



THE MONETARY TRANSMISSION MECHANISM: A CLOSER LOOK AT THE INTEREST RATE CHANNEL IN TRINIDAD AND TOBAGO

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CENTRAL BANK OF
TRINIDAD & TOBAGO

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ABSTRACT

Since 2003, the Central Bank of Trinidad and Tobago initiated a shift in monetary policy stance through the phased reduction in the use of direct instruments of monetary policy toward increased use of indirect instruments. This paper examines the strength and dynamics of the interest rate channel as part of the monetary transmission mechanism with particular attention paid to the repo rate pass through effects. The vector autoregressive model that was employed suggests that the interest rate channel in Trinidad and Tobago is weak, but there are some encouraging relationships among the variables. These relationships require policy support aimed at encouraging the development of a wider range of investment instruments and adopting a mix of direct and indirect tools.

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¹ The authors are Economists in the Central Bank of Trinidad and Tobago and the views expressed are those of the authors and not necessarily those of the Central Bank.

1. Introduction

The early Keynesian position centred on the view that money was not important to movements in aggregate output and by extension the business cycle. This ineffectiveness of monetary policy could be traced to three pieces of evidence taken from a structural model detailed in Mishkin (2004). In the 1960s Friedman and his followers produced evidence which suggested that there was a strong effect of money on economic activity. After the criticism of the early Keynesian position the economic research took two paths. In the first, reduced form models to test for the importance of money on economic activity were undertaken. The second path used a structural model approach as well as attempted to build a better understanding of the channels through which monetary policy can affect aggregate demand. It is these channels that the literature calls transmission mechanisms.

This paper focuses primarily on only one of these channels in the Trinidad and Tobago economy, that is, the interest rate channel. The introduction of the repo rate by the Central Bank of Trinidad and Tobago as one of the main instruments of monetary policy and the intention of the Bank to rely less heavily on direct tools of monetary policy has increased the importance of the interest rate channel in the conduct of monetary policy in Trinidad and Tobago's economy. It is from a policy perspective that an understanding of the impact the repo rate has on the variables that the Central Bank seeks to influence took on added importance. The paper attempts to capture the dynamism of the interest rate channel, with particular focus on the responses of market variables such as money market rates, credit and inflation to the repo rate via the various phases of the transmission process.

To empirically test the strength of the interest rate channel the paper employs a vector autoregressive model (VAR). The use of VARs for this type of analysis is consistent with the plethora of research on this subject matter (see Cheng (2006) and Poddar et al (2006)). There are also a number of studies on the Trinidad and Tobago economy which apply VAR analysis to test the monetary transmission mechanisms; these include Watson (2002) and (2006), Ramlogan (2006) and Matthias et al (2002). In this study, the strength of the interest rate channel will be

assessed through the analysis of impulse response functions and the variance decomposition. The paper does not seek to define the criteria for full pass through.

The remainder of this paper is divided into seven additional sections. In section 2, a review of the theory behind the monetary transmission mechanism is undertaken and the various channels of the transmission mechanism are explored. An examination of previous work conducted on the monetary transmission mechanism in Trinidad and Tobago is also undertaken in section 3. Section 4 describes the interest rate channel in detail and its application to Trinidad and Tobago. This is followed by the sections 5 and 6 which describe the econometric model and analyzes the results, respectively. Finally section 7 looks at policy implications of the results and draws a number of conclusions.

2. Monetary Transmission Mechanism: In Theory

The monetary transmission mechanism is the process whereby monetary policy impacts on prices and income. There are several channels identified in the literature through which monetary policy affects income and prices. This section briefly discusses both those channels that have traditionally been explored in the literature as well as additional channels of the monetary transmission mechanism that have recently been proposed.

The Keynesian monetary transmission model identifies the interest rate channel as the key channel. Through this channel, the pursuit of tighter monetary policy is expected to result in higher interest rates which increase the cost of borrowing and lead to lower investment. Given the basic national income identity² lower investment reduces aggregate demand, income and prices. The opposite is also true, expansionary monetary policy is expected to result in a lowering of interest rates which reduces the costs of borrowing and provide an incentive to increase investment and hence aggregate demand. Treating consumer durables and the purchase of housing as investments, allows this channel to be equally applied to business firms and consumers alike.

² The national income identity states that aggregate demand equates to consumer spending (C) plus investment (I) plus government spending (G) plus net exports (Exports – Imports), $Y = C + I + G + NX$.

With the collapse of the Bretton Woods system and the adoption of flexible exchange rate regimes by many countries the exchange rate channel of the monetary transmission emerged. Economic theory suggest that when monetary policy of the home country tightens (loosens) and real interest rates rise (fall) foreigners would demand more (less) of the home country's currency thereby causing it to appreciate (depreciate). The appreciation (depreciation) in turn makes domestic goods expensive (cheaper) relative to foreign goods resulting in a fall (rise) in exports and an increase (a decrease) in imports assuming an elastic export product. This fall (rise) in net exports would lead to a fall (an increase) in aggregate demand.

The monetarists consider the monetary transmission mechanism to be a phenomenon through which monetary policy is considered to affect the economy through relative asset prices and real wealth. Monetarist postulates the existence of two channels of monetary transmission, one that is considered to operate through Tobin's q theory of investment (asset prices effect) and the other which operates through wealth effects on consumption. Tobin defined q as the market value of installed capital divided by the replacement cost of installed capital. Tobin reasons that if q is greater than one then managers can raise the market value of their firm by buying more capital or in other words increasing investment. If q is less than one then the stock market values capital less than its replacement cost and managers would choose not to invest in new capital. The asset price channel works through the presumption that tighter monetary policy will result in a fall in the money supply. With a lower supply of money consumers would have less money than they want and would compensate by reducing spending. One area in which individuals are expected to reduce spending is in the stock market. Reduced demand for shares would result in a fall in the share price and lowers the value of Tobin's q . Thus firms would reduce investment and aggregate demand would fall. The opposite would hold if monetary policy loosens.

