Monetary Policy rule in the presence of persistent excess liquidity: the case of Trinidad and Tobago

Anthony Birchwood

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Abstract

The effectiveness of the repo rate as the main policy tool of monetary policy tends to be thwarted by persistent excess liquidity which typifies the banking system in Trinidad and Tobago. This paper conducts an empirical examination with respect to Trinidad and Tobago, in a bid to explore the effectiveness of the policy instrument in the presence of chronic excess liquidity. GMM estimation is used to see how the repo rate transmits across the money market and the bank credit market. It is found that there is a higher pass through of the repo rate in the bank credit market compared to the money market. Moreover, the evidence suggests that the commercial banks mark-up on the repo rate by taking inflation and excess reserves into account.

1.0 Introduction

This study examines the reliability of the monetary policy rate to effect changes in market interest rates and therefore on aggregate demand in the presence of chronic excess liquidity in an embryonic money market as is the case of Trinidad and Tobago. In attempting to deepen the instruments in the money market, the repo rate was introduced in March 2002 as the policy rate to signal the monetary policy stance of the central bank and the policy rate was expected to go through the transmission mechanism to impact on aggregate demand.

Under tight liquidity conditions commercial banks were expected to exhibit greater reliance on the interbank market or the central bank to raise funds. Repo rate was expected to act as the lowest rate at which the central bank is willing to lend to commercial banks. In addition, for the Trinidad and Tobago case, the policy rate was expected to transmit hrough the term structure of interest rates with respect to the banking sector, thus influencing credit.[1]

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[1] The transmission mechanism is captured in The Implementation of Monetary Policy in Trinidad and Tobago" Public Education Pamphlet Series, no. 1 of the Central Bank of Trinidad and Tobago, September 2005.

Nevertheless, this mechanism could be thwarted by persistent excess liquidity. This can allow banks to be less dependent on the central bank for financing. Under such circumstances, a loosening of the spread between the repo rate and the market rate could occur thereby implying less influence of the market rate on the repo rate set by the central bank. Under these circumstances, the repo rate at best would act as a signalling rate.

An important question here concerns the extent to which the Trinidad and Tobago Central Bank has been able to influence market interest rates through the manipulation of the repo rate. Moreover, we examine the relative importance of excess liquidity and the inflation rate on the transmission mechanism from the repo to market rates. This is akin to Martin and Millas (2009) where they examined the transmission from the optimal policy rate to the Libor rate.

Unlike Martin and MIllas (2009), we consider the actual central bank policy rate and examine the pass through with respect to two markets: the money market and the commercial bank credit market. Short-term rates in the money market carry information on inflation expectations given that noise emanating from risk is not a major factor in this market, see for example Woodford (2003).[2] Further, some central banks inclusive of the bank of England also use the yield curve to do inflation rate forecasting.[3] However, the construction of the yield curves require a more sophisticated market.[4] Further, in the case of Trinidad and Tobago, monetary policy is more likely to impact on aggregate demand through its effect on the banking system, given the dominance of banks in the financial sector. Since the bank lending rate is likely to influence private sector borrowing, the impact of the repo on the direction and magnitude of the lending rate in this market is expected to impact on aggregate demand.

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[2] The Bank of England for example conduct a constant interest rate forecast in order to forecast inflation and GDP, see Bank of England Inflation Report for various years at www.bankofengland.co.uk/publications/inflationreport/ir08nov5.ppt.
[3] See for example Joyce and Medrum (2008) and Gurbaynak et al. (2007) and Stock and Watson (2003) for a discussion on this. Birchwood (2000) found that in the case of Trinidad and Tobago interest rate was useful in predicting inflation.

[4] Block and Hirt (1994) defined a yield curve as "A curve that shows interest rates at a specific point in time for all securities having equal risk but different maturity dates" p670.

2.0 Behaviour of Market Rates and quantity factors in Trinidad and Tobago

2.1 Market Rates

The Trinidad and Tobago money market is at an embryonic stage of development with four rates existing in 2009, two prescribed by the central bank: the discount rate and the repo rate, and the market determined rates been the Treasury bill rate and the average interbank rate. The money market rates were closely aligned to the policy rate set by the central bank such that the correlation in monthly terms between the repo rate and the interbank rate was 0.90 and the correlation between the repo rate and the Treasury bill rate was 0.85, see Figure 1. This was in keeping with the Report of the Bank of International Settlements (1999) which suggested that short-term maturity of collateralised repo instruments allowed for strong linkages with other money market instruments. However, the central bank policy rates were less volatile compared to the market determined money market rates. Nevertheless all the rates were relatively flat prior to 2005 following which there was a distinct rise in all money market rates thereafter.

