coverage. However, using four lags, causality is unidirectional from demand to the reserve coverage ratio.<sup>17</sup> At demand Granger causes changes in interest rates (evaluated using two lags). Attesting to the short-run importance of external factors, the supply side of the economy is more insulated from domestic influences (bottom panel of Table 1). While there is evidence that supply variations Granger cause interest rate changes, none of the endogenous variables Granger cause changes in the supply proxy.

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<sup>16</sup> Unless stated otherwise, all significance was judged at the 5% level.

<sup>17</sup> At the 10% level of significance causality is evident in both directions between growth in aggregate demand and changes in the reserve coverage ratio.

**Table 1: Pairwise Granger Causality Tests**

	Obs	F-Stat	Prob	Obs	F-Stat	Prob
	Sample: 1970Q1 2005Q4			Sample: 1970Q1 2005Q4		
	Lags: 2			Lags: 4		
<b>Demand Side Model</b>						
<b>Null Hypothesis:</b>						
D_TBILL does not Granger Cause COV	133	3.997	0.021	131	1.257	0.291
COV does not Granger Cause D_TBILL		11.301	0.000		3.674	0.007
INFL does not Granger Cause COV	138	0.048	0.953	136	0.822	0.514
COV does not Granger Cause INFL		4.422	0.014		3.263	0.014
GROWTH1 does not Granger Cause COV	122	3.955	0.022	120	3.279	0.014
COV does not Granger Cause GROWTH1		3.281	0.041		2.112	0.084
INFL does not Granger Cause D_TBILL	133	0.617	0.541	131	0.483	0.748
D_TBILL does not Granger Cause INFL		0.295	0.745		2.094	0.086
GROWTH1 does not Granger Cause D_TBILL	122	2.751	0.068	120	0.723	0.578
D_TBILL does not Granger Cause GROWTH1		1.216	0.300		0.993	0.415
GROWTH1 does not Granger Cause INFL	122	2.145	0.122	120	4.805	0.001
INFL does not Granger Cause GROWTH1		1.131	0.326		1.110	0.355
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	Sample: 1970Q1 2005Q4			Sample: 1970Q1 2005Q4		
	Lags: 2			Lags: 4		
<b>Supply Side Model:</b>						
<b>Null Hypothesis:</b>						
GROWTH2 does not Granger Cause COV	122	0.970	0.382	120	0.226	0.923
COV does not Granger Cause GROWTH2		2.289	0.106		1.335	0.261
GROWTH2 does not Granger Cause D_TBILL	122	2.430	0.092	120	2.761	0.031
D_TBILL does not Granger Cause GROWTH2		1.190	0.308		0.720	0.580
GROWTH2 does not Granger Cause INFL	122	0.935	0.396	120	1.611	0.177
INFL does not Granger Cause GROWTH2		0.675	0.511		1.257	0.291

Below, these causal chains inform the ordering of the variables in impulse response analysis. The demand side ordering is interest rates, the reserve coverage, domestic demand and inflation. The supply side ordering also places interest rates first, followed by the reserves coverage, inflation and aggregate supply, that is, in the first instance we assume that interest rate changes signal the Central Bank's assessment of economic conditions and underline the direct credit interventions which affect the reserve coverage ratio. Shifts in credit trends give rise to changes in demand that may (or may not) have a subsequent effect on inflation. The slight difference in the supply side ordering assumes that the response of inflation to monetary policy precedes any significant response, in output supply.

## **7.0 Econometric Estimation and Results**

First we discuss the estimation of the demand side model, noting that a similar approach was taken when searching for the best estimated version of the supply side specification. Various lag specifications for the endogenous variables were explored, before a final length of two was selected. This corresponded to the optimal lag length recommended by the Hannan-Quinn information criterion. The other considerations in the choice of the lag length included the model's ability to satisfy the normality and homoscedasticity assumptions for the residuals, and the VAR's stability as inferred from having all of the characteristic roots of the estimated equations less than one in absolute size. Examination of the autocorrelation plots revealed that some serial correlation remained in the squared residuals, notable at the fourth lag, which could be eliminated by estimating the equations with 6 lags. However, this specification did not satisfy the normality assumption and the predicted results were qualitatively similar to those from the model that was estimated with 2 lags.