The wealth channel which is the other channel of the monetarist transmission states that as monetary policy tightens, stock prices decline resulting in a decrease in individual wealth. As individual wealth decreases, the level of consumption is expected to fall, thus resulting in lower aggregate demand. An expansionary monetary policy would cause stock prices to increase resulting in greater wealth, and consequently expenditure and aggregate demand.

Dissatisfied with the traditional view about the way in which interest rates and asset prices affect national income and prices economists have searched for other explanations to the manner in which the monetary transmission mechanism works. Bernanke and Gertler in 'Inside the Black Box: The Credit Channel of Monetary Policy Transmission' state that the flaws in the traditional view of monetary transmission have lead economist to explore the existence of imperfect information and other frictions in credit markets which might further explain the lack of potency of monetary policy. The proposed credit channel of monetary policy is supposed to manifests itself through bank lending and balance sheet channels. The bank lending channel is based on the assumption that tighter monetary policy would reduce the money supply therefore deposits are expected to fall. If the latter occurs this should dampen the increase in bank loans especially to individuals leading to lower investment spending and ultimately to lower aggregate demand.

The balance sheet channel of monetary policy works through two main effects; firstly, through adverse selection and moral hazard effects and secondly, through cash flow effects. As noted in the asset price channel, tighter monetary policy is expected to lead to a general decline in stock prices. The decline in stock prices would lead to a reduction in the net worth of firms and thereby increasing adverse selection and moral hazard problems. The latter can result in lower commercial bank lending leading to a fall in investment and demand. Cash flow effects also work through adverse selection and moral hazard problems. Tighter monetary policy increases interest rates which in-turn reduces cash flows. Lower cash flows would also increase adverse selection and moral hazard problems which once again would result in decreased bank loans, investment and aggregate demand.

Link between Monetary Policy and GDP: Monetary Transmission Mechanism

	Other asset price effects			Credit view				
Traditional interest rate effects	Exchange rate effects on net exports	Tobin's q theory	Wealth effects	Bank lending channel	Balance sheet channel	Cash flow channel	Unanticipated price level channel	Household liquidity effects
Monetary policy	Monetary policy	Monetary policy	Monetary policy	Monetary policy	Monetary policy	Monetary policy	Monetary policy	Monetary policy
↓	↓	↓	↓	↓	↓	↓	↓	↓
Real interest rates	Real interest rates	Stock prices	Stock prices	Bank deposits	Stock prices	Nominal interest rates	Unanticipated price level	Stock prices
↓	↓	↓	↓	↓	↓	↓	↓	↓
	Exchange rate	Tobin's q	Financial wealth	Bank loans		Cash flow		Financial wealth
	↓	↓	↓	↓		Moral hazard adverse selection		Moral hazard adverse selection
					↓	↓	↓	Probability of financial distress
					Lending activity	Lending activity	Lending activity	
					↓	↓	↓	↓
	Investment	Net exports	Investment	consumption	Investment	Investment	Investment	
Residential housing	Residential housing				Residential housing			
Consumer durable expenditure					Consumer durable expenditure			

Source: Frederic S. Mishkin (2004).

3. Previous Research

While there has been extensive international research on the monetary transmission mechanism in developing countries, for small open developing economies such as Trinidad and Tobago this has not been the experience. This section identifies and briefly reviews four known papers that have examined the monetary transmission mechanism in Trinidad and Tobago, Watson (1996), Watson (2002), Matthias et al (2002) and Ramlogan (2006).

Watson (1996) attempted to answer two questions. Firstly, does monetary policy impact on real activity and to what extent? Secondly, what are the channels of the transmission? To answer these questions the paper employed a small vector autoregressive (VAR) model of the Trinidad and Tobago economy. Utilizing a technique similar to that used by Bernanke and Blinder (1992, p. 902) the paper assumes “the reduced-form responses of the economy to observed policy shocks would correctly measure the dynamic structural effects of a monetary policy change”. Watson (1996) argued that this allowed for the determination of the nature and extent of the monetary transmission mechanism, and concluded (rather tentatively) that both the money supply and credit matter in the monetary transmission process but that money plays a much more important role.

Watson (2002) also examined the monetary transmission but focussed on the effectiveness of the measures used to conduct monetary policy when applied to a small primary exporting economy. The paper tries to determine the nature and the extent of monetary policy on the real sector of the Trinidad and Tobago’s economy given the importance of oil to the economy. It explored three potential transmission mechanism channels; the money channel, the credit channel and the exchange rate channel. Watson (2002) used the Treasury bill rate and the reserve requirement ratio as the main monetary policy instruments, while real GDP was used as the only target variable. The study employed a VAR model with seven endogenous variables and the price of oil as the only exogenous variable. Quarterly data from 1971 to 1998 was used in the model. The paper concluded that monetary policy does have an impact on the economy, with the Treasury bill rate being “useful as an instrument of monetary policy”. In addition the conclusion

noted that of the three monetary transmission mechanism channels explored the exchange rate channel is the most influential.

