

Monetary Policy and Deposit Rates Rigidity in a Transitional Economy: The Case of China

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Abstract

This study examines the conduct of monetary policy and the setting of deposit rates in China. As China is still in the transitional stage from a centrally planned economy to a market economy, state-owned enterprises and banks are being restructured and financial markets are being developed. Our findings show that there is a long-term relationship between deposit rates and inflation, but the relationship is weak. In the short-run, the central bank adjusts the deposit rates downward faster than they adjust them upwards. The weak long-term relationship reflects the fact the monetary policy is ineffective and the asymmetric adjustment speed shows that retail rates are kept deliberately below their equilibrium levels for the state-sponsored objective of stimulating economic growth, creating jobs and maintaining financial stability.

1. Introduction

In virtually all mature market economies, monetary policy is an essential tool for the management of the economy and the interest rate is the main instrument by which the monetary authorities manage aggregate demand, control inflation and ensure sustainable economic growth. However, in developing countries, the tools, objectives and the transmission mechanism may be different from those in the developed countries, thereby reducing the role of monetary policy in the management of the macro-economy.

This paper examines the conduct of monetary policy in China. Specifically, we investigate the relationship between inflation and government administered deposit rates in the long term and we examine whether this relationship varies at deposit rates of different maturities. We also investigate how deposit rates adjust in response to inflationary pressures in the short-term and we examine whether the speed by which these retail rates are adjusted varies in relation to whether rates are adjusted upwards or downwards.

In China, like in other developing countries, financial repression is quite widespread. Interest rates are controlled by the government and kept deliberately low, often resulting in negative real interest rates. In situations where interest rates are kept below market-clearing levels even low yielding investment projects may become profitable, leading to an inefficient allocation of credit (see, for example, McKinnon 1973, Shaw 1973, and Fry 1988).¹

Efficiency considerations aside, the Chinese government regards the creation of employment opportunities as the primary strategic task in its economic and social development programme and controlling the unemployment rate as a key target of macro-economic management (see the State Council's 2004 "Labour and Social Security" white paper). Government policy has been assigned the task of promoting employment through economic growth.² For example, in order to discourage savings and stimulate consumption, withholding tax on interest income of

¹ According to the Economist (2005) report on China, investment in this country is so unproductive to the extent that about US\$5 fresh capital is needed to generate US\$1 of incremental output. Economic reforms in recent years including widespread partial privatisation and closures of state-owned enterprises (SOEs) have been aimed at improving economic efficiencies but have also lead to big increases in unemployment and growing labour unrest. Between 1998 and 2003, about 27.8 million workers were laid off, about two-thirds of which have been reemployed ("Millions to be laid-off as SOEs streamline," China Daily, 8 January 2004). Further, three million workers are expected to be laid off every year in the next few years as the over-staffed SOEs continue to restructure. Both the chief of the State Economic Planning Committee and the Minister of Social Security have admitted that unemployment is a very serious problem in China during the transitional phase (Song and Tong, 2003).

² The government has set the economic growth target at 7 to 8% per year in the 10th five-year economic plan of 2000 to 2005. In the long term, the government is planning to quadruple 2002 GDP by year 2020, implying that GDP needs to grow at 8% a year on average over the period. In line with this high growth objective, monetary policy is preoccupied with maintaining a highly competitive exchange rate rather than focusing primarily, as in many developed countries, in the achievement of price stability.

deposits was imposed in 1999. In addition, a policy involving a series of interest rate cuts that was implemented since the beginning of 2002 has given extra stimulus to private spending. By making smaller adjustments in long rates relative to short rates this policy has aimed at stabilising interest and inflation rate expectations in the long run while stimulating consumption and investment in the short run (Xie 2004).

A low interest rate environment and strong economic growth are also needed to maintain the stability of the banking system which dominates the financial system. China has one of the highest savings rates in the world at over 40% of GDP. However, due to the underdeveloped nature of the capital markets in China, most of the savings end up in bank deposits which account for about 70% of investors' financial assets. Only 10% is in the form of bonds and equity and the remaining 20% in cash (Song and Tong 2000, Kang et al, 2002). For borrowers, bank loan is the dominant way of financing. Bank lending accounts for about 90% of total financing and the banking system is dominated by the four state-owned banks which are undercapitalized, poorly managed and have huge amounts of non-performing loans (NPLs) in their balance sheets.³

To alleviate the NPLs problems, banks are required to reduce the bad debt by 3% each year. Only with strong economic growth, the relative size of the NPLs will decline and both the banks and the government will have more resources and time to deal with the problems.