## 8.0 Analysis of Results

### 8.1 Demand Side

The estimated VAR results from the demand side of the economy are shown in Table 2. These also reveal the final lag structure on the exogenous variables. After adjustments for missing observations, the estimation used 122 observations from 1975Q2 -2005Q4. At the 5% and 10% levels of significance and 107 degrees of freedom the critical T-statistics for the evaluation of the coefficients are 1.98 and 1.67 respectively. A quick evaluation of the impulse response functions (Figure 3) shows that any specific shock from the exogenous variables will only have predicted short-run effects on the endogenous variables, since the 95% confidence intervals for all of the responses eventually overlap with zero. Before analyzing these graphs we consider each of the direct exogenous influences and the channels through which they are transmitted to the endogenous variables.

As to the direct policy intervention dummy, this was only found to be significant in the reserve coverage equation, lagged three periods. The estimated coefficient of 0.093 is of the expected sign, and implies that after three quarters, tightening (POLICY=1) results in a 9.3% increase in the log coverage ratio. This attests both to the effectiveness of selective credit controls in stabilizing the external reserves and to the considerable delay (nine months) before the results materialize.

As to fiscal shocks, which correspond to reductions in the average deficit to GDP ratio, significant coefficient estimates were obtained in the equations for inflation (0.063) and aggregate demand (-1.05). The positive (albeit very inelastic) inflation response might seem counterintuitive to expectations that reductions in fiscal spending ought to reduce inflation pressures. However, when these shocks correspond to changes in tax receipts from import duties, as tends to be the case in The Bahamas, then

smaller deficits (positive shocks) would be directly correlated with inflated prices of imported goods. The estimated demand response to fiscal shocks, which was not significantly different from one, is best viewed in terms of the automatic stabilization built into government expenditures, which are less likely to adjust when tax collections fall during recessions. Once transmitted from aggregated demand to the reserve coverage (one period later) each 1% widening in the deficit to GDP ratio (negative shock) results in a roughly 0.27% deterioration in the reserve coverage ratio. This is the only significant channel through which fiscal shocks are transmitted to the foreign reserves. It implies that the monetary authorities have had to respond to deficit shocks by being less accommodating to the private sector.

Although the estimated model does not show any significant short-run transmission from inflation to the other endogenous variables, it reveals a significant direct effect of US trends on The Bahamas' inflation rate—an approximately 74% pass-through after two quarters—focusing on the implied transmission via the coefficients that are significantly different from zero<sup>18</sup>.

Disentangling the significant effects of US growth rate on the endogenous variables is more complicated. The direct effect after one period is a highly elastic response in demand growth (1.42) and a negative, very inelastic response in the Treasury bill rate (0.09). The demand response to US output shocks is transmitted negatively to the reserves ratio one period later (t-2) and the initial Treasury bill response shows up in the reserves two quarters later (t-3). Working through the significant coefficients it can also be shown that after three periods the cumulative impact of US shocks in the reserves coverage ratio is negative. This points to a tendency for monetary policy to accommodate depletions of

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<sup>18</sup> Making use of the estimated coefficient on the first lag of inflation in the inflation equation the first period response is 0.49. After the second period this becomes  $-0.36 + 1.234 * 0.95 = 0.243$ , for a total response over two periods of 0.74 which is quite large.

**Table 2: VAR Estimates of Demand Model**

Sample (adjusted): 1975Q3 2005Q4

Included observations: 122 after adjustments

T-statistics in [ ]

