



THE DEMAND FOR EXCESS LIQUID ASSETS IN BARBADOS

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Abstract:

This paper provides a survey of the trends and key determinants of the holdings of excess liquid assets of commercial banks in Barbados between 1975 and 2004. These results show that excess reserves are highly persistent and significantly related to shocks to the currency to deposit ratio, the business cycle, the interest rate and money creation. The model is then employed to generate dynamic projections for excess reserves between 2000 and 2004 to identify whether the build-up in reserves during this period was due to supply-or demand-side factors. These forecasts suggest that with the exception of 2003, most of the expansion in excess liquidity in recent years can be accounted for by demand-side factors.

Keywords: E58; G21; G28

JEL Codes: Liquid assets, Banks, Credit Crunch

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1. Introduction

Liquid assets of commercial banks are those assets that are generally thought to have low risk (for example government securities) and a short maturity horizon (Garber and Weisbrod, 1992). In most countries, the monetary authority sets prudential floors on the amount of liquid assets a bank should hold. These minimum reserve requirements have been in place in Barbados since the Central Bank of Barbados began operations in 1973. At this time, commercial banks were only required to hold 2% of their deposits in cash or in non-interest bearing accounts at the Central Bank and 1% in Government securities. Subsequent to its introduction, the Central Bank utilised the reserve requirement to pursue its monetary and prudential objectives (Blackman, 1997). The reserve requirement reached a maximum of about 33% in 1991 when Barbados was in the troughs of one of its deepest recessions. Since then the rate has been gradually reduced as the Bank endeavoured to liberalise the financial market, and at the end of 2004 was 17% of domestic deposits¹.

Commercial banks tend to hold reserves above the minimum required amount – referred to as excess liquid assets – for a number of reasons. Alger and Alger (1999) identifies three broad categories of theories that explain why commercial banks hold reserves: (1) portfolio management; (2) precautionary motives, and; (3) market imperfections. This body of mostly theoretical literature predicts that the amount of liquid assets should increase when the opportunity cost of holding reserves declines and the uncertainty regarding the return on assets and the likelihood of a liquidity shock rises.

¹ See Williams (2004) for an assessment of the potential impact of financial liberalisation on businesses in Barbados.

While liquid assets allow commercial banks to maintain profitability and reduce the risk associated with its asset portfolio, the monetary authority also carefully monitors trends in liquidity. Within the Central Bank of Barbados, a report is prepared on developments in domestic and external liquidity every two weeks and a meeting of personnel from various departments within the Bank (primarily research, banking, bank supervision and exchange control) is held to discuss key developments. These meetings and reports assist the Central Bank to track overall financial sector vulnerability, assess the potential of the banking system to provide new credit and monitor the effects of monetary and fiscal policy changes.

To illustrate the role of excess reserves a simplified commercial bank balance sheet is provided in Figure 1. On the asset side of the balance sheet are cash and cash equivalents (deposits at the central bank), investments in government securities and loans (the only long-term asset in this example). Liabilities, on the other hand, are composed of demand deposits that can be withdrawn without incurring a penalty, time and savings deposits and borrowings from the head office. A tighter monetary policy stance by government – an increase in the required reserve ratio – results in an expansion in the holdings of either cash or government securities that can only be satisfied by the commercial bank reducing the amount of loans it provides.

Given its importance in the monetary transmission process, a number of recent studies have attempted to model the empirical determinants of commercial bank excess reserves. The most recent of these, Agénor, Aizerman and Hoffmaister (2004) examine the extent to which the fall in credit in crisis-stricken East Asian countries during the 1990s was as a result of a reduction in demand or an increased incidence of credit rationing. The authors report that the required

reserves tend to have a negative impact on the holdings of excess reserves while the volatility of cash holdings and interest rates were inversely related to the holdings of excess reserves. Cyclical changes and the volatility of the cycle, however, did not significantly influence excess reserves. Using a panel of Mexican commercial banks, Alger and Alger (1999) report similar results but also find that banks with relatively more demand deposits hold less liquid assets and that small banks usually rely more on liquid assets to meet severe liquidity shocks relative to large banks. The authors attribute these results to large banks being able to maintain a more diversified depositor portfolio and better access to liabilities to meet liquidity needs. Gonzalez-Eiras (2004), using a similar model but different objectives, estimate a difference-in-difference model to evaluate the impact of the announcement of a lender of last resort facility on banks' liquid asset holdings. The results of the study indicate as a result of the facility, liquid assets holdings fell by almost 7%.