³ As at June 2004, according to official statistics, the non-performing loans of the big four banks and eleven joint-stock banks were 1.66 trillion yuan (US\$200 billion) or 13.32% of total loans (Pepole's Daily, 2004). To support their current level of loan growth without the injection of external capital, Chinese banks must generate an average rate of return on assets (ROA) of 2.1%, more than five times their current level (The Economist, 2005). So far, the government has injected more than US\$260 billion into the banking system in its attempt to clean up the bad debts. This is about the same the US spent in bailing out its savings and loans industry, but relative to its GDP, the amount is significant higher as the Chinese economy is much smaller than the US economy.

Hence, even a slight deterioration in the economic growth and business conditions can have a major impact on the banks which are under pressure to meet the 8% minimum capital adequacy ratio requirement.

In spite of some progress in recent years with financial sector deregulation, deposit interest rates are still regulated by the government. It is possible in situations where retail rates are administered by the central bank directly, as in the case of China, that monetary policy transmission to the economy via the interest rate channel can be complete and instantaneous. In other countries, even developed countries, the monetary policy stance is typically transmitted to the economy in a sluggish and incomplete manner (Hofmann and Mizen, 2004, Chong et al, 2005, Kleimeier and Sander, 2005).

However, in reality, the Chinese economy is not sensitive to changes in interest rates and monetary policy in China is largely ineffective.⁴ When the economy is not doing well, banks are reluctant to lend. To stimulate the economy, government has to resort to fiscal measures and other administrative measures such as instructing banks to lend. When the economy is booming, returns to investment are so high that borrowers are not sensitive to small increases in interest rates. To prevent the economy from overheating, the government has to use old-fashioned administrative measures such as credit curbs, widely used in the central planning period. Instead of making loans more expensive by increasing interest rates, loans were made

⁴ Although since 1998 the central bank (PBoC) has modernised its operating procedures and strengthened the role of interest rates, the effectiveness of the monetary transmission mechanism is still hampered by a lack of investible debt instruments, the large volume of liquidity in the banking system exacerbated by FX inflows, and problems with the ability of banks to price loans and manage risk (see Green 2005).

difficult to obtain as banks were told to reduce lending to certain sectors. In some cases, investments in certain projects/sectors are not allowed at all.⁵

When the central bank sets retail interest rates directly, it also means that there is very little price competition in the banking industry, hampering the transmission of monetary policy. Studies show that competition in the banking industry can enhance the transmission of monetary policy (Hannan and Berger, 1991, Neuman and Sharpe, 1992 Cottarelli and Kourelis, 1994, Bondt, 2002). Further, given that the central bank in China is required to maintain the stability of the domestic currency instead of controlling inflation, the central bank may not always respond to the threat of inflation in a timely manner, resulting in the hard landing of the economy. To promote economic growth and create employment, the central bank may adjust interest rates in an asymmetric manner. For example, deposit rates may be adjusted down faster than they are adjusted upwards. In the developed countries, deposit rate adjustment can be sluggish and asymmetric due to factors such as imperfect competition and customer inertia/switching costs (Hannan and Berger, 1991, Chong et al 2005). In developing countries, governments often set interest rates in an asymmetric manner. For example, Scholnick (1996) shows that in Malaysia, the base lending rate was adjusted by the central bank in an asymmetric way.

⁵ For example, in 1994, China experienced the highest rate of inflation since 1949 when the People's Republic was established. Inflation as measured by CPI reached 24.1%. As monetary policy was largely ineffective in curbing overheating, it took the government two years to achieve soft landing of the economy through various other measures. On the other hand, in the aftermath of the Asian financial crises, CPI inflation decreased steadily and deflation set in throughout 1998 and 1999. Again, monetary policy proved to be ineffective. With the economy in recession, the state-owned enterprises were heavily in debt and demand for bank lending was weak. Further, the commercial banks were inadequately capitalised due to the large amount of NPLs in their books. Even if banks are willing to lend, loan rates are regulated by the government and banks cannot price in the credit risk exposure.