	<b>D_TBILL</b>	<b>COV</b>	<b>GROWTH1</b>	<b>INFL</b>
C	7.94E-06 [ 0.00449]	-0.013818 [-0.42533]	-0.034189 [-1.36445]	0.002165 [ 1.25333]
D_TBILL(-1)	0.932838 [ 10.2590]	-1.19038 [-0.71203]	0.474326 [ 0.36787]	-0.100163 [-1.12698]
D_TBILL(-2)	-0.25484 [-3.07878]	2.752267 [ 1.80850]	-0.767993 [-0.65432]	0.058096 [ 0.71807]
COV(-1)	-0.017583 [-3.61705]	0.53176 [ 5.94973]	0.15846 [ 2.29882]	0.008803 [ 1.85277]
COV(-2)	-0.004653 [-0.85724]	0.135586 [ 1.35858]	-0.008767 [-0.11390]	-0.015373 [-2.89747]
GROWTH1(-1)	0.021072 [ 3.24021]	-0.273568 [-2.28801]	0.268668 [ 2.91347]	0.004793 [ 0.75407]
GROWTH1(-2)	-0.013717 [-2.16320]	0.144433 [ 1.23887]	0.222248 [ 2.47173]	-0.00995 [-1.60533]
INFL(-1)	0.038965 [ 0.46317]	-1.65534 [-1.07020]	1.446026 [ 1.21216]	1.233848 [ 15.0050]
INFL(-2)	-0.085726 [-1.08145]	0.132782 [ 0.09111]	-1.710299 [-1.52155]	-0.431836 [-5.57344]
	<b>D_TBILL</b>	<b>COV</b>	<b>GROWTH1</b>	<b>INFL</b>
GROWTH_US(-1)	-0.082492 [-2.14002]	0.607082 [ 0.85658]	1.424996 [ 2.60697]	-0.05523 [-1.46584]
INFL_US(-1)	-0.085093 [-0.60462]	-0.577725 [-0.22327]	-2.315256 [-1.16012]	0.490416 [ 3.56500]
INFL_US(-2)	0.161688 [ 1.28939]	2.007341 [ 0.87065]	2.505385 [ 1.40896]	-0.306988 [-2.50459]
POLICY(-2)	0.002234 [ 1.05673]	-0.036148 [-0.92990]	-0.00825 [-0.27518]	0.00232 [ 1.12265]
POLICY(-3)	0.001808 [ 0.84521]	0.092501 [ 2.35211]	-0.005711 [-0.18829]	-0.003171 [-1.51678]
INFL_OIL(-1)	0.003209 [ 1.14903]	-0.113385 [-2.20808]	0.088234 [ 2.22791]	-0.006007 [-2.20033]
FISC_SHOCK(-1)	0.018442 [ 0.70614]	-0.100861 [-0.21005]	-1.054255 [-2.84679]	0.063206 [ 2.47606]
Adj. R-squared	0.840	0.513	0.357	0.954
F-statistic	43.40	9.49	5.49	170.03
Log likelihood		1151.2920		
Akaike information criterion		-17.8245		
Schwarz criterion		-16.3535		

the reserves in anticipation of positive spillovers from US economic growth, signalled indirectly through reductions in interest rates. Domestic demand also picks up in response to the US economic trends, having negative impact on reserve accumulation.

As expected, increases in international oil prices are predicted to have a negative effect on the reserves coverage, and stimulate higher demand expenditures, which have further negative effects on the reserves. There is also a predicted significant but highly inelastic negative response in domestic inflation that is difficult to explain, but which is not transmitted from the inflation response to any other endogenous variable in the system.

In sum, all of the exogenous variables have an impact on the monetary sector, domestic demand and inflation in The Bahamas. Imported inflation, however, does not have any short-run impact on the real or monetary sector (interest rates and levels of external reserves).

A study of the impulse responses completes the analysis of the transmission of shocks among the exogenous variables (Figure 3). These indicate that central bank-engineered changes in interest rates are predicted to continue in the same direction, dissipating to zero after four periods. However, such changes are only predicted to cause marginal responses in the reserves coverage, which do not appear until five quarters later and remain significant for only four periods in total. Hence, compared to selective credit controls, the transmission of policy actions through the interest rate channel appears to have only negligible effects on the reserves.

Once direct shocks (improvements) are encountered in the reserves coverage ratio, they disappear over four quarters. These are predicted to cause a significant positive response in domestic demand, evident after two quarters but disappearing within four quarters. A significant easing in interest rates in response to positive reserve shocks is evident and last for up to seven quarters, with a U-shaped pattern, which peaks at one year.