Figure 1 Monthly Money Market Rates in Trinidad and Tobago
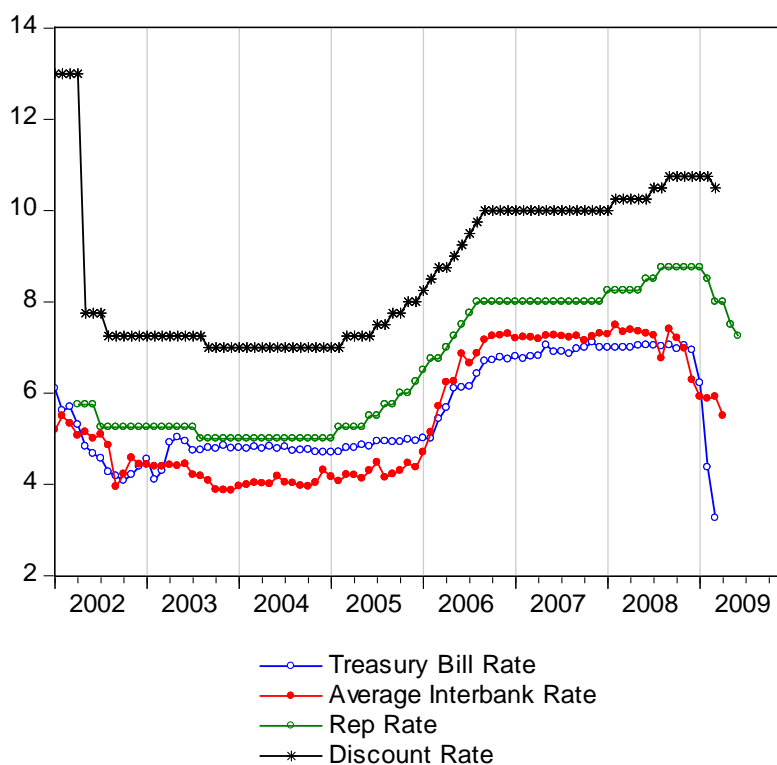
The basic prime lending rate was used as the representative credit market rate, partly as a result of the fact that this rate is available on a monthly basis and also because the movement of this rate sets the

underlying trend for the movement of lending rates. Here the prime rate is defined as the rate at which commercial banks are prepared to lend to its most favoured customers. An examination of the rate showed that the trend was almost 'U' shaped, indicating that the rate picked up alongside the increase in the policy rate and inflation, see Figure 2. Accordingly, inflation rose steeply beginning from 2004 and by the following year it continued on an upward trend well above that recorded in the preceding years, see Figure 3.

