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EVALUATING MONETARY POLICY MEASURES IN A SMALL PRIMARY-EXPORTING ECONOMY

The Case of Trinidad & Tobago

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Introduction

Since the seminal work of Friedman and Schwartz (1963) economists generally agree that monetary policy can and does affect the real economy. In small highly open primary-exporting economies like that of Trinidad and Tobago, this still remains an empirical question. This is so largely because the effect on economic activity of other variables, notably, in this instance, the price of oil (over which monetary policy exercises no influence whatever), may very well have an attenuating effect and indeed may result in outcomes totally unanticipated by any policy measure. The effects of monetary policy on the real sector are likely to be uncertain since economic activity is so responsive to external factors that the outcome for the real sector may instead be a reflection of disturbances from this source rather than of monetary policy. In resolving such confusion one therefore requires empirical evidence rather than strict theoretical reasoning.

Even where economists agree that the real sector responds to monetary shocks, they generally do not agree upon the mechanism through which monetary policy measures are transmitted through the economy to the real sector and the nature and extent of the effects. This is why the transmission mechanism is referred to as a "black box" by Bernanke and Gertler (1995). Sims (1992) sums up the dilemma as follows:

> ... the (economics) profession as a whole has no clear answer to the question of the size and nature of the effects of monetary policy on aggregate activity p. 975

This paper represents an attempt, in the first instance, to determine empirically whether and to what extent monetary policy impacts the real sector in Trinidad & Tobago given the great dependence on oil (and in particular movements in the price of oil). The principal policy instrument used in Trinidad & Tobago over most of the period of the study is the Required Reserves Ratio (RRR). We will also be evaluating the effectiveness of this instrument as a tool of monetary policy and, indeed, if it ought to be considered a policy tool at all. Secondly, there is the question of the nature of the transmission mechanism in Trinidad and Tobago and, in particular, the relative importance of the different transmission channels from monetary policy to real activity.

The principal methodological tool will be a quarterly VAR model which will incorporate a deterministic/exogenous component to account for peculiarities of the monetary policy history of Trinidad & Tobago as well as the price of oil. The final specification retained will be determined following the application of a battery of tests which, in particular, will establish that the residuals of the reduced-form VAR are normally distributed, serially uncorrelated and homoscedastic. Bagliano and Favero (1998) are very critical of VAR studies that have ignored this step.

The rest of this paper is organized as follows: in the following section, the salient theoretical points are reviewed and discussed with a view to the peculiarities of an oil-based economy like Trinidad & Tobago. There follows a historical/analytical review of monetary policy measures in Trinidad and Tobago from 1970 to the present time. The modeling methodology and data used in the empirical study are then considered,

followed by specification of the model and an analysis of the empirical results obtained on the monetary policy issues. We then conclude the paper.

Theoretical considerations

There is a voluminous literature on the subject of monetary policy and its transmission to the real sector. There is considerable debate, in particular, on whether it is "money" rather than "credit" that is the conduit of choice of monetary policy measures. See Bernanke and Blinder (1988, 1992), Bernanke and Gertler (1995), Dale and Haldane (1995) and Sims (1992).

The "money" view emphasises the role of the "open market operations" of the monetary authority and, by extension, the existence of a vibrant market for bonds. It is difficult on *a priori* theoretical grounds to justify consideration of this view in the case of Trinidad & Tobago since there is no organised market for bonds in that country and open market operations, as they are traditionally conducted, are still very much in embryonic form. However, the monetary policy instrument of choice in Trinidad & Tobago has been the Required Reserves Ratio (RRR) and application of the RRR results in some fixed percentage of deposits being withdrawn from circulation. This restricts the ability of the commercial banks to "create" money, results in higher interest rates and a consequent fall in aggregate demand (and other effects on the real sector) which is very much the path predicted by the "money" school. The public may also hold real (physical) assets as an alternative to cash in the absence of a bond market.

The alternative "credit" view lays emphasis on commercial bank loans as the transmission mechanism. Restrictive monetary policy measures (such as an increase in the RRR) adversely affect the commercial banks' ability to make loans. Aggregate expenditure falls because borrowers face a credit crunch. Many have argued that the money channel and the credit channel are independent of each other but the opposite view is gaining ground. Bernanke and Gertler (1995) argue that the term "credit channel" is a misnomer and such a channel is in fact an enhancement of the money channel. They also argue very cogently that the credit channel is really two distinct channels – the balance sheet channel and the bank-lending channel. The first is in evidence when rising interest rates result in lower value of a firm's net worth and the consequent difficulty in raising funds by borrowing. The second (bank-lending) channel is in evidence when monetary contraction results in a fall in deposits which constrains the banks' ability to make loans.

Whether or not the credit channel is just another aspect of the money channel, it seems on *a priori* grounds to be the more likely conduit of monetary policy measures in Trinidad & Tobago where there exists a fairly sophisticated commercial banking sector. We will not be concerned in this paper about formally discriminating between the bank-lending and balance sheet channels but may speculate a little on the relative importance and influence.

In a highly open economy like Trinidad & Tobago, other transmission channels may be considered. Following De Fiore (1998), we will consider the rate of exchange. It was not until April 1993, however, that Trinidad & Tobago moved from a fixed to a floating rate of exchange. During the period of the fixed rate regime, it would seem that monetary impulses would not be transmitted through the exchange rate. However, during that

entire period, there was a lively black market where the "real" rate of exchange was likely to be more truly reflected. Indeed pressures in this market led to successive devaluations and eventually the liberalisation of the exchange rate regime. It is for this reason that, in this paper, we will consider a measure of the real exchange rate as a possible transmission channel. A contractionary monetary policy measure ought, *ceteris paribus*, to lead to an appreciation of the value of the local currency for at least two reasons. Firstly, liquidity shortages would curb the demand for imported goods so strengthening the balance of payments position. This is all the more likely in a petroleum based economy like Trinidad & Tobago where total exports are dominated by oil exports whose price is denominated in US dollars and not in the national currency. Secondly rising interest rates may slow down capital outflows and even encourage capital inflows. This second feature is not extremely likely since there is no real market, financial and otherwise, for assets denominated in Trinidad and Tobago dollars.

Whatever the nature of the transmission mechanism, and whether or not monetary measures will impact the real sector as it is expected to do in more developed economies, is more than likely to be attenuated by the peculiarities of the Trinidad & Tobago economy. The most likely attenuating factor will be the price of oil that is determined by considerations that lie outside the control of the local economy. Montiel (1991) presents an interesting set of stylized facts about the typical developing economy, some of which apply to the Trinidad & Tobago case, that can result in totally unanticipated effects of monetary policy measures.

Monetary policy initiatives in Trinidad & Tobago: 1970-1999

The evolution of monetary policy in Trinidad and Tobago can be divided into four broad periods: 1970-1974, 1975-1982, 1983-1989 and 1990-1999. Each phase represents a fundamental shift in not only policy objectives but also in the strategies and typology of instruments. See Farrell et al. (1994) for further details.