**Figure 3: Impulse Response Functions for Demand Side Model  
Response to Cholesky One S.D Innovations  $\pm 2$  S.E.**

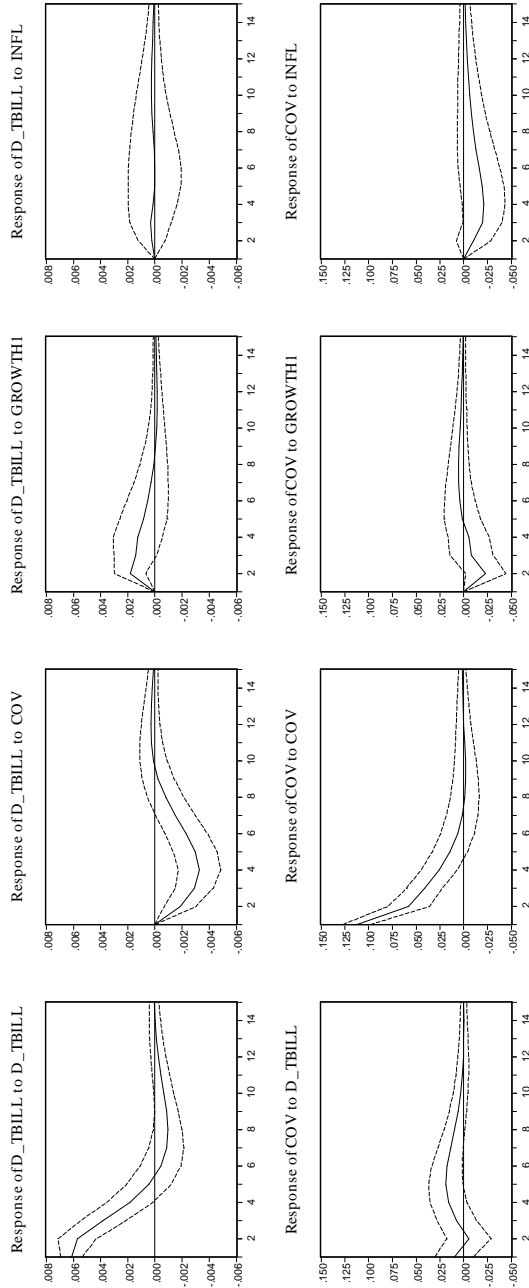
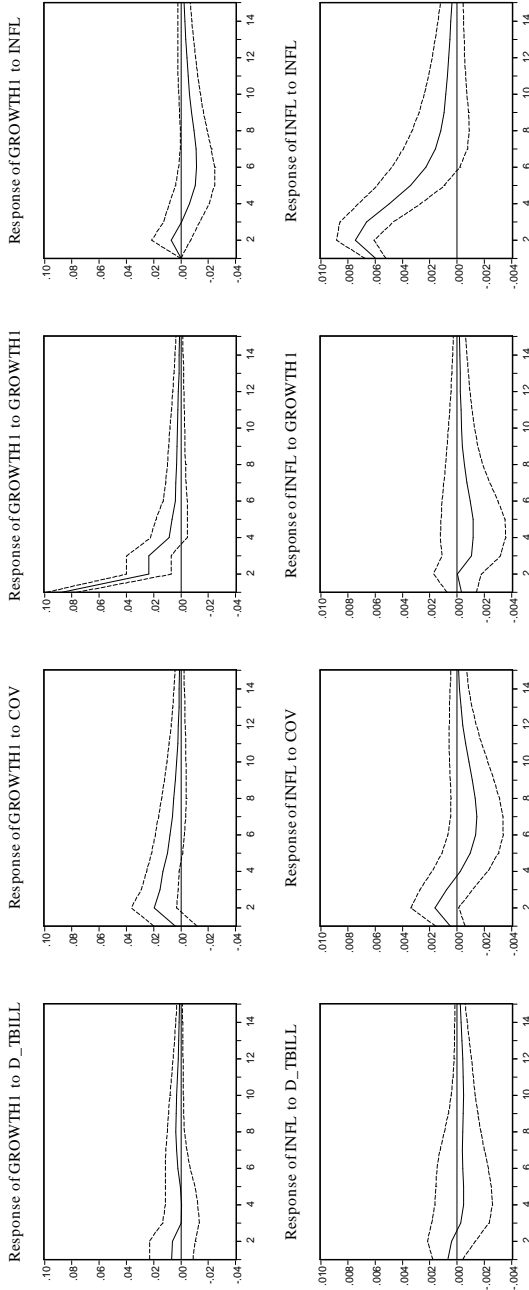




Figure 3 (Continued)



The response of demand to demand shocks is positive, but declines to zero three quarters later. Demand shocks also have a marginally significant and negative effect on reserves that lasts for one period, and a positive impact on interest rates (evidence of indirect tightening) which appear within the second period but disappear during a later period.

Finally, the response of inflation to inflation shock peaks after two quarters and takes almost six quarters to dissipate. These, however, are not transmitted any further in the system.