Figure 2 Prime Lending Rates by Commercial Banks in Trinidad and Tobago
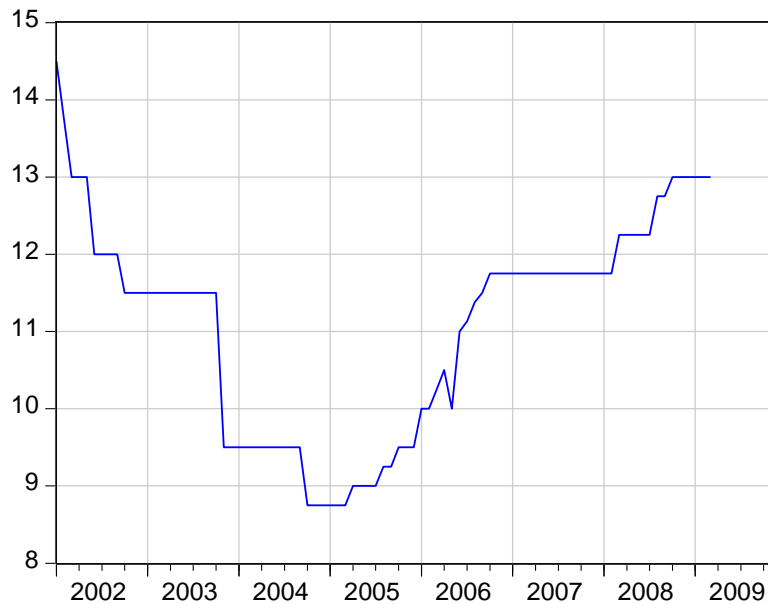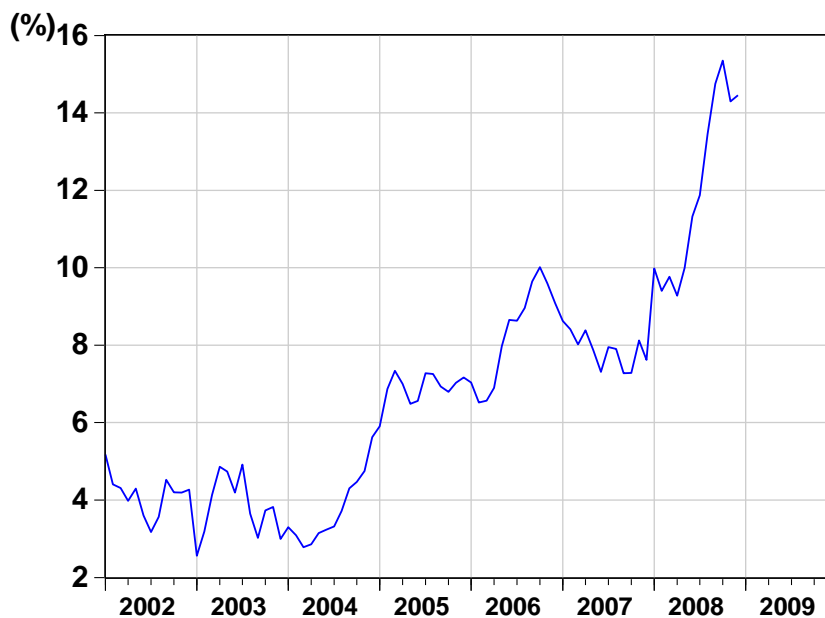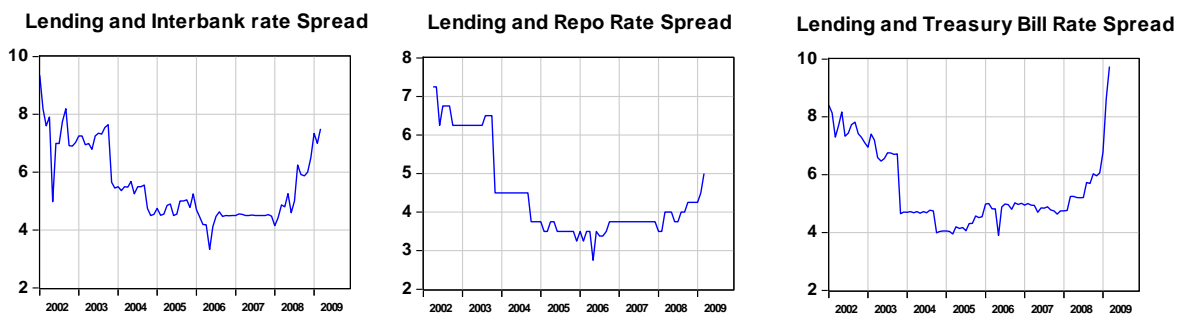
Figure 3 Monthly Inflation Rate

The spreads between the various money market rates and the prime lending rates of commercial banks were compared to see whether they exhibit a distinctive trend, see Chart 1 Spreads were calculated as the lending rate minus the money specific market rate. The trends were similar regardless of the money market rate considered, owing primarily to the high correlation between the rates,. This suggested that there were declines in the lending rate in relation to the money market rates in the first half of the period, but the lending rate begun rising in relation to the money market rates thereafter. This rise in the spread in the latter half of the period may have been attributable to the rise in inflation expectations and the policy rate set by the central bank.