1970-1974

Although the Central Bank of Trinidad and Tobago was established in 1964 the conduct of monetary policy actually began two years later in 1966 as the relevant sections of the legislation required proclamation. During this period the Trinidad and Tobago (TT) dollar was pegged to the pound sterling and the monetary authorities sought to move domestic interest rates in line with international sterling interest rates by varying the rediscount rate. Free convertibility of TT dollars into pound sterling meant that local investors could move funds abroad and back again in response to large interest rate differentials. Changes in the rediscount rate were influenced by changes in the UK bank rate and served as a signal to commercial banks to alter their interest rate structure. However, by 1970, the pound sterling was declared foreign exchange and, as such, the Central Bank no longer needed this instrument since foreign exchange was now under its control. The rediscount rate became an inactive instrument after 1973.

Apart from the rediscount rate, the other main instrument of policy was the reserve requirement. Commercial banks were required to hold and maintain reserves with the Central Bank in two basic forms:

- Non-interest bearing cash reserves which took the form of a statutory minimum ratio (primary reserve);
- A voluntary reserve in the form of Treasury Bills and special deposits (secondary reserves). These secondary reserves facilitated banks in that they could hold excess reserves which were highly liquid and interest-bearing, while at the same time broadening their portfolio of assets.

The statutory reserve requirement was intended to control the monetary base and thus control the expansion of credit. The desired effects of increasing the reserve requirement would therefore be to reduce the money multiplier, and as such reduce the money supply, having a contractionary effect on the economy. However, the actual effects of such actions would also depend on the demand for money balances by the non-bank private sector and the demand for excess reserves by the banking system. Moreover, a restrictive or contractionary monetary stance results in higher interest rates that serve to attract deposits. An increase in deposits would ultimately raise the money supply, the extent to which is uncertain. Thus, in determining the impact on the real sector, the monetary transmission mechanism must be properly identified.

1975-1985

The year 1975 marked the start of a boom period resulting from the skyrocketing of oil prices. The country experienced rapid economic growth, a sharp build-up of foreign reserves, and increased government revenue. As a result, the Central Bank took a somewhat passive stance towards monetary policy, generally accommodating the expenditure and resource demands associated with the oil boom. Nonetheless, the following measures were implemented to keep the economy in check:

- Selective credit controls were imposed under which banks were required to restrict non-business loans to no more than 25% of incremental credit;
- Commercial banks were subject to a marginal reserve requirement of 15% in 1980;
- Non-bank financial institutions were required to hold reserves ranging 3-5% of their deposit liabilities with the Central Bank.

This period also marked the end of the link between the pound sterling and the TT dollar which was instead pegged to the US dollar. In 1979, limits were increased on the amount of foreign exchange commercial banks could release for imports of services. However, given the high marginal propensity to import in Trinidad & Tobago and the external debt build-up associated with the construction of a new industrial capacity, the effects were such that, by 1983, there was a rapid decline in the country's foreign exchange reserves. The Central Bank responded by introducing direct measures to control the purchase of foreign exchange for imports.

1986-1992

By 1986 oil prices had collapsed, leading to fiscal and balance of payments deficits, rising inflation and unemployment, and weak economic growth. The monetary authorities, wary of rapid and incipient inflationary pressures, undertook cautious expansionary monetary policy actions in an effort to slow the rate of economic decline. The idea was to lower the level of interest rates by reducing the reserve requirement so as to facilitate investment and encourage economic revival. However, the commercial banks had large credit exposures to cyclically sensitive sectors such as manufacturing and construction that at this time could not afford to repay their loans. Consequently, commercial banks wound up with deteriorating asset positions – two indigenous banks were restructured and eventually merged with a third - while the non-bank sector experienced severe financial distress as evidenced by the failure of six Finance Houses. Lax regulations on the part of the non-bank sector led to unsound business and investment decisions that, in turn, further deteriorated the quality of asset portfolios. In 1986 a deposit insurance scheme managed by the Deposit Insurance Corporation (DIC) became compulsory for all licensed financial institutions.

The primary reserve requirement was further reduced and the secondary reserve requirement was increased, so keeping the overall reserve ratio fixed but altering the portfolio of the banks' assets. Commercial banks now held less of their deposits as primary reserves, and more in the form of secondary reserves (largely Treasury Bills) which were interest bearing.

By 1989, the authorities turned to the IMF to help put the economy back on a stable path. The country entered into two back-to-back stand-by arrangements with the Fund whose conditionalities inevitably shaped the policy arena, including the future thrust of monetary policy. The IMF required Government to reduce its budgetary deficits which inevitably meant wage restraint (and in some cases wage cuts) in the public sector and state enterprises. This was a period of considerable unrest which culminated in an attempted coup d'état by a fringe Muslim organisation and the electoral defeat of the government in power.

During this turbulent period, monetary targets were established, limits put on commercial bank lending to state enterprises and statutory authorities, and on Central Bank lending to central government.

1993-1999

The process of economic liberalization following the Fund programme was hastened in this period. The IMF encouraged the Government to liberalize trade and to dismantle controls on current and capital transactions, ostensibly to help arrest the decline in international reserves. The negative list was removed leading to the collapse of many "screw-driver" type industries who were no longer protected from foreign competition. Those that could not survive in such an environment were forced either to lay off workers or close down completely, resulting in increased unemployment.

Additionally, the country was faced with a serious problem of debt servicing. A great proportion of the government's income was used to service these debts, and more so, the

interest incurred. Thus, less funds could be used for developmental purposes and in such areas as the health and social sectors. The standard of living of many fell during this period but the economy also began to show signs of sustainable recovery.

The Central Bank, in these circumstances, moved to defend domestic interest rates so as to minimize short-term capital movements that appeared to be quite responsive to US/TT interest rate differentials. In doing so, and at the same time preserving the exchange rate, the Bank increased the required reserves ratio and made active use of moral suasion. The Bank also increased its Open Market Operations through the sale of treasury bills to commercial banks, in response to sustained high levels of liquidity in the system.

Modelling and data framework

In this section we develop the basic modelling framework to be used in the empirical study. The point of departure is a structural VAR model of the Trinidad & Tobago economy of the form:

$$\Pi_0 \mathbf{y}_t = \Pi_1 \mathbf{y}_{t-1} + \Pi_2 \mathbf{y}_{t-2} + ... + \Pi_n \mathbf{y}_{t-n} + \mathbf{B}_0 \mathbf{x}_t + \mathbf{B}_1 \mathbf{x}_{t-1} + \mathbf{B}_2 \mathbf{x}_{t-2} + ... + \mathbf{B}_1 \mathbf{x}_{t-m} + \varepsilon_t \qquad (1)$$

where $\mathbf{y}_t$ is a px1 vector of jointly determined endogenous variables, $\mathbf{x}_t$ is a kx1 vector of deterministic/exogenous variables, Π_i (i=1, 2, .., n) and $\mathbf{B}_j$ (j= 1, 2,.., m) are p×p and k×p coefficient matrices, and ε_t is a vector of orthogonal innovations that are uncorrelated with the **x** variables.

The **y** vector must comprise a monetary policy instrument, potential channels of transmission of monetary policy and target real variables. Monetary policy in the context of the VAR model considered in this paper is partly exogenous and partly endogenous. It is exogenous because the policy instrument is, in the final analysis, perfectly controllable by the monetary authority and innovations to this instrument are generated autonomously. But it is endogenous because there are also "within-period" feedbacks so that unpredictable movements in the monetary policy variable are generated in part by disturbances originating elsewhere in the economy. This endogenous response occurs through the monetary authority's reaction function which is likely to be influenced by movements in the (short-term) rate of interest which must therefore also appear among the endogenous variables.