Our findings show that there is a long-term relationship between the administered deposit rates (policy rates) and inflation, but the relationship is weak. In the short run, the central bank in China adjusts deposit rates upwards more slowly than they adjust them downwards. The interest rates for time deposits with a maturity of six months and above are rigid upwards. The weak long-term relationship reflects the fact the monetary policy is ineffective in China due to the transitional nature of the economy, in particular, the problems of state-owned commercial banks and the loss-making state-owned enterprises. The asymmetric adjustment speed results show that deposit rates are kept deliberately below its equilibrium level for the purpose of economic growth, job creation and financial stability, which has led to severe low productivity of investments in China.

The rest of the paper is organised as follows. Section 2 details the institutional background of monetary policy in China. Section 3 outlines our methodology. Section 4 discusses the data and results and the final section concludes the paper.

2. Monetary Policy in China

2.1 Goals of Monetary Policy

The formulation and conduct of monetary policy is the responsibility of the People's Bank of China which, unlike central banks in the developed countries, is not an independent body but part of the government. The goals of monetary policy in China differ from those in the developed countries. In developed countries, the main objective of monetary policy is to control inflation and maintain sustainable economic growth. In some countries, e.g., New

Zealand, inflation targeting is formally adopted and the central bank is responsible in ensuring that inflation is contained within a certain band. In other countries, like the United States, there is no specific inflation targeting and the central bank is required to pay attention to both inflation and employment. In China, the Central Bank Act requires the Bank to maintain the stability of the domestic currency, Renminbi (RMB), and thereby promote economic growth. No reference is made with regard to controlling inflation. Indeed, the central bank makes great effort to maintain the stability of Renminbi (Wang and Ma, 2001).⁶

2.2 Targets and Tools of Monetary Policy

The tools of monetary policy in China have evolved over time. Prior to 1994, direct central bank lending to the four state-owned banks was the main channel of injecting monetary base. Between 1994 and 1999, the sterilisation of foreign reserves as a result of the rapid growth of FDI was the main instrument to control the monetary base. In 1998, the government abandoned the national bank credit quota and open market operations became the main channel of controlling the monetary base and money supply, together with other instruments such as reserve requirement, rediscounting and the guidance of credit orientation.⁷

In 1996, the central bank embarked on a gradual process of interest rate deregulation with the establishment of the inter-bank money market was and the removal of the controls over inter-bank offered rate. In June 1997, the inter-bank bond market was established. In October 1998 and later in September 1999, the central bank twice widened the loan rate band banks were

⁶ Before December 1993, the central bank pursued the dual goals of maintaining currency stability and promoting economic development.

⁷ In October 1998, active open market operations began with the introduction of cash bond trading. Initially cash bond trading was used to adjust money supply. Shortly after, bond-based repo transactions were used to affect money market interest rates. By September 2002, the central bank had run out of bonds to make repo transactions. In May 2003, the central bank began issuing Central Bank bills through regular auctions (Green, 2005).

allowed to charge medium-sized and small enterprises. In July 1999, the central bank lifted control over the interest rates on RMB borrowings by foreign banks. In October 1999, the ceiling on interest rate for deposits over 30 million yuan with a minimum maturity of five years was lifted. In September 2000, the foreign currency banking business was open to foreign competition. In October 2004, restrictions on lending rates were lifted. However, domestic currency deposit rates are still controlled by the central bank.

While the tools of monetary policy are mostly present in China, they are not effective enough for the conduct of monetary policy. For example, to control money supply, the central bank often uses repos to affect short-term money market rate. However, banks, flush with liquidity, do not need to borrow from money market and are insensitive to changes in money market rates. Currently, the bond market is too small. With outstanding bonds accounting for only 20% of GDP, demand for bonds is far greater than the supply. With limited investment alternatives, banks simply deposit their excess cash with the central bank which, unlike in other countries, pays interest on the excess reserves. Interest rates in the money market or the bond markets have not been used as benchmark interest rates; instead, the one-year deposit rate administered by the central bank is widely used as a benchmark interest rate in China.

3. Methodology

In this paper, we examine both the long-run relationship and the short-term dynamics between inflation and deposit rates. A two-step approach will be used.