Chart 1 Spread Between Prime Lending Rate and Money Market Rates

Lending and Interbank rate Spread

Lending and Repo Rate Spread

Lending and Treasury Bill Rate Spread

2.2 Quantity Factors

Excess liquidity was defined as the actual deposits of commercial banks placed in the central bank in excess of the prescribed deposit liabilities. From an examination of the monthly excess reserves ratio, it was evident that commercial banks maintained deposits in the central bank well in excess of prescribed deposit liabilities after 2005, see Figure 4. This period coincided with extraordinary windfalls accruing from the energy sector causing the external current account and import cover to rise dramatically from 2004 onwards, see Table 1.

Figure 4 Excess Reserves as a percentage of deposit liabilities
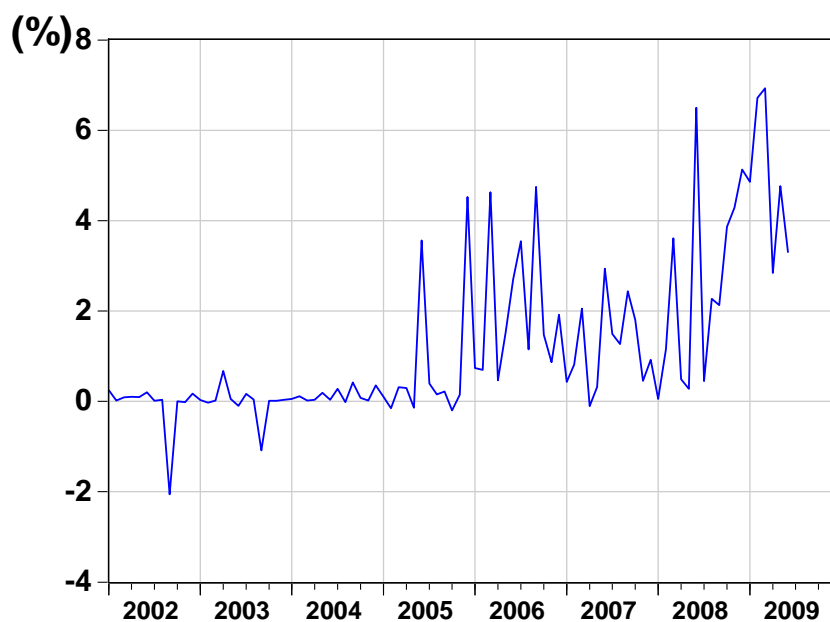
Table 1 External inflows and economic growth of the Trinidad and Tobago Economy

	2002	2003	2004	2005	2006	2007	2008
External Current Account Balance as a percentage of GDP	0.8	9.3	14.4	23.7	25.5	18.6	36.2
Months of Import Cover	5.4	6.5	8.9	9.7	9.5	9.9	11.3

Source: Data extracted from CCMF (June 2009).

Loan growth and Credit Market Rate

Beyond 2005 there were larger spikes in growth in loans compared to the earlier period, see Figure 5. It may be the case that the growth in credit was generated by income demand despite the rising interest rate. It may have been the case that the growth in credit was generated by income demand despite the rising interest rate. It may be further possible that the increase in lending rates may have been prompted by rising inflation rates and inflation expectations.

Figure 5 Growth of Credit in Trinidad and Tobago
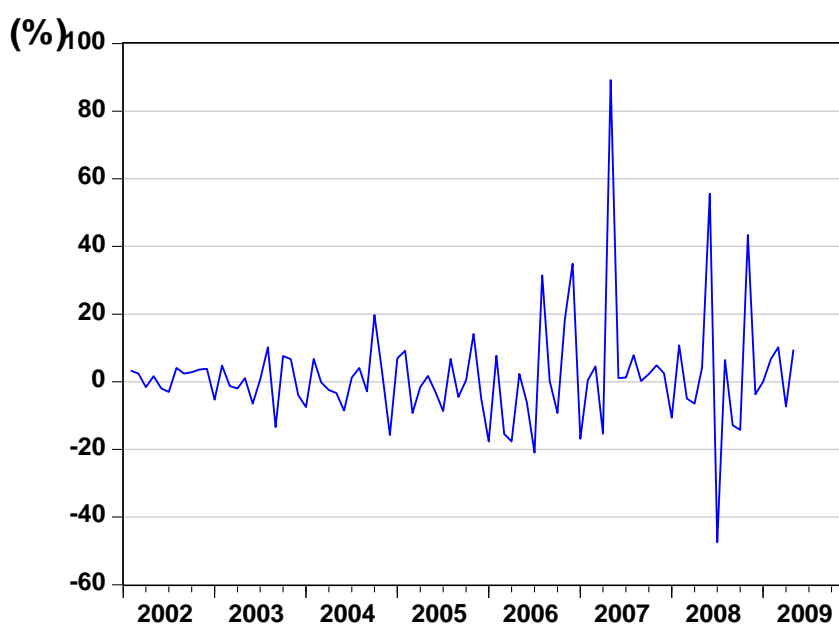
4.0 Theoretical Framework