Matthias et al. (2002) main objective was to determine the existence and nature of the monetary transmission channels in Trinidad & Tobago and to gauge the response of credit, output, the exchange rate and prices to monetary policy decisions. This paper also employed a small VAR model to identify the various channels of the monetary transmissions. The model consisted of nine endogenous variables and three exogenous variables consisting of monthly seasonal dummies, a regime shift dummy and an oil price dummy. Using the LR³ and the AIC⁴ criteria Matthias et al found the appropriate lag order to be six months. The paper concludes that monetary policy in the past had a significant impact on real output and prices in the domestic economy. Somewhat surprisingly the paper found that there is evidence to suggest that “the transmission mechanisms do work in the domestic economy in much the same way they do in developed countries with well-developed markets.” One limitation of the paper was the research did not identify whether monetary policy measures works through the money channel, the credit channel or both. Matthias et al. (2002) noted that this issue warrants further research as “a better understanding of the channels through which monetary policy affects business and consumer decisions is likely to enhance the effectiveness of monetary policy decisions.”

Ramlogan (2006) indentified some of the differences between developed and developing economies and suggested these differences would impact the functioning of the monetary transmission mechanism. She argued that developing countries generally had under developed financial markets, which provided investors with a narrow base of financial products from which to develop a portfolio. In fact she pointed out that the main source of external funding to businesses was through the banking system. This she claimed had implications for the effectiveness of monetary policy. It was felt that in the implementation of monetary policy, instruments impacting on credit levels would have a greater effect on the real sector instead of the price of credit. In an attempt to better understand the nature of the monetary transmission mechanism in developing countries, Ramlogan conducted an empirical analysis of the monetary

³ LR: sequential modified Likelihood Ratio test statistic.

⁴ AIC: Akaike information criteria.

transmission mechanism in Trinidad and Tobago using a structural vector auto regression (VAR) analysis. She found that the credit channel is more important than the money channel in transmitting impulses from the financial sector to the real sector. This result supported *a priori* expectations that an underdeveloped money market will not be the main avenue through which monetary shocks can be transmitted.

This paper seeks to update and add to the existing literature on the monetary transmission mechanism in Trinidad and Tobago by analyzing the impact of the Central Bank's main policy rate, the repo rate, on the Bank's 'target' variables. This is an area previously unexplored and for which analysis is of importance to policy makers. The paper therefore, explicitly explores the interest rate channel of the monetary transmission mechanism.

4. The Interest Rate Channel in Trinidad and Tobago

The Central Bank of Trinidad and Tobago in 2003 implemented a major reform initiative designed to reduce dependence on the use of direct monetary policy instruments – in particular the reserve requirement. Through phased reductions of the latter instrument it was expected that the cost of financial intermediation would be reduced. The shift towards a more market based approach exerted greater emphasis on the use of the repo rate⁵ as well as open market operations. The effectiveness of the repo rate and thus the transmission through which the repo rate impacts the monetary authority's target variables is very important to monetary policy. This transmission mechanism in economic literature is referred to as the interest rate channel. This paper concentrates primarily on the interest rate channel.

The interest rate channel states that when monetary policy tightens interest rates can be expected to rise. Such a move can be expected to increase the cost of borrowing which would lead to a fall in investment that in turn is expected to lead to a decline in aggregate demand, inflation and income. This channel works through the presumption that the policy rate has a pass through on short term market rates such as the inter-bank rate and short term treasury bill rates. These short

⁵ The repo rate was introduced in May 2002 and is the Central Bank of Trinidad and Tobago's main policy rate.

term market rates then have a pass through on longer term market rates, such as bond rates and bank lending rates. In the traditional theory of the interest rate channel the main focus was on bond rates, because these rates directly impacted on investment in developed countries. However in developing economies such as T&T, businesses fund investments through commercial bank borrowing rather than issuing equity or bonds. Therefore, this study place greater emphasis on commercial bank credit rather than the bond market and bond rates.

This departure from traditional theory may in fact have a greater resemblance to the credit channel of the monetary transmission mechanism, which works through the bank lending and balance sheet channels. However Bernanke and Gertler hold the view that the credit channel is not separate from the interest rate channel, but he sees it as a set of factors that amplify and propagate conventional interest rate effects.” Since in Trinidad and Tobago it is possible to use credit granted by commercial banks to businesses as a proxy for investment, the traditional interest rate channel is adjusted to reflect credit to businesses. Under the assumption that the credit channel is part of the interest rate channel means the transmission should also be adjusted to include consumer credit. The rationale is that consumer credit reflects consumer demand, lowering this is expected to also lower final demand and prices. Indeed in the past the Central Bank has focused its efforts on limiting consumer credit in its fight against inflation while encouraging business sector credit to grow.