The policy instrument already identified is the Required Reserves Ratio that the Central Bank imposes on the commercial banking sector. The potential channels of transmission are bank deposits (the money channel), bank loans (the credit channel) and the exchange rate. In order to keep the VAR to manageable proportions, we target only two real variables – real GDP and the price level – while short-term interest rates are represented by the rate on bank loans. There are thus seven (7) endogenous variables in the system.

We are also hypothesising that effects of the monetary measures will be affected by the price of oil which enters into the system as an exogenous variable and consequently among the **x** variables. We also believe that, in the tradition of the "narrative" approach of Romer and Romer (1989), the model should incorporate the historical record of

monetary policy measures (discussed in the previous section). This will be done using a series of dummy variables.

There are several issues to be resolved in applying the general framework defined by (1). There is, in the first instance, the identification problem which Sims (1980) resolves using the Choleski decomposition. This requires the triangularisation of Π_0 which translates into the orthogonality of the reduced form innovations of (1). But then the ordering of the variables is of crucial importance to the analysis. This shortcoming is usually overcome in monetary policy studies by assuming that there is no contemporaneous feedback from the non-policy variables to the policy variable. This is tantamount to putting the monetary policy instrument at the top of a recursively ordered system (implied by the triangularisation of Π_0). In the words of Dale and Haldane (1995) "the recursive mapping between the policy and non policy variables then constitutes a valid representation of the monetary transmission process".

This ordering, however, is quite restrictive. In the first place there may be no theoretical justification for assuming that there is no contemporaneous feedback from the non-policy variables to the policy variable, especially in a model using quarterly data. Furthermore, it does not solve the problem of the ordering of the non-policy variables. In a recent paper, Pesaran and Shin (1998) propose a more general alternative to the Choleski decomposition which is unaffected by the ordering of the variables and which does not require the orthogonalisation of the reduced form innovations. It is this procedure that will be employed in this paper.

A second issue is the measurement of variables already identified for incorporation into the model and the periodicity of the data. Relatively reliable monthly data, dating back to 1970 and even earlier, exist for the required reserves ratio, the (nominal) exchange rate, the loan rate (on bank loans), the volume of bank loans, commercial bank deposits[1], the retail price index and the oil price. There is no corresponding series for GDP. However, since 1982, the Central Bank has been publishing a quarterly real GDP index. Otherwise, all GDP data are available only in annual format. Given the importance of GDP to the study, we decided to use quarterly data. Our series cover the period 1971, first quarter, to 1998, fourth quarter. We explain below how we used the quarterly GDP index to generate a GDP series covering the entire period. Data sources are provided in the appendix.

Some of the data had to be massaged in order to be used in the model. We first had to calculate a real exchange rate using the nominal rates. This was done using the formula:

$$RER = NER \frac{USCPI}{RPI}$$

[1] A "total deposits" figure was used representing the sum of demand, savings, time deposits and foreign deposits. The latter became available only from April 1993 when the floating rate regime was introduced.

where RER and NER are, respectively, the real and nominal exchange rates (expressed in TT dollars per US dollar), USCPI the US consumer price index and RPI the Retail Price Index of Trinidad and Tobago.

A quarterly series for real GDP is computed in two steps. In a first step, annual constant price data for the period 1971 to 1981 are converted to quarterly data using a method proposed by the Lisman and Sandee (). Secondly, GDP growth rates derived from the Central Bank Quarterly (real) GDP index were applied from 1982, first quarter, to 1998, fourth quarter (using the value for 1981, fourth quarter, as an initial value) to generate quarterly GDP series from 1982 to 1998. We should note, *en passant*, that there is some suggestion in the literature that current values should be preferred to constant price values. Sims (1972), for instance, argues that causation runs from money to money income. See also Laidler (1978).

Dummy variables are defined to account for the monetary policy history of Trinidad & Tobago. In summary, four such variables are defined as follows:

D_1= 1 if observation is made in the period 1971-1974, 0 if not.

D_2= 1 if observation made in the period 1975-1985, 0 if not.

D_3= 1 if observation made in the period 1986-1993, 0 if not.

D_4= 1 if observation made in the period 1994-1998, 0 if not.

Model Specification

All variables except the "rates" (required reserve ration and loan rate) enter into the model in logarithmic form. The variables were all tested for unit roots and all appeared to be I(1). In the presence of these non stationary series, we tested for the presence of cointegrating vectors using the procedure suggested by Johansen (1988) and determined the existence of long-run relationships. It was therefore decided to use "levels" rather than first differences which makes our system equivalent to a VAR error correction system. See Johansen (1988).

Enders (1995), p. 312-5, discusses a procedure to determine the optimal lag length for the VAR. However, this procedure may only be applied if the residuals from each equation form a normal white noise process. See Bagliano and Favero (1998). We therefore decided to determine beforehand a lag stucture for the model whose associated residuals would be:

- Normally distributed
- Serially uncorrelated
- Homoscedastic

Once we were satisfied with this we would proceed to determine if the lag length chosen is optimal or if a more parsimonious lag structure might be an alternative candidate. Such a candidate would be accepted as an alternative only if it is a normal white noise process (which must be verified by formal testing).

We started with a model containing 14 lags and considered lower values. The most parsimonious structure satisfying the criteria contained 12 lags. Table 1 below shows the p-values associated with the corresponding tests:

Table 1

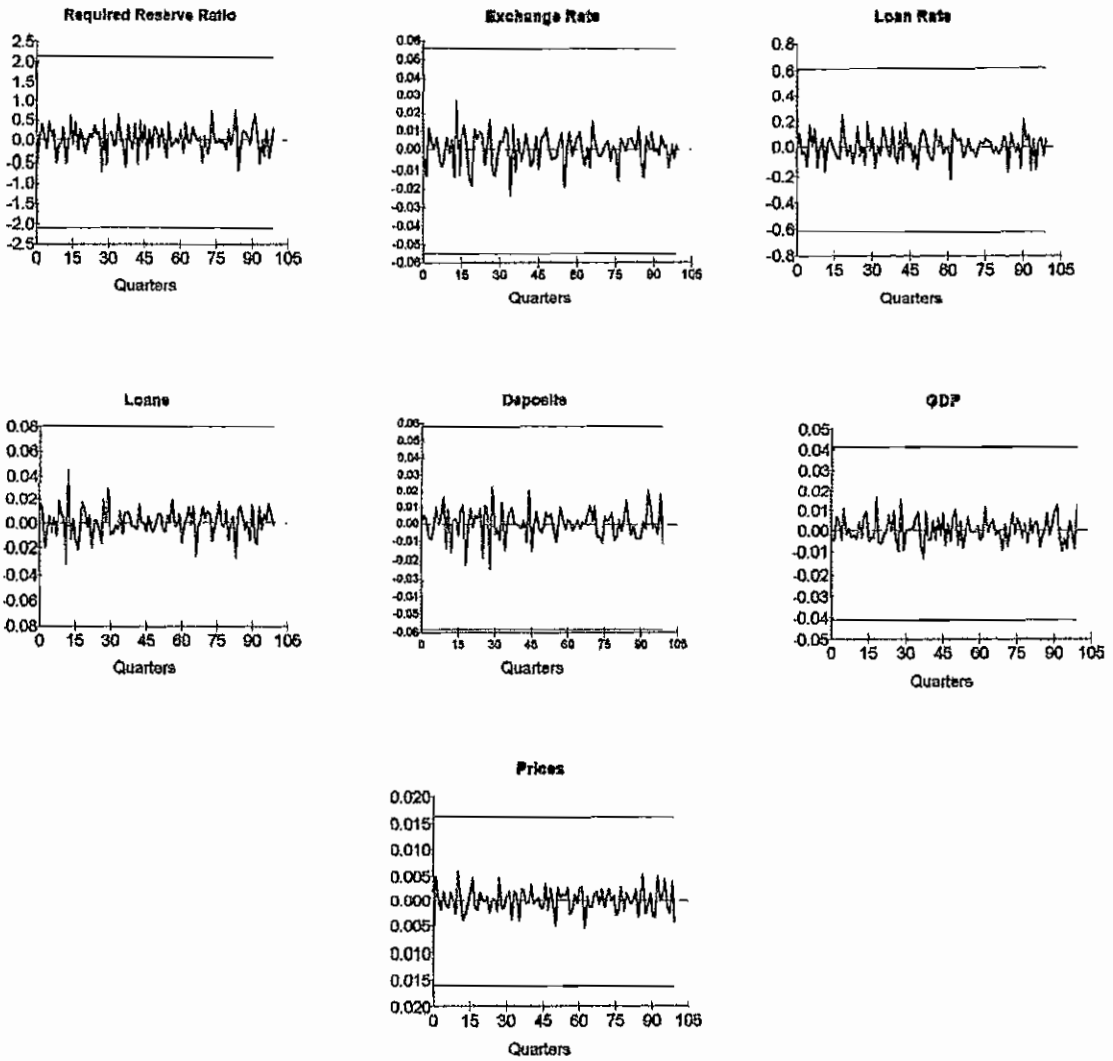
P-values associated with Jarque-Bera test for Normality, Breusch-Godfrey test for Serial Correlation and Koenker's test for Heteroscedasticity

Variable	Normality	Serial correlation	Heteroscedasticity
Required Reserves	0.746	0.296	0.470
Exchange rate	0.329	0.171	0.200
Loan Rate	0.711	0.037	0.928
Loans	0.041	0.028	0.015
Deposits	0.658	0.343	0.438
GDP	0.243	0.181	0.020
Prices	0.701	0.017	0.588

The results are very satisfactory except for the case of the loans equation where the null hypotheses have to be rejected at levels as low as 1%. A plot of the residuals is shown below in Figure 1:

Figure 1

Plot of Residuals from VAR regression
(2 S.E. bands are shown)



All the residuals, including those of the loan equation, are well within the 2 standard error limits, confirming the conclusions drawn above.

The results of the lag-length tests, with 12 lags as the null, are shown in Table 2 below:

Table 2

Test Statistics and Choice Criteria for Selecting the Order of the VAR Model

Order	LL	AIC	SBC	LR test	Adjusted LR test
12	2080.7	1443.7	613.9843	------	------
11	1811.1	1223.1	457.1381	CHSQ(49)= 539.3457[.000]	48.5411[.492]
10	1558.8	1019.8	317.7308	CHSQ(98)= 1043.8[.000]	93.9432[.597]
9	1432.9	942.9325	304.6658	CHSQ(147)= 1295.6[.000]	116.6037[.969]
8	1326.5	885.5067	311.0666	CHSQ(196)= 1508.4[.000]	135.7604[1.00]
7	1212.5	820.5073	309.8940	CHSQ(245)= 1736.4[.000]	156.2803[1.00]
6	1153.7	810.6502	363.8635	CHSQ(294)= 1854.2[.000]	166.8745[1.00]
5	1117.3	823.3256	440.3656	CHSQ(343)= 1926.8[.000]	173.4130[.000]
4	1072.5	827.4930	508.3596	CHSQ(392)= 2016.5[.000]	181.4828[.000]
3	1021.1	825.1108	569.8041	CHSQ(441)= 2119.2[.000]	190.7316[.000]
2	993.0966	846.0966	654.6165	CHSQ(490)= 2175.3[.000]	195.7742[.000]
1	948.5076	850.5076	722.8542	CHSQ(539)= 2264.4[.000]	203.8002[.000]
0	6.7621	-42.2379	-106.0645	CHSQ(588)= 4147.9[.000]	373.3144[.000]

AIC=Akaike Information Criterion SBC=Schwarz Bayesian Criterion

Using the Adjusted LR test (the procedure recommended by Sims (1980)), the null is not rejected against the alternatives of lags of lower order (from 11 or 6 lags). The Schwarz Bayesian criteion suggests a lag length of 9 and the Akaike Information Criterion a lag length of 6. All these structures, however, were not as convincing in satisfying the first-stage criteria (normality etc.) and in some cases there was outright rejection of the null of normality (p-values equal to zero to 5 places of decimal). We therefore retained the 12-lag specification.

We performed a series of bloc causality tests on the endogenous variables in the system. In all cases the null of non-causality was convincingly rejected with p-values in all cases zero to three decimal places. We then carried out variable deletion tests on the exogenous oil price and dummy variables. In the case of the dummies, both individually and collectively, the null was rejected with p-values of zero to three places of decimal. In the case of the oil price, the original model contained lags from 1 to 5. When they were individually tested, the lag 1 value displayed a p-value of 0.541 while the others, individually and collectively, had p-values very close to zero. The final model therefore contains the dummies and the oil price lagged from 2 to 5.

Analysis of results

The model retained may be considered the best fit available from the data. The statistical significance of the dummies shows clearly that the various monetary policy regimes must be taken into account in order to carry out the analysis effectively. The statistical significance of the oil-price variable, an exogenous variable in the system, means that exogenous monetary policy shocks can be "tainted" by movements in this variable so clouding the effects of such measures.

In Table 3 and Figure 3 below, we display Pesaran and Shin's generalized impulse responses over a 5-year period (20 quarters) to a one-standard-error shock to the required reserve ratio series. For the variables expressed in logarithmic form, these responses trace out a growth rate relative to the base period when the shock occurred. For those which

are not (and which are expressed as rates), the responses trace out the percentage point changes relative to the base period.