The long-term relationship between the inflation and deposit rates is as follows:

$$y_t = \alpha_0 + \alpha_1 x_t + \varepsilon_t \quad (1)$$

where y_t is the endogenous deposit rate; x_t represents the rate of inflation; ε_t is the error term; α_0 and α_1 are the parameters.

Equation (1) is valid only in the long run. As inflation changes, the central bank will not adjust their retail rates immediately. To examine the short-run dynamics of interest rate changes in response to changes in inflation, we employ a standard error-correction methodology similar to that used by Chong et al (2005) and Scholnick (1996). The error-correction representation is as follows:

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + \nu_t \quad (2)$$

where Δ denotes first difference operator; $\hat{\varepsilon}_{t-1} = (y_{t-1} - \alpha_0 - \alpha_1 x_{t-1})$ represents the extent of disequilibrium at time $(t-1)$ and it is the residual of the long run relationship given by Equation (1); and ν_t is the error term. β_1 measures the short-term response of interest rate to changes in inflation (i.e., within one month period); and β_2 captures the error correction adjustment speed when the rates are away from their equilibrium level.

Following Hendry (1995), the mean adjustment lag (MAL) of a complete pass-through can be calculated as follows:

$$MAL = (1 - \beta_1) / \beta_2 \quad (3)$$

The MAL measure the amount of time (in our case, the number of months) for interest rates to completely adjust to the long-term equilibrium relationship.

The short-term adjustment may be asymmetric, in other words, the adjustment speed may differ when rates are above the equilibrium from that when rates are below. To test for the

existence of asymmetric adjustments, we add a dummy variable, λ , to Equation (2). λ is equal to one if the residual, $\hat{\varepsilon}_{t-1}$, is positive and 0 otherwise. The asymmetric short-run dynamic equation is as follows:

$$\Delta y_t = \delta_1 \Delta x_t + \delta_2 \lambda \hat{\varepsilon}_{t-1} + \delta_3 (1 - \lambda) \hat{\varepsilon}_{t-1} + \eta_t \quad (4)$$

where δ_2 captures the error correction adjustment speed when the rates are above their equilibrium level and δ_3 captures the error correction adjustment speed when the rates are below their equilibrium level. To test for the existence of asymmetric adjustment, we use the standard Wald test to determine if δ_2 is significantly different from δ_3 .

As with the symmetric adjustment case, we can define the asymmetric mean adjustment lags (MAL) of a complete pass-through as follows (see Hendry, 1995):

$$MAL^+ = (1 - \delta_1) / \delta_2 \quad (5)$$

$$MAL^- = (1 - \delta_1) / \delta_3 \quad (6)$$

where MAL^+ represents the mean adjustment lag when the retail interest rates are above their equilibrium value and MAL^- represents the mean adjustment lag when the retail interest rates are below their equilibrium value.

4. Data and Analysis of Results

The monthly series of deposit rates data and inflation as measured by CPI are from the People's Bank of China. The sampling period is from January 1991 to May 2005, covering a time span of over 14 years. The sample size is 173. The deposit rates are call deposit rates and term deposit rates with maturity of three months, six months, one year, two years, three years and five years. All the deposit rates are set by the central bank and reviewed from time

to time. The one-year term deposit rate is regarded as the benchmark rate by the market and it is widely used to as the reference rate for floating rate government bonds and corporate bonds in China.

Table 1 provides the descriptive statistics for the data. The deposit rates are positively related with maturity, indicating an upward sloping yield curve. Interestingly, the interest rate volatility is also related to maturity. In matured markets, short-term interest rates are typically more volatile than long-term rates. Further, the average inflation rate is below term deposit rate with a maturity of one year and above, but is above those with a maturity of less than one year. The average inflation was 5.62% whereas the average six-month deposit rate was 4.56% and the average three-month deposit rate was 3.32%. The average savings deposit rate was almost 4% below inflation.

INSERT TABLE 1 HERE

The pair-wise correlation coefficients between the various interest rates and inflation are reported in Table 2. All the deposit rates are highly correlated with each other, with virtually all the pair-wise correlation coefficients being over 0.95. The call deposit rate is also highly correlated with all the term deposit rates. This indicates that the central bank tends to adjust the rates of various maturities (call to five years) concurrently.