This paper adds to this growing body of literature by providing an empirical assessment of excess reserve dynamics in Barbados. Barbados is an interesting case study because, unlike most of the countries examined in the literature, it maintains controls on capital account transactions. As a result, any build-up in excess liquidity or reduction in liquidity cannot be easily offset by accessing the external financial market. The remainder of this paper is structured as follows: Section 2 presents a survey of the trends in the holdings of excess liquid assets in Barbados; An empirical model of the demand for excess reserves is introduced in Section 3 and Section 4 gives the estimated model results and an assessment of whether the build-up in excess liquid assets between 2000 and 2004 in Barbados was due to supply- or demand-side factors. Section 5 summarises the main findings of the paper and presents some policy recommendations.

2. Trends in the Holdings of Liquid Assets by Commercial Banks

Both the monetary and fiscal authorities have a vested interest in liquidity developments. The fiscal authorities are concerned about excess liquid assets since it represents resources that could be used to finance possible growth-enhancing ventures. The central bank, on the other hand, monitors liquidity developments to ensure that the financial system is able to cope with shocks and to evaluate the likely effectiveness of policy changes.

Figure 2 provides macroeconomic indicators for Barbados between 1975 and 2004. The first panel plots the ratio of excess reserves to demand deposits. It shows that excess reserves have fluctuated widely around an average of about 9% of domestic deposits between 1975 and 2004. Excess reserves consist primarily of excess holdings of government securities: during the period holdings of excess securities was on average 7% of domestic deposits while holdings of excess cash was only 2%. Excess cash holdings exceeded those of excess securities only twice during the review. The first time this occurred was in 1975 when the government securities market was still quite thin and in 2002 when the government recorded a fiscal deficit (on- and off-budget) of almost 10% of gross domestic product.

If one compares the income to trend income ratio – an indicator of the business cycle – and the excess reserves panel one can identify that reserves seem to be highly pro-cyclical. During the two major oil-induced recessions in Barbados (1981-1982 and 1990-1992) excess reserves fell to their lowest levels on record. At the end of 1991, excess liquid assets were actually negative as the nation struggled under the pressure of an international and domestic liquidity crisis. As a

result, balance of payments support was sought from the International Monetary Fund that culminated in a 1992 Staff-Monitored programme. The programme, along with a general rebound in the world economy, resulted in eight consecutive years (up until 2000) of growth in real gross domestic product, modest external current account balances and a rebound in domestic and international liquidity.

Unlike the previous two recessions, excess liquidity of the banking system actually rose significantly during the 2001 downturn, as the Government engaged in a major counter-cyclical spending programme to reflate the economy after the September 11th attacks. The programme was financed by a US\$150 million bond issue on the internal capital market and \$52 million from the partial divestment of the Barbados National Bank – subsequently sold to Republic Bank of Trinidad and Tobago in 2003 – and the Insurance Corporation of Barbados. This monetary expansion along with a slowdown in credit resulted in excess reserves of commercial banks rising to about 23%, the highest ratio on record and in addition to required reserves of 24%.

The expansion in excess liquidity during the 1990s also reflected a programme of both domestic and external liberalisation. In terms of domestic liberalisation, the monetary authorities have also attempted to utilise more indirect monetary policy tools. In light of the very high levels of liquidity in the financial system in recent years, it is no longer necessary to have a securities requirement in order to guarantee the purchase of government securities. The securities reserve requirements has therefore fallen from as high as 25% in 1991/92 to its present level of 12%, and the cash reserve ratio was lowered from 8% to 5% over the same period. The Bank has also moved away from setting the weighted average loan rate – since this could result in commercial

banks holding more reserves – and now only controls the minimum deposit rate. Williams (2004) states that controls over the minimum deposit are maintained for two reasons: (1) the level of concentration within the commercial banking industry and; (2) to control the financing costs of businesses.