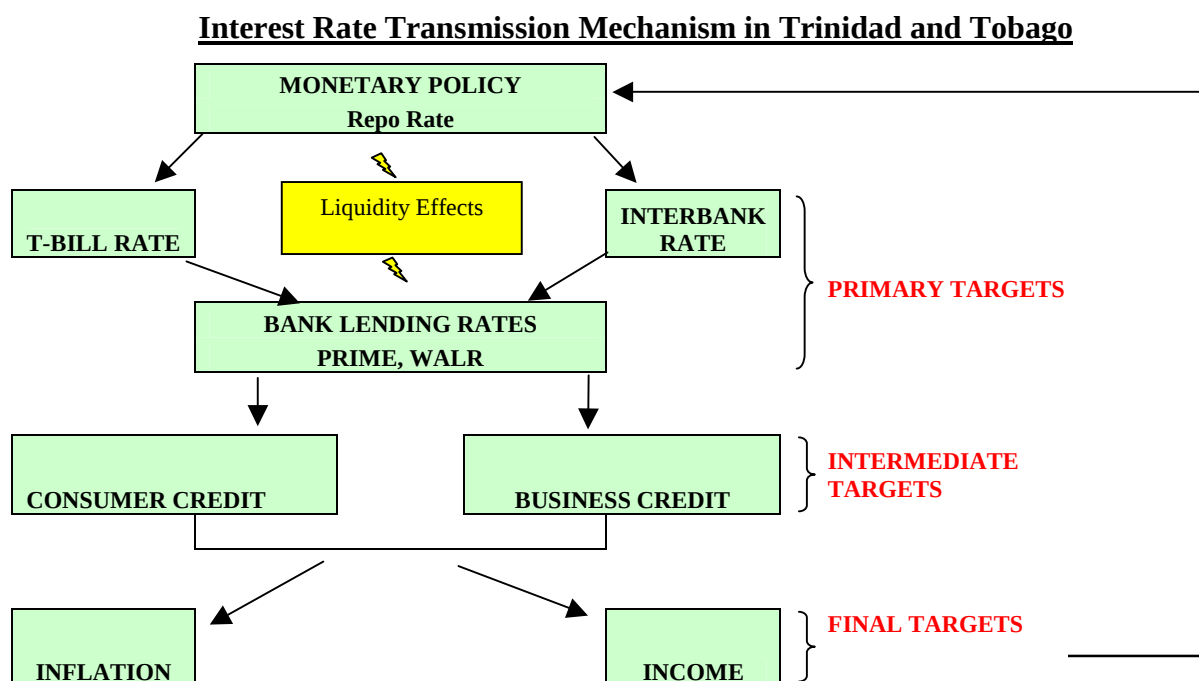
The paper looks at the impact of the interest rate channel on non-oil GDP rather than total GDP because the energy sector is dominated by large foreign multi-national firms who are not affected by domestic monetary policy. Foreign energy companies are not affected by increasing domestic interest rates as the majority of these firms source their funding through foreign capital markets or retained earnings. Increasing interest rates in the domestic economy would not affect energy GDP growth and since the energy sector accounts for a large portion of national income, overall GDP may not be as responsive to changes in monetary policy (Table 1). Therefore to truly reflect monetary policy on the domestic economy we use non-energy GDP. The interest rate channel as proposed by this study is illustrated in the schematic below.

Table 1
Gross Domestic Product at Current Market Prices (TT\$ millions)

	2004	2005	2006	2007	2008
Energy Sector	32,345	46,188	60,048	62,896	70,454
Non-Energy Sector	51,156	54,159	61,746	73,749	80,371
Total	86,652	100,386	122,108	137,427	152,115

Source: Central Statistical Office of Trinidad and Tobago.

Figure 1



In theory the interest rate channel assumes that the Central Bank's policy rate would have a full and complete pass through on short term market rates and retail lending rates. In some instances however there may be factors affecting the policy rate pass through to lending rates, these include high financial system liquidity or incorrect reading of market signals. In the case of Trinidad and Tobago, structural excess liquidity⁶ has existed more or less since the introduction

⁶ Liquidity is defined as commercial banks' holdings of reserves at the Central Bank of Trinidad and Tobago in excess of the statutory reserve requirement.

of the repo rate in May 2002. There is evidence that this surplus liquidity has resulted in an incomplete and sluggish repo rate pass through onto lending rates, which in turn weakens the channel. In the diagram above the interest rate channel is separated into three phases; primary targets, intermediate targets and final targets. This paper seeks to capture the strength and dynamism of each phase in the transmission.

5. The Model

The objective of this paper is to test the strength of the interest rate channel of the monetary transmission mechanism. The dynamic relationship between interest rates and the economy will be tested through the analysis of the impulse response functions and variance decomposition of the VAR model. The impulse response function traces the response of market interest rates, the intermediate targets such as credit and monetary aggregates and the final targets such as inflation and income to changes in monetary policy. The impulse response function will therefore give an idea of what effect the repo rate will have on the other variables in the system such as lending rates, credit and inflation.

The variance decomposition of a VAR also gives useful information, Watson and Teelucksingh (2002) state that “the variance decomposition of a VAR gives information about the relative importance of each of the random innovations in the explanation of each variable in the system.” This study seeks to determine the relative importance of the repo rate in the explanation of market interest rates, the importance of interest rates on credit and finally the importance of credit in the explanation of movements in inflation and income. The variance decomposition also gives information on the length of time it takes for one variable to have its strongest explanation on the other variables. Analysis of both the impulse response functions and variance decomposition will provide an idea of the strength of interest rate transmission and also the time it takes for interest rate policy to have an impact on target variables.

The model uses monthly data from May 2002 to May 2008. The data set is limited because the repo rate was only introduced in May 2002. All variables are expressed in logarithms except for interest rates. The model consists of nine variables:

1. The repo rate (repo): The Bank's main interest rate policy tool used to provide short term funding to commercial banks.
2. 91 day treasury bill rate (tbill): The discount rate on 91 day treasury bills, it is considered a money market rate.
3. Inter-bank rate (interbank): A money market rate at which commercial banks provide short term funding to other banks, usually overnight.
4. Log Liquidity (log_liquidity): The log of special deposits which is used as a measure of liquidity. From January 2006 onwards special deposits was replaced by commercial banks' 'excess reserves'.
5. Prime lending rate (prime): The lending rate that commercial banks charge their preferred customers.
6. Log business credit (log_bizcrdt): The natural logarithm of business credit granted by commercial banks.
7. Log consumer credit (log_conscrtdt): The natural logarithm of consumer credit granted by commercial banks.
8. Log RPI (log_rpi): The natural logarithm of the retail price index
9. Log non-oil GDP (log_noilgdp): The natural logarithm of the Index of real Gross Domestic Product (2003 = 100) exclusive of the energy sector. The Index of real GDP is produced quarterly by the Central Bank of Trinidad and Tobago and was disaggregated using FAME.