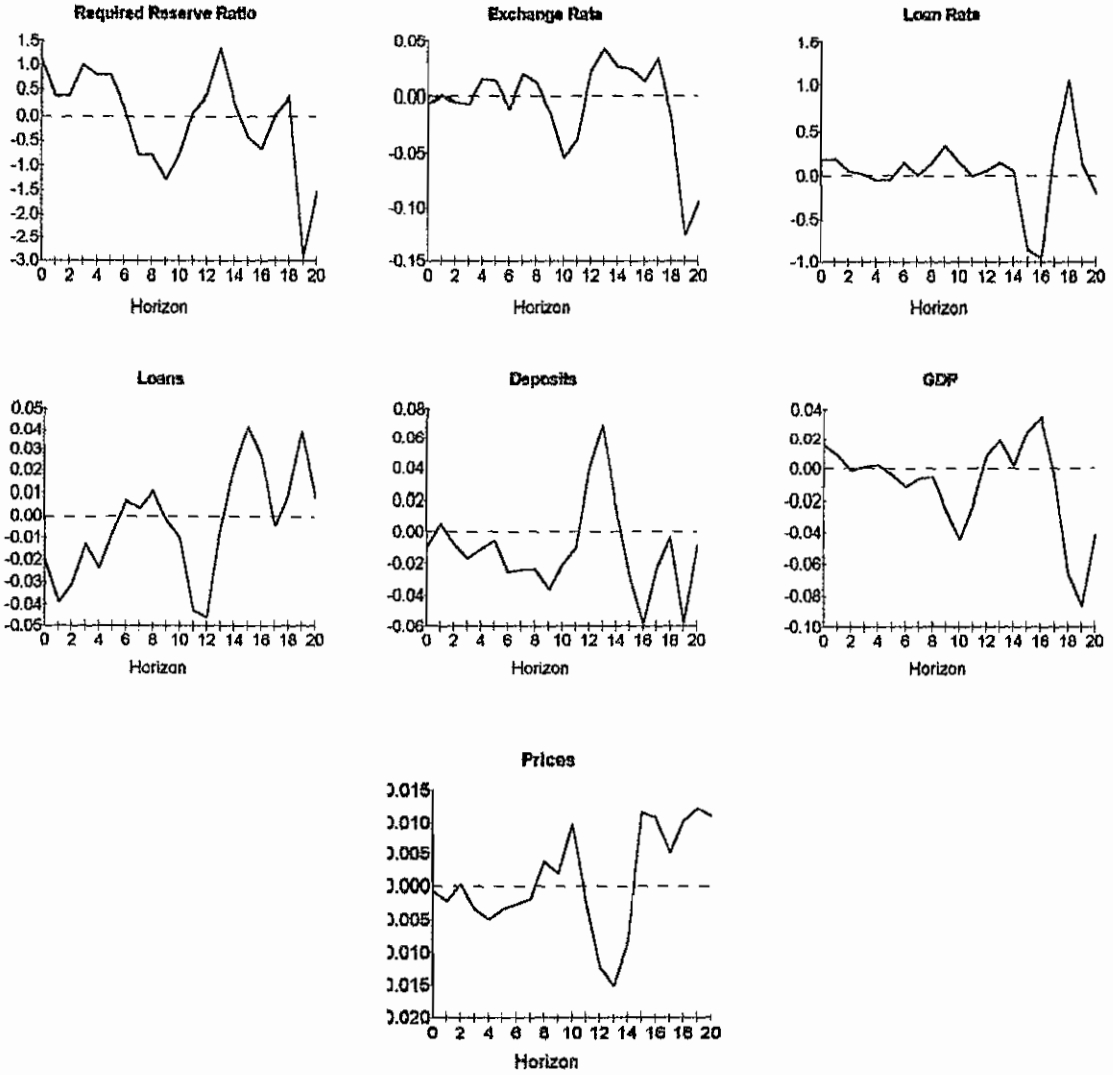
Table 3

Generalised Impulse Responses to one SE shock in the equation for Required Reserves Ratio (RRR)

Horizon	RRR	Ex. Rate	Loan Rate	Loans	Deposits	GDP	Prices
0	1.0571	-.0059466	.16874	-.021117	-.010156	.015248	-.9289E-3
1	.34342	-.4938E-3	.18474	-.039291	.0042905	.0082353	-.0021580
2	.35802	-.0042409	.043189	-.031680	-.0089688	-.0021109	.8144E-4
3	.96461	-.0070198	.0077689	-.013706	-.017601	.4201E-3	-.0035038
4	.75820	.014136	-.061767	-.024286	-.011690	.0017685	-.0049785
5	.75099	.011820	-.047196	-.0083762	-.0064035	-.0049243	-.0034160
6	.13905	-.010916	.14266	.0064204	-.026337	-.012654	-.0026446
7	-.79542	.018017	-.0060802	.0030725	-.024590	-.0073902	-.0018770
8	-.81608	.010624	.13702	.010130	-.024270	-.0060273	.0036124
9	-1.3035	-.014722	.32750	-.0027634	-.037195	-.026662	.0016640
10	-.78395	-.054719	.15108	-.010847	-.021341	-.045168	.0097324
11	.052096	-.037534	-.013155	-.043337	-.011029	-.022958	-.0022602
12	.37712	.021297	.054078	-.046287	.039608	.0080873	-.012349
13	1.3137	.042468	.14442	-.0064197	.069012	.018818	-.015241
14	.22073	.025559	.044079	.020125	.013361	.0014803	-.0084400
15	-.46396	.023599	-.87225	.040564	-.029153	.025079	.011578
16	-.69723	.012706	-.96602	.025776	-.058671	.034559	.010790
17	.022851	.032940	.34086	-.0050659	-.023134	-.0072464	.0050204
18	.34010	-.019938	1.0467	.0090405	-.0043658	-.067054	.010325
19	-2.9396	-.12531	.11529	.038310	-.058285	-.086939	.012116
20	-1.5727	-.094586	-.20511	.0075576	-.0098490	-.042106	.011101

Figure 3

Graph of Generalised Impulse Responses to one SE shock in the equation for Required Reserves Ratio (RRR)



Let us begin by looking at the responses over the first two years or so where the theory predicts that the policy shock is likely to have greatest effect. The results generally support the predictions of the theory but there are some puzzles. They indicate that a tight money policy results generally in interest rate values above the base. There is an immediate fall off in bank loans for most of the initial period, possibly on the heels of higher borrowing costs. The exchange rate appreciates in the first instance (which is what

is expected) but then depreciates (it is denominated in TT dollars so that a minus sign indicates an appreciation). The monetarists predict that, in a situation of rising interest rates, bank deposits would rise rather than fall. Paradoxically, however, bank deposits decline for the better part of three years and GDP rises for a substantial part of the early period. At the same time, prices decline.

One plausible explanation for the falling deposits is that economic agents respond to the initial shock by drawing down on accumulated deposits rather than through raising loans. The "policy reaction" function of the monetary authority in this early period is of considerable interest in this regard and seems to be in direct response to this possibility. There is no marked tendency for the policy instrument to return to base following the initial shock and this is clearly because there are some unanticipated results, such as falling bank deposits. The response to a policy measure that is not working as expected is to try more of the same and to keep the dosage going. The monetary authority succeeds generally in maintaining lower price levels for most of the first four years as well as higher interest rates which seems to result, eventually, in slowing down growth in the economy. But deposits keep falling which is not inconsistent with the eventual sustained decline in production (GDP) and the depreciation of the national currency.

But there may be other unseen factors at work which are responsible for some of the unexpected consequences of a tight money policy. One of the main features of a primary exporting country like Trinidad & Tobago is the high propensity to import, especially intermediate and capital goods which have a direct impact on levels of production. The major exporters, like the oil companies, earn and often deposit large amounts of their earnings abroad (in foreign banks). A tight money policy, especially a sustained one, may encourage such tendencies further (and may even encourage capital flight) as it jeopardises the smooth financing of business activity. This is consistent with falling deposits, falling production levels and devaluation of the national currency.

The foregoing discussion tends to give some credence to all three channels of transmission hypothesised at the beginning of this paper viz. the money, credit and exchange rate channels. But what are their relative strengths? A study of the Forecast Error Variance Decomposition will help to elucidate that. Such a decomposition provides information about the relative influence on any one variable of the random innovations of the rest of the variables making up the system.