## **9.0 Supply Side**

Analysis of the impulse responses on the supply side of the economy reveals new information only as far as the proxied measure of aggregate supply is concerned. The estimated regressions shown in Table 3 confirm that there is no significant short-run connection between this side of the economy and other sectors modelled. Although after two periods supply shocks have a significant negative effect on interest rates, the impulse response functions (Figure 4) suggest that the response to the shock is not significant. This is the only channel through which such changes can be transmitted to the other endogenous variables (external reserves and inflation). As to exogenous influences, none of their estimated coefficients in the supply equation is significant. A significant positive coefficient on the US growth rate does result if it is included in the equations with a sixth quarter lag, but then the residuals violate the normality assumption and the supply responses are still not transmitted beyond interest rates.

**Table 3: VAR Estimates of Supply model**

Sample (adjusted): 1975Q3

2005Q4

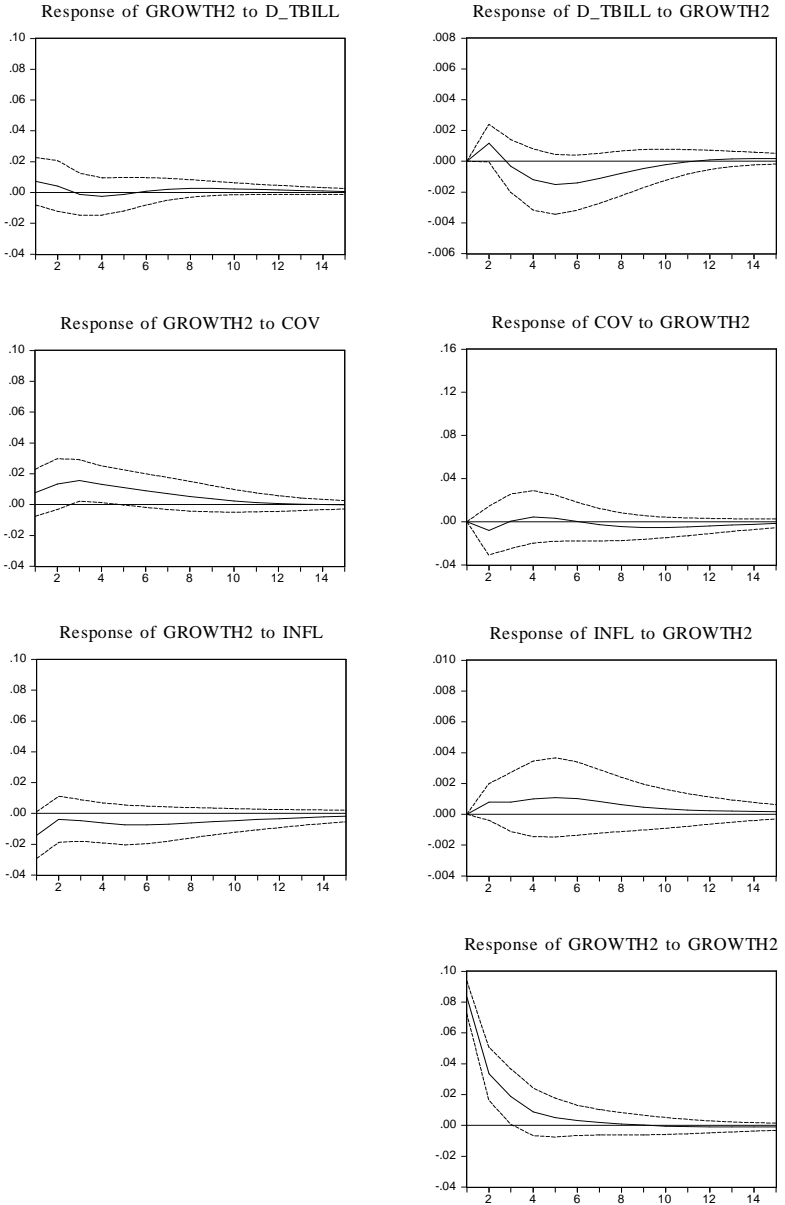
Included observations: 122 after  
adjustments

T-statistics in [ ]