The VAR model was estimated in levels and can be specified as an unrestricted reduced form to a structural model where there are no exogenous variables. The model could be represented as follows:

$$x_t = \sum_{i=1}^p \Pi_i x_t + \varepsilon_t$$

Where Π is a 10 x 10 matrix of coefficients, x_t is a 10 x 1 vector of endogenous variables and ε_t is a 10 x 1 vector of error terms. The endogenous variables are ordered in the VAR model as presented above. The ordering follows the path that theory postulates the transmission will work its way through the system (see Figure 1). That is, from the policy rate to short-term interest rates, to longer term interest rates then on to credit and finally on to aggregate demand. This is consistent with Poddar et al (2006) which chose the ordering of their model based on the assumed speed with which the variables would respond to the monetary policy shocks. That is, variables assumed to respond quicker to monetary policy shocks appeared before variables with a slower response time.

Pair-wise Granger causality tests were performed on the respective variables. These tests revealed that the repo rate Granger causes both the 91 day treasury bill rate and the inter-bank rate; the inter-bank rate Granger causes the prime lending rate; and the prime lending rate Granger causes consumer credit but not business credit (Table 2). It also shows that both business and consumer credit Granger causes non oil GDP, while neither of them Granger causes inflation. The optimal lag length based on the likelihood ratio test statistic, the final prediction error and the Hannan-Quinn information criterion was two months (Table 3).

Table 2
Pairwise Granger Causality Tests

Decision Criteria: If p-value > alpha do not reject the Null, where alpha = 10%.			
Sample Size: May 2002 to May 2008; Lags 2			
Null Hypothesis:	Obs	F-Statistic	Probability
REPO does not Granger Cause TBILL	71	6.33273	0.00305
REPO does not Granger Cause INTERBANK	71	20.4879	1.20E-07
REPO does not Granger Cause PRIME	71	4.5471	0.01412
INTERBANK does not Granger Cause PRIME	71	5.53066	0.00602
TBILL does not Granger Cause PRIME	71	2.18399	0.12066
PRIME does not Granger Cause LOG_BIZCRDT	71	2.35162	0.10315
PRIME does not Granger Cause LOG_CONSCRDT	71	8.88835	0.00038
LOG_BIZCRDT does not Granger Cause LOG_NOILGDP	69	6.83243	0.00204
LOG_BIZCRDT does not Granger Cause LOG_RPI	71	1.1401	0.3260
LOG_CONSCRDT does not Granger Cause LOG_NOILGDP	67	3.02909	0.05534
LOG_CONSCRDT does not Granger Cause LOG_RPI	71	1.10159	0.33837

Source: E-Views 6.

Table 3**VAR Lag Order Selection Criteria**

Endogenous variables: REPO TBILL INTERBANK LOG_LIQUIDITY PRIME LOG_BIZCRDT LOG_CONSCRDT LOG_RPI LOG_NOILGDP Sample: 2002M05 2008M05 Included observations: 66						
Lag	LogL	LR	FPE	AIC	SC	HQ
1	930.2080	NA	5.48E-23	-25.7336	-23.04627*	-24.6717
2	1048.1830	171.5994*	2.00e-23*	-26.8540	-21.4794	-24.73025*
3	1124.6110	90.3250	3.19E-23	-26.7155	-18.6536	-23.5299
4	1222.7240	89.1929	3.98E-23	-27.2341	-16.4848	-22.9865
5	1373.8850	96.1936	2.16E-23	-29.36015*	-15.9236	-24.0507
Source: E-Views 6. * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criterion.						

Using the Johansen cointegration test, the null hypothesis that there are no cointegrating vectors is tested against the alternative that there is at least one cointegrating vector.

Formally:

$$H_0: \gamma = 0$$

$$H_1: \gamma \geq 1$$

where γ is the number of cointegrating vectors.

The acceptance or rejection criteria are:

Trace Statistic > Critical Value; reject the null

Trace Statistic < Critical Value; do not reject the null

And

Maximum Eigenvalue > Critical Value; reject the null

Maximum Eigenvalue < Critical Value; do not reject the null

Both the Trace and the Maximum Eigenvalue tests state that the null should be rejected and the alternative accepted, that is, there is at least one cointegrating vector. The Trace Test indicates that there are four cointegrating equations, while the Maximum Eigenvalue test shows the existence of two cointegrating equations at a 5 per cent level of significance.

With the presence of cointegrating equations it may be plausible to re-specify the model as a vector error correction model (VECM). However, given the short sample size (May 2002 to May 2008) this paper will not seek to analyse the explicit long run behaviour among the variables. As such, the VAR framework would be used (see Cheng 2006).

One of the limitations in the model is the small sample size used. The repo rate was introduced only in May 2002 therefore the model uses monthly data from 2002 to May 2008 totalling 73 data points. Further, during the period May 2002 to December 2005 the repo rate was infrequently adjusted. Only in 2006 has the repo rate been adjusted with a high degree of frequency. Thirdly there are other problems inherent in the data employed. Due to the small sample size monthly data was used, however the index of real non oil GDP is available only on a quarterly basis. Therefore the series was disaggregated to a monthly basis using FAME. Although disaggregating the data was essential, it is not ideal and in this case it may not have been without imperfection.