The Central Bank has also eliminated much of the control it previously held over foreign exchange transactions. Commercial banks in Barbados are now allowed to approve, without reference to the Central Bank: applications to transfer funds from Barbados to CARICOM countries in respect of all current transactions with the exception of certain specified transactions to which special limits or restrictions apply; investments in corporate securities in the form of equities cross-listed and cross-traded on the stock exchanges in CARICOM may, without limit, but approved by the Barbados Stock Exchange, and; approve all investment transactions in private unlisted equities in CARICOM countries. In addition, commercial banks and other entities in the financial sector can invest monies overseas under a so-called “second-tier” reserve programme. This allows the institutions access to investment opportunities abroad on the condition that the funds can be repatriated if the monetary authorities require them.

3. Econometric Model

This section of the study specifies a demand function for excess liquid reserves (er) of commercial banks. From the literature, the main factors that explain a bank's demand for reserves can be linked to its customer characteristics, macroeconomic environment, monetary policies and fiscal strategies. A bank needs to hold liquid assets to meet the cash requirements of

its customers (captured by fluctuations in the cash-to-deposit ratio, C/D). In most financial systems around the world, if the institution does not have the resources to satisfy its customers' demand, then it either has to borrow on the inter-bank market or the central bank, both of which incur an interest penalty. Agénor, Aizenman and Hoffmaister (2004) show that a sufficiently high penalty rate and liquidity shocks, which increase consumers' demand for cash, can encourage a bank to hold more liquid assets.

The current macroeconomic situation, in terms of both the level of economic activity (given by the deviation of income from trend, Y/Y^T) and income volatility, also has an important impact on the demand for liquid reserves of commercial banks. A cyclical downturn, for example, lowers banks' expected transactions demand for money, on the part of consumers, and therefore lead to decreased holdings of excess liquid assets. In contrast, a rise in economic volatility, since it is usually accompanied by liquidity shocks, can lead to greater holdings of excess reserves.

The actions of the monetary authorities influence the demand for liquid assets primarily through statutory changes. The variables employed to capture monetary policy in this paper are the reserve requirement (rr), the discount rate (r^d) and the treasury-bill rate (r^{tb}). An increase in required reserves should, holding all other factors constant, reduce the demand for liquid assets, since this increases the revenue foregone from holding these low or zero interest-bearing assets. The interest rate variables are expected to have similar but opposite effects on the demand for excess liquid assets. For example, an increase in the penalty rate on borrowing from the central bank increases the costs of a liquidity shortfall and should increase the demand for excess

reserves, while an increase in the treasury bill rate increases the opportunity cost of holding liquidity assets and should result in lower holdings of excess reserves by commercial banks.

Changes in the fiscal policy stance of government can also have a significant influence on the liquidity of commercial banks. During downturns in the business cycle, the classic Keynesian policy recommendation is to boost government spending, which then raises overall aggregate demand by a multiple (commonly referred to as the Keynesian multiplier) of the increase in expenditure. Government spending, however, can only be raised by issuing debt, increasing taxes or creating money (given by the change in the net domestic assets of the central bank, nda). Since, raising taxes are implemented with a significant lag, the most popular means of financing the increased spending is through money creation or borrowing from overseas. Both actions, however, result in greater deposits in the banking system and by extension a rise in bank reserves.

The estimated demand equation of excess liquid assets is therefore given by the following autoregressive specification, which allows for a gradual adjustment to the desired level of excess reserves:

$$\ln\left(\frac{er}{dd}\right) = A_1 \ln\left(\frac{er}{dd}\right) + A_2 \ln\left(\frac{rr}{dd}\right) + A_3 \ln(CV_{C/D}) + A_4 \ln\left(\frac{Y}{Y^T}\right) + A_5 \ln\left(\frac{CV_Y}{Y^T}\right) + A_6 \ln(r^d) + A_7 \ln(nda) + \varepsilon \quad (1)$$

where ε is an error term which is assumed to have normal properties and $a_j(L)$ are lag polynomials, with

$$A_1 = a_{11}L + \dots + a_{1p}L^p \text{ and}$$

$$A_j = 1 + a_{j1}L + \dots + a_{jp}L^p$$

for $j \geq 2$ and L is the lag operator. The model is estimated using ordinary least squares using the econometric package PCGIVE 10.4 within OX 10.4 (see Doornik, 2001; Hendry and Doornik, 2001). A similar equation is also estimated for the holdings of excess cash and excess securities, with the only change being that total required reserves is replaced by the cash reserve and required securities reserve ratio. The Kwiatkowski, et al. (1992) test indicates that all the variables are stationary in levels.²