Since we are interested in the effect of the monetary policy on the real variables, consider first the forecast error variance decomposition of GDP and Prices shown, respectively, in Tables 4 and 5, and Figures 4 and 5 below. This is the generalised forecast error variance decomposition due to Pesaran and Shin (1998). One minor drawback in using this rather than one based on orthogonalised responses is that the row totals do not sum to unity. This makes their interpretation over time somewhat clumsy but not at all impossible.

Table 4

Pesaran and Shin's Generalised Forecast Error Variance Decomposition for variable GDP

Horizon	RRR	Ex. Rate	Loan Rate	Loans	Deposits	GDP	Prices
0	.54382	.019595	.31316	.057596	.27156	1.0000	.27463
1	.41748	.019870	.19168	.092529	.31117	.66859	.17886
2	.31193	.18210	.27461	.18141	.22975	.49719	.13285
3	.25286	.25922	.28165	.27434	.19094	.41286	.12119
4	.19369	.35081	.27333	.37725	.15488	.31437	.092082
5	.18213	.35134	.32495	.36450	.15522	.29783	.11169
6	.21302	.29100	.31837	.28783	.26360	.36055	.14306
7	.22423	.27652	.30548	.27949	.29070	.36337	.13561
8	.21219	.24563	.28464	.30353	.26901	.32249	.14647
9	.34882	.20247	.32441	.29253	.24865	.38572	.10896
10	.47547	.18835	.33466	.17423	.43765	.54718	.072879
11	.44539	.20366	.34328	.14470	.50127	.54949	.065832
12	.35230	.28092	.30437	.25550	.44394	.42759	.053374
13	.29068	.29140	.28802	.37924	.33599	.33438	.047278
14	.23661	.30240	.31466	.42141	.30398	.27937	.064142
15	.25376	.28721	.29428	.44989	.28551	.27834	.060150
16	.28703	.26224	.29499	.41541	.28539	.33132	.089244
17	.26721	.24378	.27227	.40628	.29165	.31145	.096587
18	.36495	.19588	.23144	.43315	.25940	.38820	.092216
19	.47305	.14981	.21199	.39679	.26726	.48535	.081555
20	.46321	.16531	.19578	.35417	.30086	.47717	.073046

Figure 4

Pesaran and Shin's Generalised Forecast Error Variance Decomposition for variable GDP