The theoretical model was largely fashioned off of the framework employed by Martin and Millas (2009). They considered a canonical expression of the economy to model the gap between the money and credit market rates. Thus they represented the economy through the Phillips equation, IS equation and a version of the Taylor-type rule where the optimal policy rate was assumed to be obtained from the Taylor rule.   As such they specified

$$\pi_{t+1} = \pi_t + \alpha_y y_t + v_{t+1} \tag{1}$$

$$y_{t+1} = \beta_y y_t - \alpha_r\left(E_t i_t^{borrow} - E_t \pi_{t+1} - \bar{r}\right) + \eta_{t+1} \qquad (2)$$

$$i_t^{borrow} = \omega_{0t} + \omega_{1t} i_t^{base} + \varepsilon_t \qquad (3)$$

where π is the inflation rate, y is the output gap, v is a supply shock, i_t^{borrow} is the interest rate at which the private sector can borrow, i_t^{base} is the base rate, and η is a demand shock. They assumed that v_{t+1} and η_{t+1} are unknown, while ε_t is known.

Martin and Millas (2009) defined the base rate as the pillar upon which the market rate is determined, given that it is the lowest rate at which the central bank is prepared to lend at to commercial banks. An advantage of using the canonical form is that theoretically it allows for the finding of the optimum base rate that would minimise the deviation of the inflation rate from its targeted rate. Thus they assumed that the base rate can be chosen at time t based on information available at time t+1 to minimise the loss function with respect to inflation and the output gap. Martin and Millas (2009) expanded on equation (3) by allowing for the multiplication of excess liquidity by its interaction with the base rate, and different maturities of instruments in the money market. As a result they specified

$$i_t^{lib,3} = \omega_{00} + \omega_{01}\left(i_t^{lib,1} - i_t^{repo,1}\right) + \omega_{02}\left(i_t^{repo,3} - i_t^{repo,1}\right) + \omega_{03} liq_t^{FSR} + \left(\omega_{11} + \omega_{12} liq_t^{FSR}\right)i_t^{base} + \varepsilon_t$$

....(4)

where $i_t^{lib,3}$ is the average 3 month libor rate, $i_t^{lib,3} - i_t^{repo,1}$ is the differential between the 1-month libor and Gilt-Repo rates which represents the difference between secured borrowing and unsecured borrowing respectively. Accordinlgy, equation (4) was obtained by substituting the parameters in (3) with the $\omega_{0t} = \omega_0 + \omega_{01}\left(i_t^{lib,1} - i_t^{repo,1}\right) + \omega_{02}\left(i_t^{repo,3} - i_t^{repo,1}\right) + \omega_{03} liq_t^{FSR}$ and $\omega_{1t} = \omega_{11} + \omega_{12} liq_t^{FSR} . i_t^{lib,3}$.

4.1 Adoption of the Martin and Millas (2009) Framework to Trinidad and Tobago

Given the embryonic stage of development of the money market in Trinidad and Tobago, the model was applied to the market with some modifications. This was done since the market did not possess the variety of instruments or maturities compared to the UK market. Moreover, macroeconomic factors and a deepening of external capital inflows may have contributed to the build up of excess liquidity and therefore impact on the spread between the market rate and the policy rate.

A limitation of the Martin and Millas (2009) study is that they only considered liquidity and risk of default in the imputation of a mark by the private sector on the base rate. Instead we develop on the study by Martin and Millas (2009) by considering the role of inflation and excess liquidity in accounting for the mark up by the private sector on the policy rate prescribed by the central bank. In their model, they assumed that inflation was already taken into account by the central bank in devising the policy rate. Here it is assumed that the market likewise incorporated inflation in charging a mark up on the policy rate, with the idea that the market rate would be positively related to the inflation rate.