4. Results

4.1 Model Evaluation

Table 1 presents the coefficient estimates and various specification tests of the model results. The equations are able to explain more than 82% of the variation in the holdings of excess reserves, excess cash and excess securities over the estimation period. In addition, the LM test for autocorrelation accepts the null hypothesis of no autocorrelation for all three regressions at the 5% level of testing. To further evaluate the robustness of the model results the bank rate is substituted for the treasury bill rate and the income to trend income variable is generated using

² The test statistics are 0.171 for ER_{-1} , 0.110 for RR , 0.142 for CD , 0.098 for Y/Y_T , 0.033 for CV_{Y/Y_T} , 0.144 for r and 0.137 for NDA compared to the 1% critical value of 0.216.

the Hodrick-Prescott filter rather than a linear trend. These changes did not significantly influence the main conclusions of the paper. It is possible that during significant domestic and external shocks the behaviour of the banking industry could change. Testing for parameter constancy is therefore important since it indicates whether the model can be an effective tool to draw broad policy conclusions as well as the behaviour of excess liquid assets during different periods. As a result, the author employs the Hansen (1992) test for the constancy of the regression coefficients to evaluate the three estimated equations. In all three regressions, the Hansen test accepted the null of parameter constancy over the estimation period. Instability tests were also computed for each variable but these were all small suggesting that the parameters did not change significantly during the estimation period.

4.2 Regression Results

Given that the previous section indicates that the models provide a fairly robust representation of excess reserve dynamics, this section analyses the estimated coefficients. The table gives the sum of the lagged coefficients (since the individual coefficients are difficult to interpret) with the standard errors calculated using the delta method³. The coefficients therefore show the long run effects of a change in the explanatory variables on the demand for excess reserves.

All the coefficients are generally inline with *a priori* expectations. The relatively large coefficient on the lagged excess reserve term suggests some persistence in the excess reserves of

³ The delta method calculates the standard error of a group of coefficients by using the variance and covariance of the coefficients:

$$\text{var}\left(\sum_i \theta_i\right) = \sum_i \text{var}(\theta_i) + \sum_i \sum_j \text{cov}(\theta_i, \theta_j).$$

commercial banks. Similar to Agénor, Aizerman and Hoffmaister (2004), the required reserve variable and the volatility of the cash to deposit ratios are negatively related to the holdings of excess cash reserves. However, the coefficient on the required reserve variable was insignificant suggesting that a change in the required reserve ratio does not significantly influence the demand for excess reserves. This suggests that commercial banks have some target level of excess reserves over and beyond what is required by the monetary authorities.

The coefficient estimates also indicate that excess reserves tend to be inversely related to the business cycle, suggesting that commercial banks tend to error on the side of caution by holding relatively more excess reserves during downturns. While this might lead to lower risk, in terms of the number of defaults in the industry, it can also deepen the recession as the reduction in the provision of credit lowers investment and the ability of the economy to rebound from the cyclical downturn. The volatility of income is incorrectly signed and has a relatively minor effect on the holdings of excess reserves, probably reflective of the small level income volatility in Barbados (see Figure 2). As expected, a rise in interest rates, which represents the opportunity cost of holding excess reserves is negatively and significantly related to the interest rate, while money creation by government leads to a rise in the holdings of excess reserves.

To assess the behaviour of the models to replicate the dynamics of excess reserves in Barbados, Figure 3 presents the out of sample one-step ahead forecasts for excess reserves, excess cash and excess securities holdings. The forecasts are generated by estimating the models using data up to December 2002 to predict values of excess reserves for the following period (March 2003). For the following period (June 2003), the forecasted value for March 2003 is replaced by the actual

value and the forecast for June 2003 is generated. This process is replicated for the following periods up to December 2004. The figure shows that all three models are able to reasonably track the dynamics of excess reserve changes.

4.3 Was the 2000-2003 Expansion in Excess Reserves due to Supply or Demand Factors?

The second part of this study uses the models estimated in the previous section to establish whether the build-up in liquidity between 2000 and 2004 was due to supply- or demand-side factors. The first step in this process was to obtain dynamic forecasts for excess reserves. Dynamic forecast, in contrast to the previous section, are obtained by using previous forecasts of excess reserves in period k to generate forecasts for period $k+1$. For example, the forecast for the first quarter of 2000 are obtained by taking the actual values of excess reserves in the fourth quarter of 1999 and previous quarters and the actual values of the other regressors in the first quarter of 2001 and their lagged values. Subsequent forecasts are obtained by taking the forecasted value of excess reserves and for previous quarters and the actual values of the other regressors.