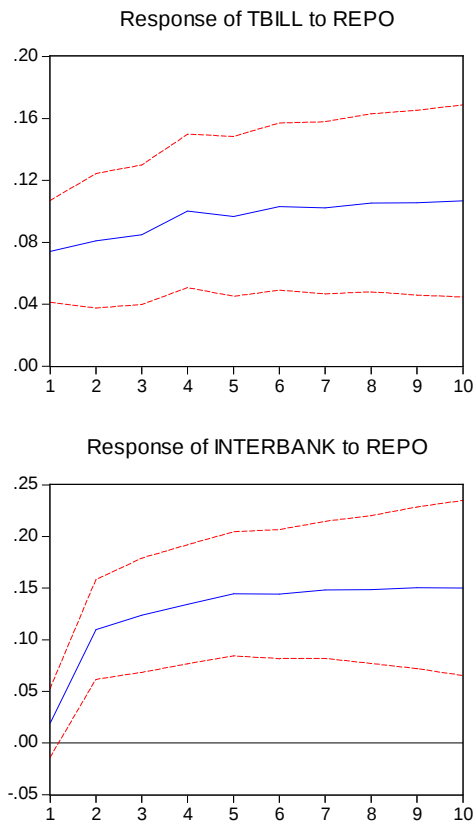
Another limitation common to all VAR systems using E-views arises from the arbitrary nature of the Choleski decomposition when dealing with correlated error terms. Error terms that are not uncorrelated have a common component that cannot be identified with any specific variable, this complicates the interpretation of the impulse response function. The Choleski decomposition deals with this by placing the entire effect of any common component to the variable first in the ordering of the VAR. This places great importance on the ordering of the VAR, since changing the ordering can change the results of the model. Despite these limitations the model can prove valuable to the policy maker as a tool to observe the responses of short term interest rates, bank lending rates and inflation to changes made to the repo rate.

6. Results

In response to a shock to the repo rate (equivalent to one standard deviation of the repo rate variable) there was an initial positive effect on the treasury bill rate. The upward momentum in the treasury bill rate was sustained throughout the period. Likewise, there was an initial increase in the inter-bank rate in month one, followed by a sharp spike in month two. Thereafter, there was a gradual yet sustained rise in the inter-bank rate through to period 10 (Figure 2).

Figure 2

Response to Cholesky One S.D. Innovations ± 2 S.E.



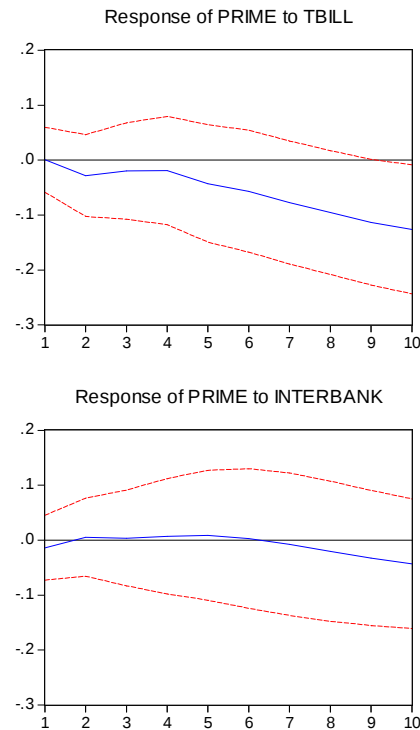
Source: E-views 6.

Figure 3 shows the responses of the prime lending rate to a shock in the inter-bank and treasury bill rates. Against *a priori* expectations, a shock to the treasury bill rate led to a steady decline in the prime lending rate from months one to ten. There was almost no response from the prime

lending rate to a shock in the inter-bank rate during months one to six. However, by the seventh month, the prime rate began to trend downwards.

Figure 3

Response to Cholesky One S.D. Innovations ± 2 S.E.

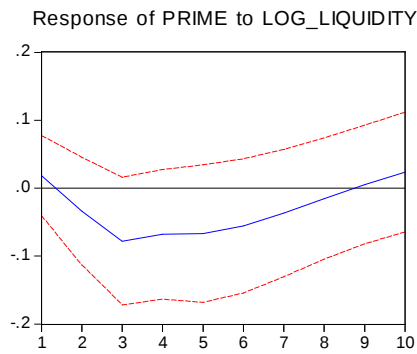
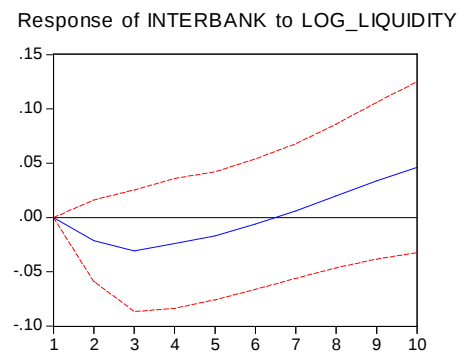
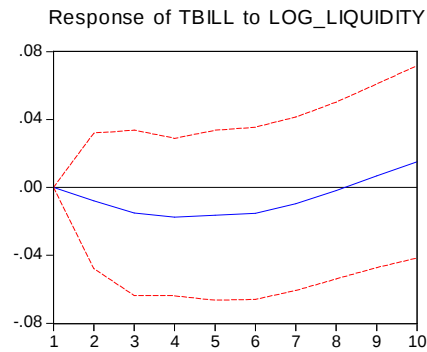


Source: E-views 6.