	<b>D_TBILL</b>	<b>COV</b>	<b>INFL</b>	<b>GROWTH2</b>
C	-0.000301 [-0.16852]	-0.011578 [-0.34708]	0.00238 [ 1.36737]	-0.00193 [-0.07859]
D_TBILL(-1)	0.926764 [ 10.2351]	-1.194543 [-0.70583]	-0.134513 [-1.52334]	0.093 [ 0.07465]
D_TBILL(-2)	-0.239473 [-2.89888]	2.671332 [ 1.73011]	0.087914 [ 1.09129]	-0.484863 [-0.42661]
COV(-1)	-0.017945 [-3.72392]	0.532597 [ 5.91330]	0.009464 [ 2.01400]	0.08796 [ 1.32672]
COV(-2)	-0.001861 [-0.35232]	0.105438 [ 1.06799]	-0.017643 [-3.42504]	0.03727 [ 0.51285]
INFL(-1)	0.027404 [ 0.32369]	-1.367953 [-0.86446]	1.239682 [ 15.0149]	0.323214 [ 0.27748]
INFL(-2)	-0.105444 [-1.34529]	0.202625 [ 0.13831]	-0.417137 [-5.45736]	-0.631631 [-0.58573]
GROWTH2(-1)	0.014041 [ 1.91448]	-0.102648 [-0.74879]	0.010271 [ 1.43606]	0.403804 [ 4.00173]
GROWTH2(-2)	-0.024708 [-3.28744]	0.126613 [ 0.90130]	-0.003154 [-0.43025]	0.065711 [ 0.63546]
GROWTH_US(-1)	-0.068992 [-1.74835]	0.466659 [ 0.63271]	-0.066958 [-1.73998]	0.53686 [ 0.98885]
INFL_US(-1)	0.030453 [ 0.22643]	-1.966387 [-0.78226]	0.478256 [ 3.64654]	-0.784849 [-0.42416]
INFL_US(-2)	0.082754 [ 0.67010]	3.003331 [ 1.30115]	-0.315409 [-2.61899]	0.85331 [ 0.50222]
POLICY(-2)	0.00188 [ 0.87684]	-0.03716 [-0.92719]	0.002548 [ 1.21867]	0.028714 [ 0.97331]
POLICY(-3)	0.000218 [ 0.10000]	0.103323 [ 2.53064]	-0.003538 [-1.66080]	-0.002113 [-0.07031]
INFL_OIL(-1)	0.003048 [ 1.07890]	-0.10656 [-2.01797]	-0.00628 [-2.27949]	0.042424 [ 1.09144]
FISC_SHOCK(-1)	0.033964 [ 1.29344]	-0.210739 [-0.42938]	0.060908 [ 2.37851]	-0.356189 [-0.98591]
Adj. R-squared	0.838	0.491	0.954	0.260
F-statistic	42.85	8.78	168.92	3.84
Log likelihood		1152.4850		
Akaike information criterion		-17.8440		
Schwarz criterion		-16.3731		

### Figure 4: Selected Impulses for Supply Side Model

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



## 10.0 Conclusion

Given the data limitations and the challenges encountered in searching for the best estimated specification of the VAR, we consider these results as a preliminary step towards a fuller understanding of monetary policy in The Bahamas. It would be best to continue such investigation using high frequency data to capture the often short time intervals in which policymakers have to respond and achieve results when faced with balance of payments shocks. To do so will require better estimates of the supply and demand sides of the Bahamian economy. At a minimum, this would mean augmenting the export and import values with estimates of the non-tradeable sector.

Our results are nevertheless consistent with the expectations that monetary policy in The Bahamas can only be conducted to stabilize the balance of payments in the short-term, by focusing on the demand side of the economy. While this is a manifestation of the foreign exchange constraint that the economy faces, the results also show that the fiscal sector imposes a constraint on the Central Bank. This implies that the automatic stabilizers built into fiscal policy are only partially effective, since the required adjustments weigh more heavily on the private sector. The VAR results also indicate that the domestic authorities have no significant control over the inflation rate and that the cost of oil imports is a significant constraint on the balance of payments.

While Bahamian capital controls allow some de-linking of the domestic and foreign interest rates, the domestic rate only seems to have marginal effects on credit trends and hence the external reserve levels. This could mean that the demand for money is very interest-inelastic, and that only the wealth effects of short-run changes in real money holdings affect consumption. Nevertheless, the Central Bank's policy narrative shows that interest rates have not always been fully market-determined, and therefore do not always convey reliable information on the relative supply and demand for credit. Having an externally driven economy, dependent on foreign investments, also means that domestic interest rates have minimal impact on investments and supply-side growth. These are

all issues that can be investigated with further research to estimate the money demand parameters for The Bahamas.

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