In the second step, the build-up in excess liquidity is said to be supply-side induced if the actual values for excess reserves fall outside of the predicted error bands (two standard errors), since if banks are unwilling to lend because of a perceived increase in the risk of default, the forecast errors from the regression model should be relatively large and positive. In contrast, if banks are unable to lend, probably due to reduced credit demand (resulting from an anticipation by firms of

future weak demand or lower profits) the forecast errors would be relatively small, suggesting an involuntary accumulation of reserves.

Figure 4 shows the behaviour of the observed excess reserves and the dynamic forecasts between 2000 and 2004 together with error bands (two standard errors). The figure shows that most of the build-up in excess reserves up to the first quarter of 2002 and most of 2004 are in line with the model projections, suggesting that the accumulation of excess reserves during this period can be attributed to a slowdown in overall aggregate demand rather than increased conservatism by commercial banks. In 2003, however, the actual values diverge significantly from predicted values – falling well outside of the error bars. The persistent build-up in liquidity during this period appears therefore to have been a supply-side phenomenon – increased conservatism by commercial banks.

5. Conclusions

This paper has three main goals: (1) discuss the trends in excess liquidity between 1975 and 2004; (2) identify the key determinants of excess demand during the period, and; (3) provide an assessment of whether the recent accumulation in liquid assets was due to supply- or demand-side factors. The discussion of excess liquidity trends suggests that the variation in excess reserves during this period was highly pro-cyclical: expanding during a boom and contracting during downturns in the business cycle. The paper then estimates a model of the demand for excess reserves using quarterly data between 1975 and 2004. These results show that excess

reserves are highly persistent – dependent on previous values of excess reserves – shocks to the currency to deposit ratio, the business cycle, the interest rate and money creation.

The model is then employed to generate dynamic projections for excess reserves between 2000 and 2004 to identify whether the build-up in reserves during the review period can be attributed to supply- or demand-side factors. The assumption is that if the actual values fall outside of the error bands, this would suggest that the expansion in liquidity was due to supply-side factors. The paper finds that most of the expansion in excess liquidity up to the second quarter of 2002 and most of 2004 were principally due to demand-side factors. During 2003, however, most of the expansion in liquidity seemed to have occurred on account of supply-side factors.

The finding that commercial banks' perceptions of risk during 2003 were somewhat higher than what was consistent with macroeconomic fundamentals seems to suggest that there exist some degree of information asymmetries. At present, the only agency that produces a quarterly press release is the Central Bank of Barbados. The Government's Statistical Department – which some have argued is understaffed and unequipped – does not widely disseminate most of the data it produces to the public and does not have a presence on the web. Similarly, the Ministry of Finance and Economic Affairs does not have a web presence and only produces forecasts of Government activity for one year. This paper recommends that greater resources should be devoted to the collection and dissemination of macroeconomic indicators on a timely, frequent and consistent basis in order to reduce information asymmetries in the financial system and wider economy.

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Table 1: Determinants of Excess Liquid Assets

	<i>ER</i>	<i>EC</i>	<i>ES</i>
Constant	4.280 (2.392)	-1.902 (0.937)	2.325 (1.821)
ER_{t-1}	0.813 (0.069)	0.651 (0.073)	0.874 (0.064)
<i>RR</i>	-0.085 (0.390)	0.165 (0.452)	-0.063 (0.361)
<i>CD</i>	-0.002 (0.000)	-0.001 (0.000)	-0.005 (0.002)
Y/Y_T	-0.024 (0.009)	-	-0.021 (0.005)
CV_{Y/Y_T}	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.001)
<i>r</i>	-0.107 (0.062)	0.121 (0.048)	-0.135 (0.068)
<i>NDA</i>	-0.001 (0.000)	-0.004 (0.001)	0.001 (0.001)
See	2.197	0.946	1.869
R^2	0.856	0.854	0.822
Autocorrelation LM Test (χ^2_5)	6.150 [0.292]	5.021 [0.413]	1.535 [0.909]
Hansen Instability	Parameter 2.843	3.792	5.080

Note: The dependent variable is the ratio of excess reserves to domestic deposits (*ER*). The regressors ER_{t-1} , *RR*, *CD*, Y/Y_T , CV_{Y/Y_T} , *r* and *NDA* are the lag of excess reserves, required reserves (as a ratio to domestic deposits), the coefficient of variation of the ratio of cash to deposits, income to trend income ratio, coefficient of variation of the income to trend income ratio, the treasury bill rate and net domestic assets of the banking system. The estimates in the table correspond to the sum of the coefficients of the lag polynomials for $p = 4$, and their standard errors (calculated using the delta method) are provided in parenthesis below the coefficients and p-values are given in square brackets.