One explanation for the weak pass through among interest rates was the high level of financial system liquidity. The impulse response function shows that for a shock to the liquidity innovation, initially all the interest rates trended downwards (Figure 4). This indicated that the existence of liquidity exerted downward pressure on interest rates.

Figure 4

Response to Cholesky One S.D. Innovations ± 2 S.E.



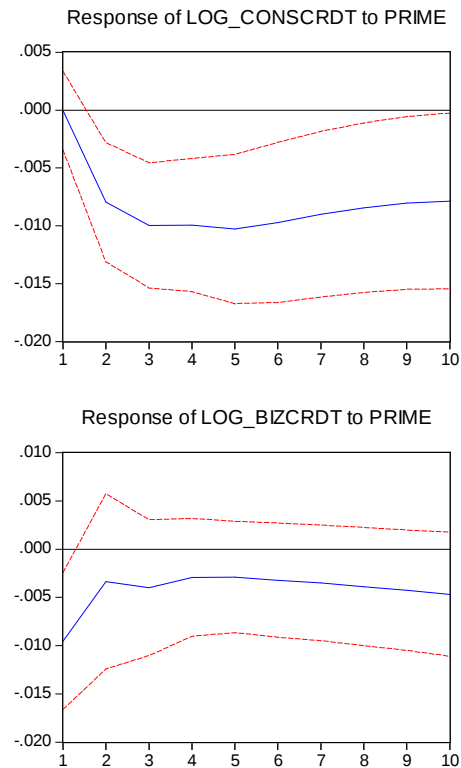
Source: E-Views 6.

A shock to the prime lending rate had a negative impact on both consumer and business credit throughout the period (Figure 5). In the first month, there was little response from consumer credit to a shock in the prime lending rate. However, in months two and three a sharp drop in consumer credit occurred. Consumer credit remained relatively flat up to month six before trending slightly upwards thereafter, but nevertheless remains in negative territory. Following a shock to the prime lending rate there was an initial fall in business credit in month one. There was a short lived increase in month two, before a slight downward trend was observed. The

model shows that consumer credit was slower to react to business credit, but by the second month the magnitude of response of consumer credit was stronger.

Figure 5

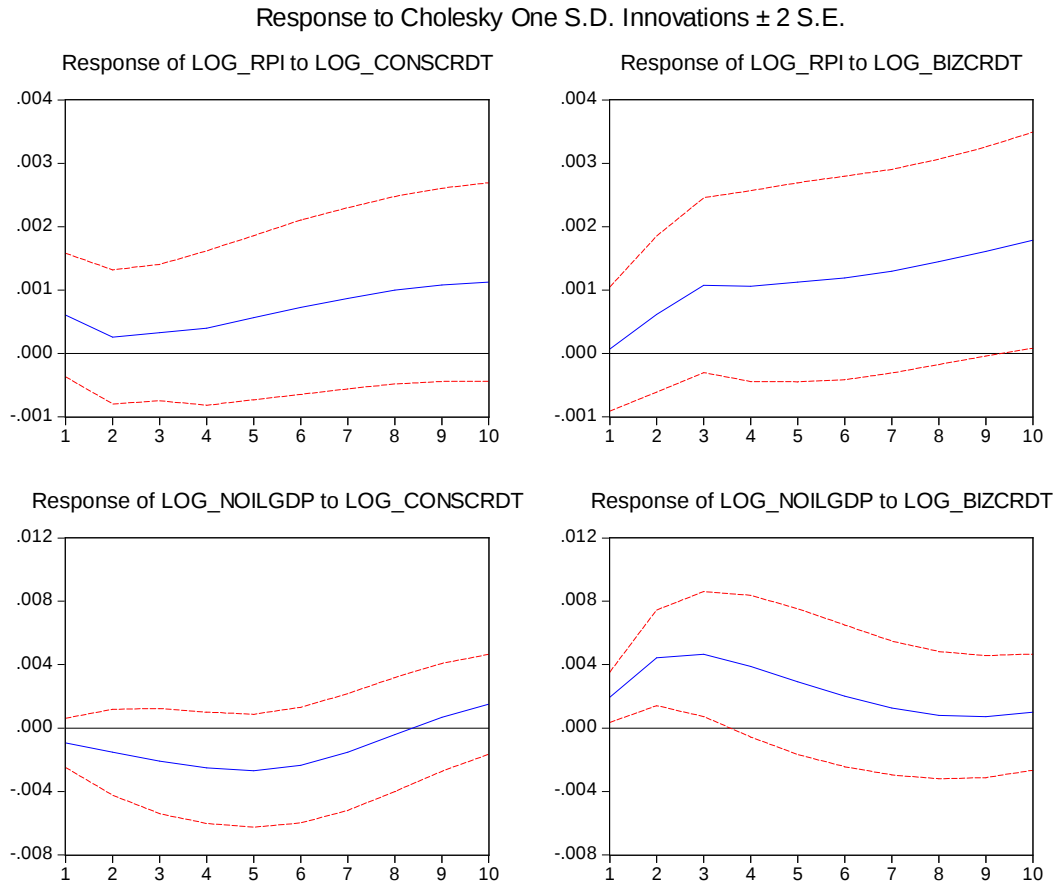
Response to Cholesky One S.D. Innovations ± 2 S.E.



Source: E-Views 6.