In addition, the mark up is assumed to be influenced by the excess liquidity measure as defined by the Trinidad and Tobago Central Bank. However we deem the expected direction of the relationship between excess liquidity and the base rate as an empirical matter that is largely dependent on the elasticity of demand for loan instruments. On the one hand it is possible that commercial banks may raise their interest rates to compensate for the level of unused funds in the system, given that loan demand is fairly inelastic. On the other hand, the surplus funds in the system may lead to commercial banks lowering their market rates in order to attract business.

4.2 Model Framework and Methodology

The study considered the transmission of the policy rates through the money and credit markets to see whether there are significant differences in the pass through across markets. As such, the overall sample period was March 2002 to December 2008, given when the repo rate was introduced. Further, the study compares a period of rising inflation with that of the overall sample to see if there is a profound difference compared to the overall sample. Accordingly, the subsample for the period 2005 to 2008 was also examined, since from 2005 there was a radical increase in the policy rate, market rates and an increase in inflation rates. In addition during the subsample period excess liquidity dramatically increased as there was a surge in external capital inflows.

4.2.1 Alternative specifications

4.2.2 Category A regressions

Following equation (3) in Martin and Millas (2009) and similar to Lowe (1995) specification, we first undertake a simple regression to see the degree of pass through from the policy rate to the market rate.

This serves as the basic model from which all other specifications can be compared. As such, the following is specified:

$$i_t^m = \beta_{00} + \beta_{01}i_t^r + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(A)}$$

where i_t^m is the market rate either in terms of the money market or the commercial banking credit market; i_t^r is the repo rate and ε_t is the random error term. The degree of pass through is therefore captured by β_{01}.

Thus the regression can be applied to the money market such that

$$i_t^{TB} = \beta_{00} + \beta_{01}i_t^r + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(A1)}$$

where i_t^{TB} is the 3 month Treasury Bill rate, which is used as the representative money market rate that is market determined through competitive bidding.

Also, for the intermediate market, the specification becomes

$$i_t^l = \beta_{00} + \beta_{01}i_t^r + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(A2)}$$

where i_t^l is the commercial bank prime lending rate.

4.2.3 Category B regressions

The pass through of the repo rate onto the market rate is tested to see whether it is influenced by inflation and excess liquidity. In addition, the Wald test is conducted to see whether the pass through rate is significant between markets when inflation and excess reserves is included in the specification. As such, the general model framework is expressed as

$$i_t^m = \beta_{00} + \beta_{01}i_t^r + \beta_{02}\pi_t + \beta_{03}exres_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(B)}$$

Where π_t is the inflation rate and $exres_t$ is excess reserves held in the central bank by commercial banks.

Thus, the pass through of the repo rate in the money market is

$$i_t^{TB} = \beta_{00} + \beta_{01}i_t^r + \beta_{02}\pi_t + \beta_{03}exres_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(B1)}$$

and the pass through in the credit market is

$$i_t^l = \beta_{00} + \beta_{01}i_t^r + \beta_{02}\pi_t + \beta_{03}exres_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(B2)}$$

4.2.4 Category C Equations

We consider the opportunity cost of holding excess reserves in the last period and its impact on the pass through of the current repo rate. To operationalise this, we estimate the potential revenue lost by commercial banks in the last period, to be in terms of the value of funds kept by commercial banks in the central bank as excess reserves. Therefore the opportunity cost of holding excess reserves in the last period is written as $OC_{t-1} = Exres_{t-1} * i_{t-1}^m$ where OC is the opportunity cost and the right hand lending rate.[5]

Substituting OC_{t-1} into equation B, the response of the market rate becomes

$$i_t^m = \beta_{00} + \beta_{01}i_t^r + \beta_{02}\pi_t + \beta_{03}exres_t + \beta_4 OC_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(C)}$$

Here it is assumed that the opportunity cost in the last period causes banks to adjust the current market rate. Thus, this formulation can be applied to the money market so that

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[5] This contrasts with the interaction term in Martin and Millas (2009). Since they measured liquidity in terms of the spread from the base rate to market rate, they allowed the yield curve to vary with the base rate thus leading to changes in the market rate.

$$i_t^{TB} = \beta_{00} + \beta_{01}i_t^r + \beta_{02}\pi_t + \beta_{03}exres_t + \beta_4 OC_{t-1}^{TB} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(C1)$$

where $OC_{t-1}^{TB} = Exres_{t-1} * i_{t-1}^{TB}$

and to the credit market where

$$i_t^l = \beta_{00} + \beta_{01}i_t^r + \beta_{02}\pi_t + \beta_{03}exres_t + \beta_4 OC_{t-1}^l + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(C2)$$

where $OC_{t-1}^l = Exres_{t-1} * i_{t-1}^l$.