Figure 1: Simplified Commercial Bank Balance Sheet

<i>Assets (uses of funds)</i>	<i>Liabilities (sources of funds)</i>
Cash	Demand Deposits
Securities	Time and Savings Deposits
Loans	Borrowing from Head Office

Figure 2: Macroeconomic Indicators

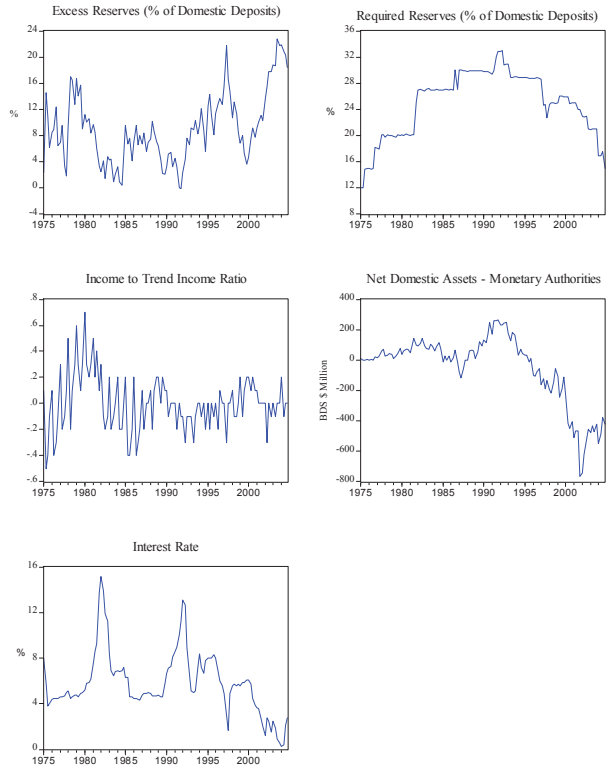
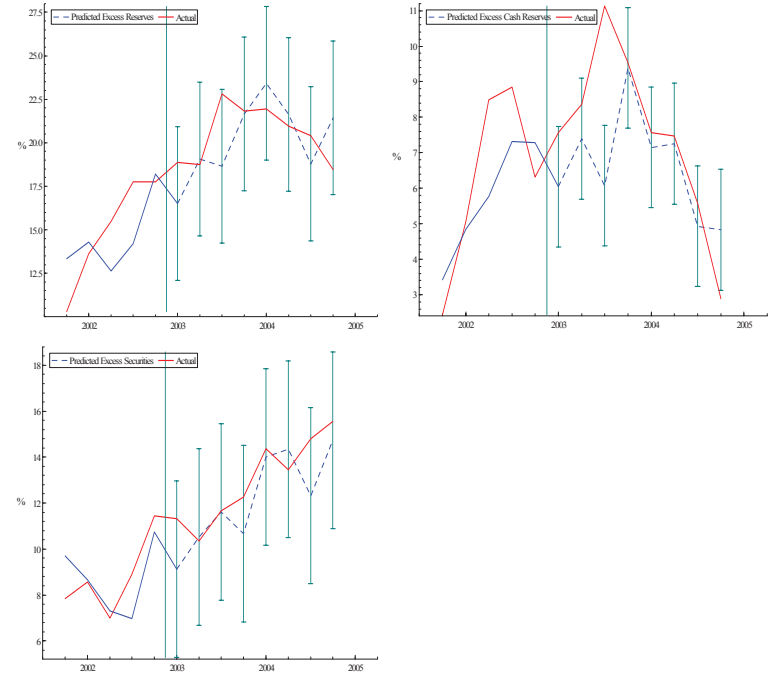


Figure 3: Actual and Predicted Excess Reserve Assets



**Figure 4: Actual and Predicted Excess Reserve Assets
(Dynamic Simulation: March 2000 to December 2004)**