INSERT TABLE 2 HERE

To assess whether the individual interest rate and inflation series are unit root processes and their first-difference are stationary series, the Philips Perron (PP) and the ADF tests are used.

The results of the stationarity tests on the various interest rate and the inflation rate series are summarized in Table 3. For the level of the series, the tests show that, all the series are unit root non-stationary at the 5% level of significance and that all the first differenced series are stationary at the 1% level of significance, i.e, all the individual series are I(1) in levels.

INSERT TABLE 3 HERE

In order to determine the dynamics of deposit rate changes in response to changes in the rate of inflation, we carry out Granger causality tests to determine if changes in inflation cause adjustments in the deposit interest rates, or vice versa. Table 4 reports the results of the Granger causality tests. The results show that changes in inflation Granger cause changes in the deposit rates, but not vice versa.

INSERT TABLE 4 HERE

Table 5 shows the results of the Johansen cointegration test. The results show that there is one cointegrating relationship between inflation and the various deposit rates, indicating there is a long-term equilibrium relationship between inflation and the various deposit rates.

INSERT TABLE 5 HERE

Table 6 shows the results on the long-term relationship between inflation and the various deposit rates obtained from OLS regressions. The results show that in the long run, the relationship is quite weak. The coefficient ranges from 0.10 for call deposit rate to 0.48 for the five year fixed term deposit rate. The relationship is positively related to maturity, i.e., the longer the maturity, the higher the coefficient. The adjusted R-square is around 70% for all

cases. The OLS results are quite robust to the maximum likelihood estimates of the long-run coefficients obtained via the Johansen procedure.⁸

The weak long-term relationship reflects the fact that monetary policy is largely ineffective. The transmission of monetary policy to the real economy in China is often difficult due to the underdeveloped nature of China's financial markets. China's capital market, though improving, is still immature and too small. Bank loans are still the dominant method of raising capital by enterprises.⁹ Although China has one of the highest savings rate in the world, about 40% of GDP, most of the savings are deposited with banks as a result of the lack of other investment outlets. However, banks, burdened with huge amount of bad debts and undercapitalised, are often unwilling to lend to risky borrowers.

For decades, as government agencies, state-owned banks in China have been told where to lend and how much to lend. Bank loans were often channelled into wasteful infrastructure projects and state-owned enterprises (SOEs), creating huge non-performing loans and keeping loss-making SOEs afloat and depressing the productivity of the economy. Today, most banks are still struggling to operate on a commercial basis. Most of these banks did not have a loan classification system until recently. Although risk management systems are being slowly put in place, banks do not know how to evaluate and price risks. For example, according to its chairman, Guo Shuqing, more than 90% of China Construction Bank's risk managers are unqualified. China Construction Bank is regarded as one of the best banks in China (The

⁸ The Johansen estimates of the slope coefficient range from 0.13 to 0.61. For all maturities there is no evidence from chi-squares tests to support the hypothesis of complete pass-through.

⁹ In 2004, bank assets were about 30 trillion yuan (US\$3.7 trillion) or 210% of China's GDP, the highest of any big economy (The Economist, 2005).

Economist, 2005). Despite nearly three decades of economic reforms, many of the state-owned enterprises are still losing money.¹⁰ They have weak balance sheet and weak corporate governance and internal control. To avoid further loan loss, banks simply refuse to lend. As a result, the mobilised savings often end up as deposits with the central bank and the transmission of monetary policy from the banks to the real economy is hampered. To prevent the economy from overheating or to get the economy out of recession, the government often has to resort to fiscal policy or administrative measures such as credit curbs and land controls, etc.

INSERT TABLE 6 HERE

Table 7 shows the results on the short-term adjustment dynamics. The results show that the error correction adjustment coefficients are negative and significant with a small magnitude implying a slow response rate. When deposit rates are above (below) their long-term equilibrium level with inflation, they will adjust downwards (upwards). However, we find no statistical evidence that deposit rates respond instantly to changes in inflation at all. This lack of response of deposit rates to changes in inflation is further evidence that monetary policy in China is largely ineffective at short, in addition to long horizons. Due to the structural problems in the Chinese economy and the underdeveloped nature of the financial sector described above, the transmission of monetary policy from the central bank to the real sector is hampered by the banks.