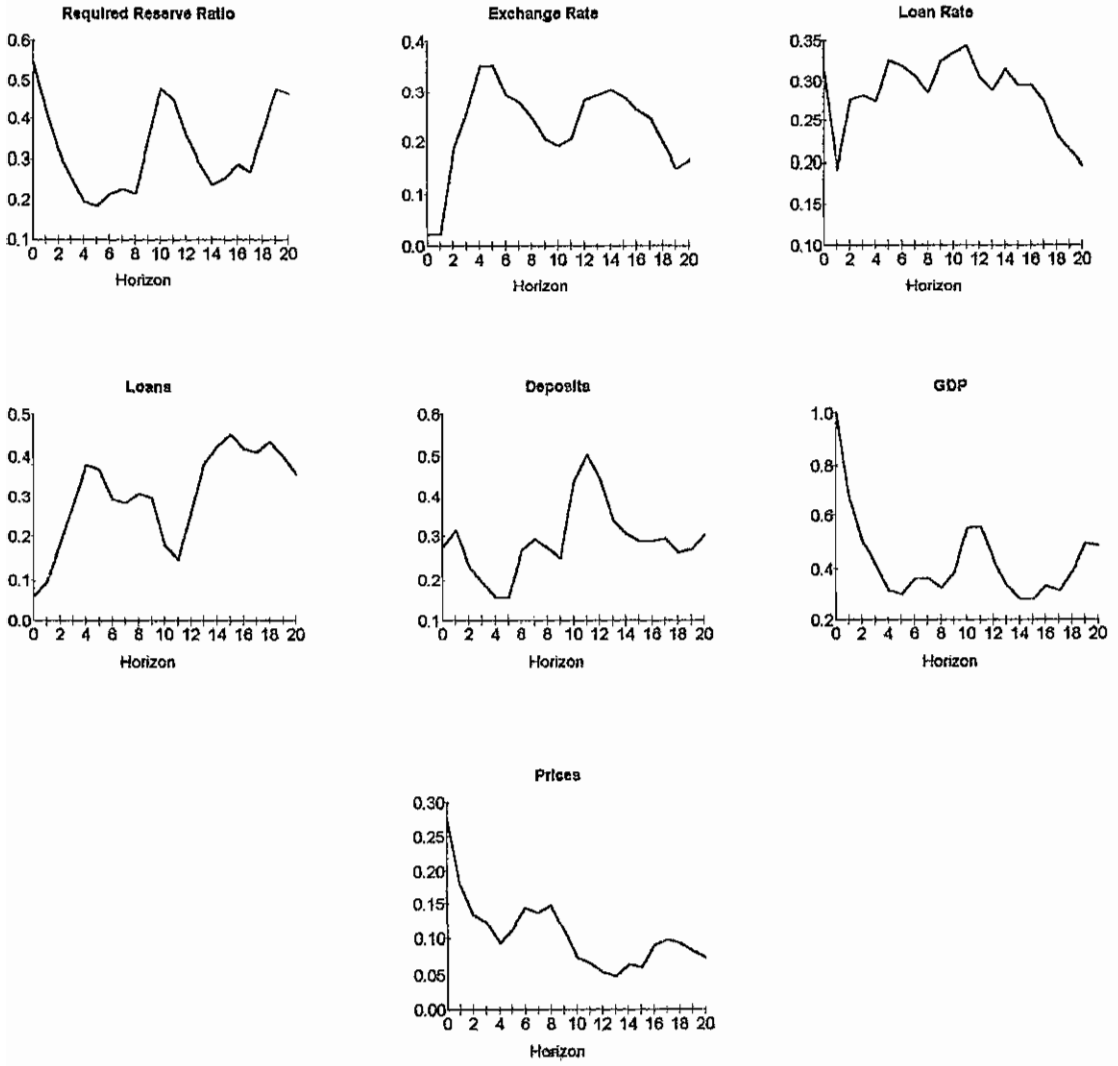


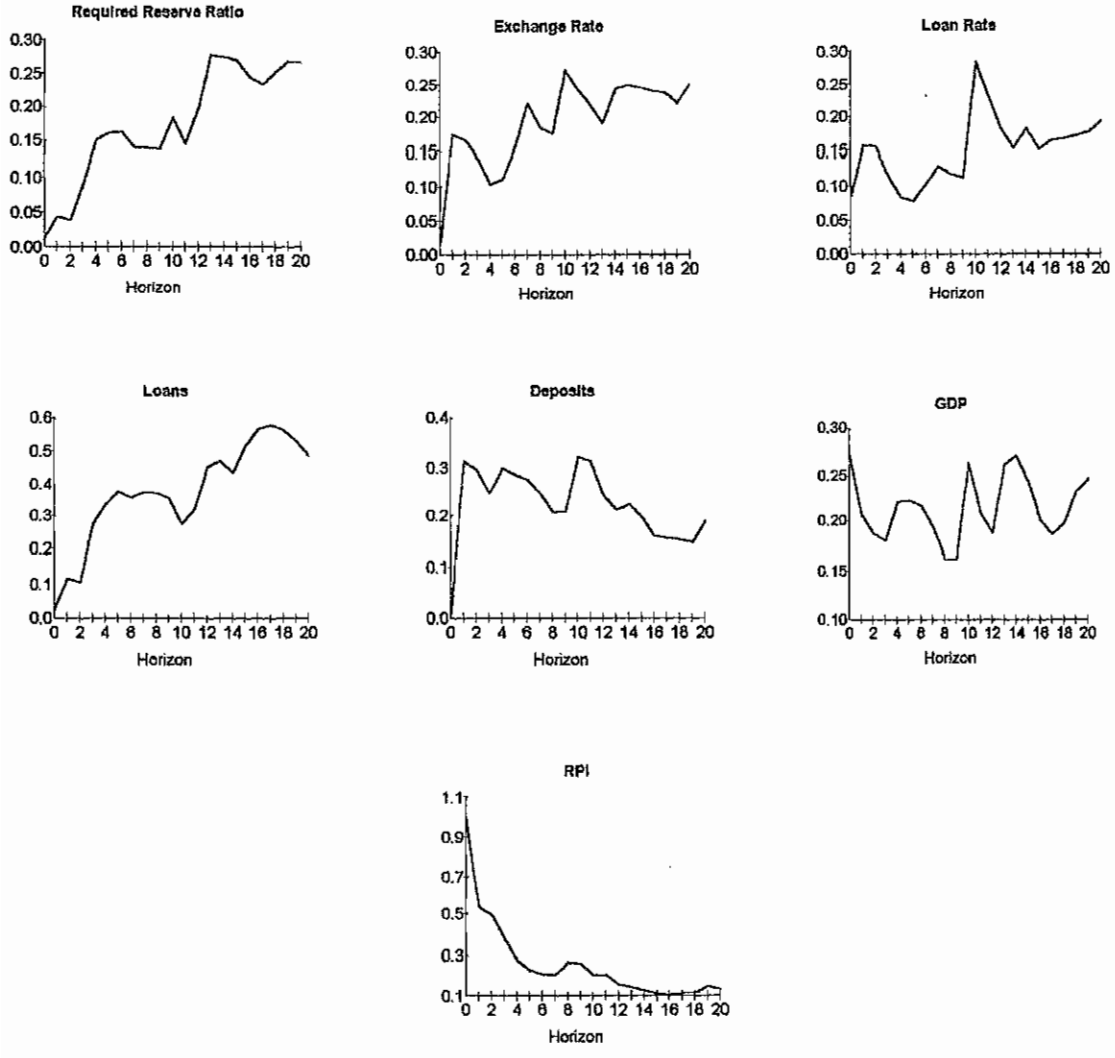
Table 5

Pesaran and Shin's Generalised Forecast Error Variance Decomposition for variable Prices

Horizon	RRR	Ex. Rate	Loan Rate	Loans	Deposits	GDP	Prices
0	.013192	.013246	.084218	.024618	.0015260	.27463	1.0000
1	.041972	.17259	.15554	.11322	.30996	.20702	.52996
2	.036813	.16389	.15390	.10293	.29450	.18677	.48922
3	.087613	.14034	.11410	.27190	.24285	.17856	.36951
4	.14877	.10282	.082194	.32955	.29685	.21993	.26786
5	.15816	.11011	.076675	.37285	.28544	.22234	.22371
6	.16032	.15628	.10285	.35208	.27398	.21616	.20384
7	.13803	.21997	.12792	.37107	.24286	.19425	.20114
8	.13784	.18310	.11704	.36659	.20384	.16157	.26456
9	.13562	.17401	.11177	.35059	.20696	.16132	.25656
10	.18053	.27211	.28341	.27067	.31880	.26316	.19926
11	.14272	.24141	.23012	.31437	.31029	.20724	.20327
12	.19694	.21667	.17981	.44949	.23812	.18752	.15205
13	.27561	.18929	.15240	.46850	.20933	.26245	.14021
14	.27284	.24213	.18021	.43054	.22070	.27099	.12380
15	.26731	.24853	.15028	.50952	.19396	.24328	.10692
16	.24339	.24417	.16303	.56050	.15590	.19983	.10056
17	.23152	.23870	.16522	.57243	.15198	.18524	.11029
18	.25010	.23564	.16993	.55888	.14896	.19833	.11030
19	.26669	.21962	.17574	.52585	.14274	.23229	.14455
20	.26503	.24976	.19249	.48255	.18643	.24663	.13020

Figure 5

Pesaran and Shin's Generalised Forecast Error Variance Decomposition for variable Prices



It will be noticed that, over time, GDP plays a relatively important role in its own forecasting but this is not true for the prices variable. In both cases, however, we notice that the required reserves ratio also plays a very influential role, confirming that the policy instrument does have an impact on the real sector. In fact after 20 periods it has the largest influence on GDP after GDP itself, and the largest influence on the price variable after loans. This confirms the statement of Bernanke and Gertler (1995), p. 29, that " although an unanticipated tightening of monetary policy typically has only *transitory* effects on interest rates, a monetary tightening is followed by *sustained* declines in real GDP and the price level".

What about the relative importance of the various transmission channels? The exchange rate has a steadily rising increase on GDP in the earlier period but then there is a marked decline. Its influence on prices increases steadily, with fluctuations. Loans (the credit variable) has a steadily increasing influence on both GDP and prices and, in the end, has the strongest influence of all three channels. Deposits (the money variable) influences both GDP and prices greatly in the earlier period but its influence peaks after about 12 quarters.

All in all, the three channels are valid. However, the money channel seems more influential in the short run while the credit channel is more important in the long run.

Table 6 and Figure 6 below show the Variance Decomposition for the required reserves ratio which helps us to understand better the monetary authority's policy reaction function.