Monthly data were used for the period May 2002, following the introduction of the repo rate, to December 2008. As a result, the overall data set was 96 data points. The subsample data runs from January 2005 to December 2008, yielding 48 data points.

Like Martin and Millas (2009), Generalised Method of Moments (GMM) is the preferred estimation technique used. For the overall period, the instruments used are 6 lags for the endogenous variables and a similar number of lags for the growth of loans, which is used as an exogenous instrument. For the subsample, two lags were used for each endogenous variable plus the growth of loans, given that a shorter data set was used, 48 data points.

5.0 Results

The results for the overall period were compared to the results for the subsample between the money market and credit markets. Regression A results showed that both the overall sample and the sub period, the pass through of the repo rate to the prime lending rate in the commercial banking credit market was one to one. This suggested that commercial banks tended to adjust their prime lending rate as soon as the central bank announced changes in the repo rate. The same result was not upheld for the money market, however. In this market, the Treasury bill rate tended to adjust positively but in less proportion to changes in the repo rate.

Table 2 Degree of Pass through to the money and intermediate markets for Model A

	Overall Sample (2002:3 to 2008:12)		Subsample (2005:1 to 2008:12)	
	Money Market Rate	Intermediate Market Rate	Money Market Rate	Intermediate Market
β_{00}	1.28 (0.10)***	3.41 (0.32)***	1.18 (0.20)***	3.49 (0.09)***
β_{01}	0.69 (0.02)***	1.05 (0.43)***	0.70 (0.03)***	1.03 (0.01)***
$\overline{R^2}$	0.65	0.31	0.48	0.97
S.E of regressions	0.63	1.12	0.75	0.25

Notes: Dependent variables are the Treasury Bill rate for the Money market and the Prime Lending rate for the Intermediate market. Money market equation is given by equation A1 and the Intermediate market is given by equation A2. Standard error of parameter estimates are placed in brackets.

Use of the Wald test showed that the pass through of the repo rate in the credit market was significantly higher than in the money market, regardless of the sample used. At the same time, use of the test showed that there was no significant difference of the pass through for the sub sample compared to the overall period. Thus the result showed that the pass through across markets rather was not significantly different between time periods. Overall the evidence showed that the pass through of the repo rate was significantly different between markets been higher with respect to the commercial bank credit market.

Regression estimations for category B, were reported in Table 3. With the addition of inflation and excess reserves, the pass through coefficient of the repo rate was now significantly less than one for both the money and bank credit markets. However, the Wald test results indicated the same results as reported for Table 2, that the pass through of the repo to the credit market is significantly higher than with respect to the Treasury bill rate for both the overall sample and the sub-period.   Again the results suggested that the effect of the repo rate is more pronounced with respect to the credit market compared to the money market.

Table 3 Incorporation of economic factors in the interest rate spread

	Overall Sample (2002:3 to 2008:12)		Subsample (2005:1 to 2008:12)	
	Money Market Rate	Intermediate Market Rate	Money Market Rate	Intermediate Market Rate
β_{00}	1.22 (0.02)***	5.25 (0.16)***	1.19 (0.07)***	3.62 (0.07)***
β_{01} (repo)	0.75 (0.01)***	0.87 (0.04)***	0.78 (0.01)***	0.95 (0.09)***
β_{02} (Inflation)	-0.04 (0.003)***	-0.05 (0.03)*	-0.06 (0.01)***	0.06 (0.01)***
β_{03} (Excess Reserves)	-2.71 (0.66)***	-4.33 (1.46)***	-3.48 (0.79)***	4.42 (0.95)***
R^2	0.94	0.52	0.94	0.97
S.E of regressions	0.26	0.89	0.23	0.21

Notes: Dependent variables are the Treasury Bill rate for the Money market and the Prime Lending rate for the Intermediate market. Money market equation is given by equation A1 and the Intermediate market is given by equation A2. Standard error of parameter estimates are placed in brackets.