¹⁰ In 1978, China shifted its focus from class struggle to economic development and started to reform its economy and began the gradual transformation from a centrally planned economy to a market economy. Reforms started in the rural sector and later expanded into the state-owned enterprises. In the early 90s, stock exchanges was set up in Shanghai and Shenzhen, state-owned enterprises were partially privatized, followed by the issuing and trading of government securities and the development of interbank money market. More than two decades later, the transformation has deepened, but is still ongoing. Before the economic reform stated, the state and collective sectors accounted for 95% of the economy, today, they account for one-third. However, many serious problems remain to be solved. For example, its banking sector is still burdened with huge amount of non-performing loans. Corporate governance standard is low and efficiency is poor. Unemployment and underemployment is high and the economy is prone to over-heating and the subsequent hard-landing.

INSERT TABLE 7 HERE

Table 8 shows the results on the asymmetric adjustment. The results show that deposit rates with longer term maturity (i.e., six months and above) were adjusted upwards more slowly than they were adjusted downwards. For the call deposit rate and the three-month deposit rate, there is no evidence of asymmetric adjustment. In China, the one-year deposit rate is regarded as the benchmark interest rate. Our results suggest that the central bank is quick to bring rates down and is slow to bring deposit rates up. When inflation increases, the deposit rates, controlled by the government, were not adjusted upwards, leading to the decrease of real interest rates, even negative real interest rates as seen from time to time in China. One explanation for the asymmetric adjustment is that a low interest rate environment is necessary for economic growth and thereby creating employment opportunities for the huge and growing population and preserving the stability of the banking system. For example, it was estimated that a series interest rate cuts in the 1990s have reduced financing costs by state-owned enterprises' financing costs by RMB 260 billion (US\$31 billion) (Song and Tong, 2003).

INSERT TABLE 8 HERE

5. Conclusions

In many countries, the central banks devote their primary attention to inflation to ensure sustainable economic growth. However, in China, this is not the case. The objective of monetary policy is to maintain the stability of the domestic currency and thereby promote economic growth. Our findings show that there is a long-term relationship between deposit

rates and inflation, but the relationship is weak. In the short run, the central bank in China adjusts deposit rates more upwards more slowly than they adjust them downwards.

The weak long-term relationship reflects the fact that monetary policy is largely ineffective. Unlike in other countries where deposit rates are adjusted by commercial banks in response to market forces, deposit rates in China are administered by the central bank. Market interest rates are still in their development stage and the transmission mechanism of monetary policy is often difficult to work due to the structural problems of the Chinese economy. The state-owned enterprises (SOEs) and state-owned banks still dominate the economy. They have not been and still are not pure commercial entities but government agencies, operating with both economic and social objectives. They respond more to government instructions than to market forces. To increase the role of monetary policy in the management of the macro-economy, China needs to make the economy more sensitive to interest rates. SOEs need to be further privatized, resulting in the loss of their lobbying power to keep interest rates. To improve the transmission mechanism, interest rates need to be deregulated, banks need to be recapitalised and develop their capacity to assess credit risk exposure and price them accordingly.

The asymmetric adjustment speed suggests that the Chinese government has kept interest rates deliberately below their equilibrium level which on occasion has caused real rates to be substantially negative. These developments may lead to short term output, financial stability, and job creation gains but their long term consequences tend to be typically counterproductive in terms of achieving sustainable objectives. While stability is of paramount concern to any government, financial repression can lead to inefficient allocation of credit and low

productivity in the economy. To ensure sustainable economic growth, the central bank needs to focus more on inflation instead of focusing on short term growth and job creation. Like its counterparts in other countries, the central bank should be allowed to conduct the monetary policy independently as part of or in line with a wider market based programme of economic and financial reform.