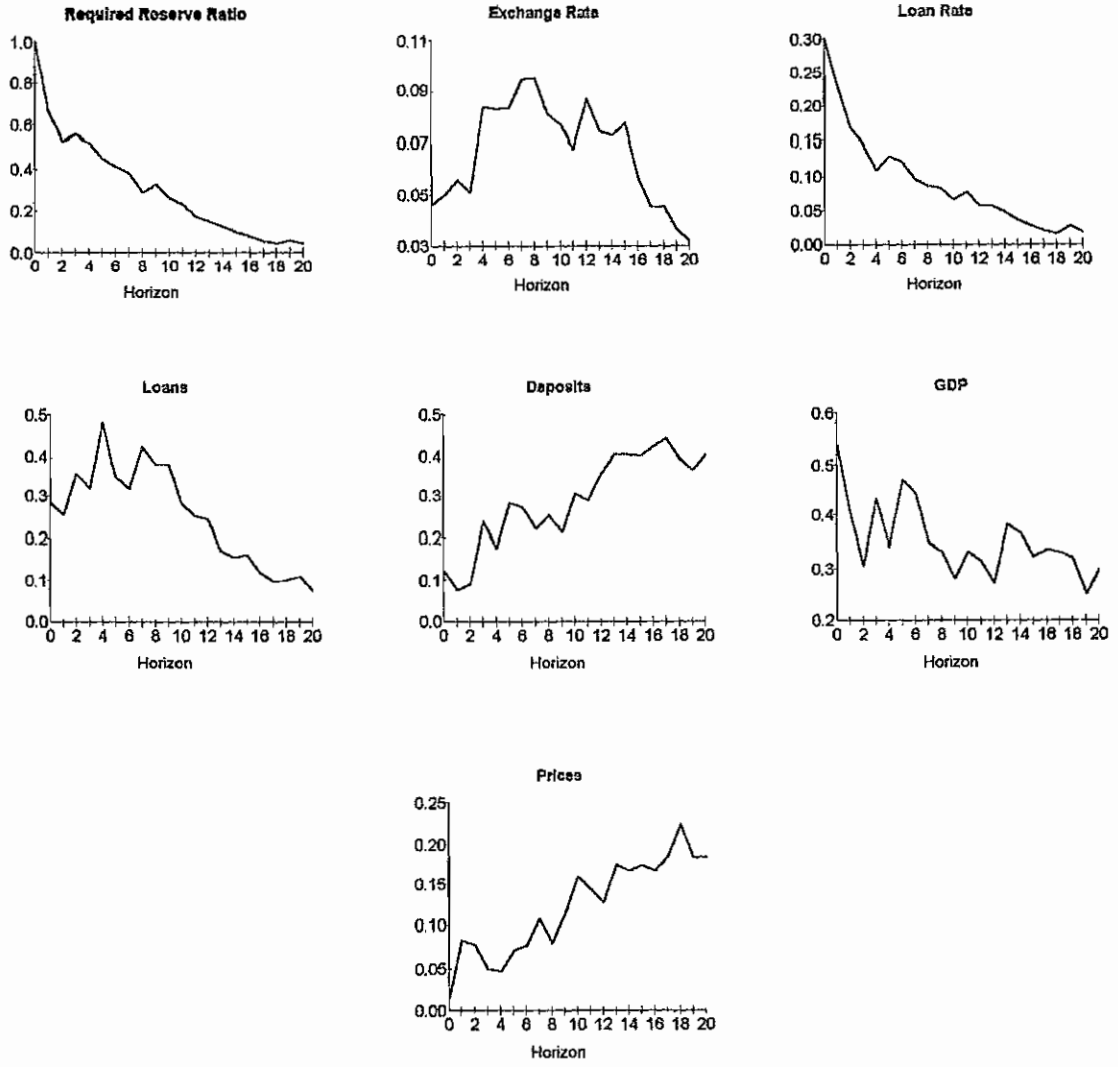
Table 6

Pesaran and Shin's Generalised Forecast Error Variance Decomposition for variable Required Reserves Ratio (RRR)

Horizon	RRR	Ex. Rate	Loan Rate	Loans	Deposits	GDP	Prices
0	1.0000	.045746	.29776	.27904	.12134	.54382	.013192
1	.65143	.049604	.22842	.25039	.074613	.40512	.082834
2	.52398	.055379	.16646	.35152	.089154	.30354	.077516
3	.55076	.050557	.14313	.31687	.23377	.42938	.048498
4	.51478	.083171	.10776	.47893	.17482	.33931	.046940
5	.44319	.082188	.12790	.34476	.27907	.46730	.071543
6	.40444	.082668	.11974	.31473	.26851	.44059	.077244
7	.37558	.093941	.095209	.42092	.21725	.34619	.10581
8	.28266	.094361	.084929	.37783	.24823	.33091	.080076
9	.32103	.080170	.082280	.37865	.20800	.27954	.11256
10	.25455	.076007	.065536	.27841	.30315	.33036	.15818
11	.22524	.067587	.076087	.24680	.28571	.31227	.14227
12	.16760	.086356	.057134	.23944	.35432	.27041	.12617
13	.14329	.073495	.056207	.16882	.40286	.37957	.17490
14	.11996	.071920	.047154	.15225	.40369	.36139	.16649
15	.090934	.076584	.034909	.15833	.40017	.32078	.17368
16	.069992	.056431	.026930	.11604	.42175	.33408	.16727
17	.049070	.044999	.019194	.093851	.44000	.32956	.18494
18	.037990	.045147	.014781	.096731	.39297	.31879	.22220
19	.050726	.036135	.026653	.10695	.36495	.24933	.18325
20	.036078	.031505	.016899	.073027	.40226	.29586	.18451

Figure 6

Pesaran and Shin's Generalised Forecast Error Variance Decomposition for variable Required Reserves Ratio (RRR)



We notice that its "own" influence declines steadily to zero which is consistent with an adjustment of monetary policy to the (one-for-all) shock. However, the decline is far from exponential for reasons we have already suggested.

Conclusion

There is ample evidence from this study that monetary policy measures do have an impact on the real sector. Moreover, the Required Reserve Ratio is useful as an

instrument of monetary policy. There also emerges the conclusion that the three channels of transmission - money, credit and the exchange rate - matter in the monetary transmission process, but that the credit channel may have a more influential role in the long run. There are, however, some limitations.

Firstly there are limitations imposed by the peculiarities of an economy like that of Trinidad & Tobago. It is clear that activity in the petroleum sector, dominated as it is by the price of oil, colours these conclusions somewhat. Secondly, there are problems inherent in the data employed. Some data like GDP, are not available as required. Then the model uses aggregates and, in particular, it aggregates all sectors of the economy. Dale and Haldane (1995) have found that, in the United Kingdom, the monetary transmission process in the "personal" sector may differ from that of the "corporate" sector. In particular, they found that the players in the personal sector increased their holdings of bank deposits following an increase in interest rates while those in the corporate sector hold less. It is possible that the Trinidad & Tobago data used in this paper are dominated by the corporate sector but it may also mean that the personal sector responds differently in Trinidad & Tobago from the United Kingdom.

It is, however, an interesting start to a debate on a well known subject within the framework of a small open economy where the endogeneity of money and monetary policy is often taken for granted. The next step will be to look at similar economies where data scarcity may be an even greater constraint. But the questions posed need to be answered as there are obvious implications for monetary and more, general economic policy in countries like these.

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Appendix

Data Sources

Data Capture

The data collected for this exercise are from three (relatively reliable) sources. These are:

(i) The Quarterly Statistical Digest (QSD) of the Central Bank of Trinidad and Tobago.

(ii) The Retail Price Index Bulletin of the Central Statistical Office.

(iii) The International Financial Statistics (a monthly publication of the International Monetary Fund).

The Table A1 below lists the raw series as they were "captured" from the above publications. All the data are quarterly and cover the period 1970, first quarter to 1998, fourth quarter.

Table A1
Raw data series: sources and description

Data Item	Source
Total Deposits	QSD, Table A2, TT$/Mn.
Gross Domestic Product	The original series in annual format is drawn form the CSO publication "The National Income Accounts of Trinidad & Tobago". It is converted into quarterly data following the Lisman-Sandee procedure.
Commercial Bank Loans	QSD, Table C9, TT$/Mn.
Interest Rate (Weighted Average Loan Rate)	QSD, Table G1.
Exchange Rate	The nominal rate (TT$/US$) is sourced from IFS, 369 rf (quarterly average).
Retail Price Index	CSO: Retail Price Index Bulletin.
Treasury Bill Rate	QSD
US Consumer Price Index	IFS, 111, 64.
Index of real GDP	QSD

QSD = Quarterly Statistical Digest of the Central Bank of Trinidad & Tobago

IFS = International Financial Statistics

CSO = Central Statistical Office of Trinidad & Tobago