In the third phase of the interest rate channel it was observed that the responses of inflation and non oil GDP to shocks to consumer and business credit (Figure 6). In response to a shock in consumer credit there was an initial rise in inflation, followed by a drop in month two then a sustained increase through month three to ten. Similarly, business credit encouraged a positive response to inflation throughout the period. The effects on output to a shock on consumer credit resulted in a negative impact on the non-oil GDP up to the eight period, before it rises in months nine and ten. On the other hand, a shock to business credit had a positive effect on non-oil GDP. In response to an innovation in business credit non oil GDP rises and peaks in the third month before gradually falling and flattening out for the remainder of the period.

Figure 6



Source: E-Views 6.

The variance decomposition also suggested that the interest rate channel is relatively weak. A look at the variance decomposition function revealed that in the first period the repo rate accounts for less than one per cent of the variation in the inter-bank rate and under 2 per cent of the variation in the Treasury bill rate. For the entire period the repo rate's impact was weak, and by the tenth month it accounted for a mere 5 per cent and 3 per cent of the variations in the inter-bank and treasury bill rates, respectively. Further, the model demonstrated that by the tenth period the liquidity variable explained 11.4 per cent of the variation in the inter-bank rate and 10 per cent of the variation in the treasury bill rate. This also supports the finding that financial system liquidity is obscuring the workings of the repo rate pass through.

Consistent with the impulse response functions, the variance decomposition suggested that the pass through from the inter-bank rate and the treasury bill rate to the prime lending rate was

weak. Up to the seventh month, the inter-bank rate accounted for less than 1 per cent of the variation in prime, and by the tenth month it was responsible for only 3.6 per cent of prime's variation. Similarly, at the end of the tenth period, the shock to the treasury bill rate accounted for a mere 2 per cent of the variation in prime.

It should be noted that the prime lending rate accounted for 4.8 per cent of the variation in business credit in the first period and its explanatory power increased with the progression of time. By the tenth period the prime lending rate accounted for 28.3 per cent of the variation in business credit. However, prime's impact on consumer credit was less profound, explaining 1.3 per cent of the variation in this credit category by the tenth period.

There were less encouraging signs in the third stage of the interest rate channel. The variance decomposition showed that both business and consumer credit did not have a significant impact on non-oil GDP. For the entire period, business credit appears to have almost no impact on non-oil GDP, while consumer credit explained less than one per cent of the variation of non-oil GDP for most of the ten month period. Initially credit appeared to have little impact on inflation (less than one per cent), but by the tenth period, business lending explained 7.8 per cent of the variation in inflation, while consumer lending accounted for 5.7 per cent. Interestingly, this result is contrary to the results produced by the Granger causality test.

7. Conclusions and Policy Implications

The introduction of the repo rate in May 2002 and the decision by the Central Bank to reduce its reliance on direct tools of monetary policy have lead to greater attention paid to the interest rate channel of the monetary transmission mechanism in Trinidad and Tobago. Focussing on the interest rate channel, this paper attempted to ascertain the strength of the repo rate pass through on the various monetary policy targets. The results of the econometric model show that while there are some relationships among the variables, generally the interest rate channel dynamics and the pass through effects are not as strong as theory suggests they should be.

Although the model did not derive strong relationships and pass through effects among the variables, particularly between the short term interest rates and lending rates, there are some positive aspects. While most of the relationships may not be strong, they nevertheless do exist. It is necessary for policy makers to strengthen these relationships, thus enhancing the effectiveness and efficiency of monetary policy. The results of the model showed that one of the main reasons for the incomplete repo rate pass through is the existence of high levels of liquidity in the financial system. The variance decomposition revealed that during the period May 2002 and May 2008 liquidity had a greater impact on the treasury bill rate and the inter-bank rate than did the repo rate. To improve the effectiveness of the repo rate the Central Bank has to consider the benefits to be derived from an environment of low excess liquidity, and then evaluate the effectiveness, costs and impact of various measures to reduce excess liquidity.

The Central Bank's effort to absorb liquidity during the past two years raises questions about the effectiveness of indirect policy instruments in underdeveloped financial markets. Such markets reduce and in some instances hinder the success of market based tools. Some obstacles in the development of Trinidad and Tobago's financial system are a lack of sound investment opportunities, inefficient pricing mechanisms, very little secondary trading and a limited number of market players. Despite the relative unsuccessful application of market based instruments, the Central Bank should be cautious of the signal that reverting to direct policy instruments will send to the market. The key ingredient has to be the introduction of measures that are direct in nature, but at the same time will limit the cost of intermediation.

The results raise some interesting questions for developing countries such as Trinidad and Tobago. These include the existence of a trade off between the effectiveness and the inefficiency of blunt direct monetary policy tools for the perceived efficiency and lack of effectiveness of indirect monetary policy tools adopted by a number of countries with more developed markets. In a developing economy with a weak transmission mechanism caused by embedded structural limitations, the options available for the application of monetary policy appears to consist of the use of both indirect and direct policy instruments. While indirect tools adhere to market efficiency, developing countries must consider the use of direct tools in a strategic capacity, this

acts as an interim strategy that provides valuable time for the financial markets to develop to the point that market based tools can become more effective.

However, the use of these direct tools should not be implemented in a manner that allows them to operate at full cost to the market, but these direct tools can be innovatively designed to reduce implementation cost. The use of remunerated reserves in varying modifications is an example of quasi direct measures that can quickly address the challenge of excess liquidity, but not necessarily result in a full cost to the market. The ability of a Central Bank and/or the government to fund this cost may be the major constraint to the application of this particular combination of instruments.

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