For either the overall or the sub period, the inflation rate did not have the expected sign for the money market. Rather the sign was negative. This may have suggested that the demand for Treasury bills is inelastic in the context of limited availability of money market instruments and high excess liquidity. Thus competition for Treasury bills could lower the Treasury bill interest rate in the money market in spite of rising inflation.

The picture was different for the bank credit market. In the sub period, the inflation rate was positively related to the lending rate, thus suggesting that banks not only raised their interest rates in reaction to the repo rate, but also in reaction to the inflation rate. The same result was not obtained for the overall period however, but this may have been due to the low level of inflation prior to the sub-sample period, so that inflation may not have been consistently used in the mark up on the bank rate.

Excess reserves had a negative effect on the market rate in all the regressions except the bank credit market for the subsample period. In general, the results would suggest that the build up of excess liquidity would tend to have a softening effect on the rates in the money market and intermediate market. However, the results for the sub sample credit market suggested that increases in excess reserves led to higher lending rates. Nevertheless, a weakness of this excess reserves measure is that it does not actually include the revenue the commercial banks could have earned, since it omitted the prevailing interest rate the bank could have charged on the surplus funds.

When the opportunity cost variable was included, its effect on the repo rate and prime lending rates was negative in all regressions, see Table 4. This may suggest that in the presence of excess liquidity, institutions may be prepared to soften their rates to attract business thereby absorbing surplus funds for revenue earning activities. Again the results suggested that the pass through of the repo rate is higher for the credit market compared to the money market.

Table 4 Inclusion of the Opportunity Cost Variable

	Overall Sample (2002:3 to 2008:12)		Subsample (2005:1 to 2008:12)	
	Money Market Rate	Intermediate Market Rate	Money Market Rate	Intermediate Market Rate
β_{00}	1.15 (0.02)***	5.78***	1.14 (0.08)***	3.13 (0.10)***
β_{01} (repo)	0.76 (0.01)***	0.70***	0.78 (0.01)***	1.01 (0.02)***
β_{02} (Inflation)	-0.05 (0.003)***	0.05***	-0.06 (0.01)***	0.08 (0.01)***
β_{4} (opportunity Cost)	-0.10 (0.05)***	-0.19***	-0.64 (0.14)***	-0.46 (0.07)***
$\overline{R}^2$	0.94	0.53	0.94	0.98
S.E of regressions	0.26	0.89	0.22	0.20

Notes: Dependent variables are the Treasury Bill rate for the Money market and the Prime Lending rate for the Intermediate market. Money market equation is given by equation A1 and the Intermediate market is given by equation A2. Standard error of parameter estimates are placed in brackets.

6.0 Conclusion

The empirical evidence showed that there is a higher pass through of the repo rate in commercial bank credit markets compared to the pass through to the Treasury bill rate in the money market. The higher pass through in the bank credit market could have taken place owing to effective moral suasion on the part of the Central Bank. Moreover, the central bank may try to absorb excess liquidity from the commercial banking sector before making changes to the repo rate. On the other hand, the lower pass through in the money market may have been attributable to less influence by the central bank on the bidders in this market. Also, it may result from the lack of sophistication and the embryonic stage of development of the money market.

An interesting result obtained was that in the money market, the inflation rate turned out not to contribute positively to the magnitude of the Treasury bill rate. This may be due to the short investment horizon of investors in this market. It may also reflect limited investment options in the money market thus suggesting that there may be a distortion in the market as a result. In contrast, banks may take

longer positions in the credit market. As such, in most regressions inflation positively impacted on the magnitude of the lending rate.

Based on the findings, the Central Bank may find it prudent to take excess reserves into account in setting the repo rate, as excess reserves tend to have a dampening effect on the market interest rates. This can therefore lead to a bias towards higher levels of demand. Moreover, in the presence of excess liquidity, commercial banks would not need to go to the central bank or the interbank market to borrow, so that there would not exist a forcing mechanism to carry through the repo rate. Moral suasion may have played an important role in effecting the pass through of the repo rate through the credit market.

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