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Table 1: Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
CALL	1.67	1.71	3.15	0.72	0.89	173
DEP_3M	3.32	2.88	6.66	1.71	1.82	173
DEP_6M	4.56	4.14	9.00	1.89	2.68	173
DEP_1Y	5.67	5.22	10.98	1.98	3.53	173
DEP_2Y	6.07	5.58	11.70	2.25	3.70	173
DEP_3Y	6.47	6.21	12.24	2.52	3.80	173
DEP_5Y	7.15	6.66	13.86	2.79	4.32	173
INFLATION	5.62	2.80	27.70	- 2.20	7.61	173

Table 2: Correlation Ceofficients

	CALL	DEP_3M	DEP_6M	DEP_1Y	DEP_2Y	DEP_3Y	DEP_5Y
DEP_3M	0.980						
DEP_6M	0.990	0.979					
DEP_1Y	0.976	0.944	0.991				
DEP_2Y	0.977	0.948	0.993	1.000			
DEP_3Y	0.976	0.949	0.992	0.998	0.999		
DEP_5Y	0.978	0.957	0.994	0.996	0.998	0.999	
INFLATION	0.836	0.880	0.856	0.821	0.828	0.831	0.841

Table 3: Unit Root Test

Panel A: ADF test

LEVEL					1 ST DIFFERENCE				
Series	Prob.	Lag	Max Lag	Obs	Series	Prob.	Lag	Max Lag	Obs
CALL	0.8458	0	13	172	D(CALL)	0	0	13	171
DEP_3M	0.5899	3	13	169	D(DEP_3M)	0	2	13	169
DEP_6M	0.8425	0	13	172	D(DEP_6M)	0	2	13	169
DEP_1Y	0.8676	0	13	172	D(DEP_1Y)	0	0	13	171
DEP_2Y	0.8468	0	13	172	D(DEP_2Y)	0	0	13	171
DEP_3Y	0.8172	0	13	172	D(DEP_3Y)	0	0	13	171
DEP_5Y	0.7908	0	13	172	D(DEP_5Y)	0	0	13	171
INFLATION	0.6252	12	13	160	D(INFLATION)	0	0	13	171

Panel B: Phillips-Perron test

LEVEL				1 ST DIFFERENCE			
Series	Prob.	Bandwidth	Obs	Series	Prob.	Bandwidth	Obs
CALL	0.8154	4	172	D(CALL)	0	4	171
DEP_3M	0.6811	7	172	D(DEP_3M)	0	6	171
DEP_6M	0.792	6	172	D(DEP_6M)	0	6	171
DEP_1Y	0.8426	5	172	D(DEP_1Y)	0	5	171
DEP_2Y	0.8192	5	172	D(DEP_2Y)	0	5	171
DEP_3Y	0.7909	5	172	D(DEP_3Y)	0	5	171
DEP_5Y	0.7601	5	172	D(DEP_5Y)	0	5	171
INFLATION	0.6742	7	172	D(INFLATION)	0	2	171

Table 4: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Probability
INFLATION does not Granger Cause CALL	171	7.40	0.00
CALL does not Granger Cause INFLATION		0.04	0.96
INFLATION does not Granger Cause DEP_3M	171	8.79	0.00
DEP_3M does not Granger Cause INFLATION		0.01	0.99
INFLATION does not Granger Cause DEP_6M	171	7.20	0.00
DEP_6M does not Granger Cause INFLATION		0.14	0.87
INFLATION does not Granger Cause DEP_1Y	171	6.30	0.00
DEP_1Y does not Granger Cause INFLATION		0.33	0.72
INFLATION does not Granger Cause DEP_2Y	171	7.07	0.00
DEP_2Y does not Granger Cause INFLATION		0.25	0.78
INFLATION does not Granger Cause DEP_3Y	171	7.46	0.00
DEP_3Y does not Granger Cause INFLATION		0.22	0.80
INFLATION does not Granger Cause DEP_5Y	171	8.29	0.00
DEP_5Y does not Granger Cause INFLATION		0.17	0.84

Table 5: Johansen Cointegration Test

Dependent	Trace	Trace	Max. Eigenvalue	Max. Eigenvalue
Variable	$r = 0$	$r = < 1$	$r = 0$	$r = < 1$
Call	13.65*	1.05	12.60*	1.05
DEP_3M	19.65***	1.20	18.43***	1.20
DEP_6M	15.96**	0.86	15.10**	0.86
DEP_1Y	14.38*	0.59	13.79*	0.59
DEP_2Y	15.75**	0.67	15.08**	0.67
DEP_3Y	16.76**	0.75	16.01**	0.75
DEP_5Y	18.45**	0.80	17.64**	0.80

Table 6: Long-term relationship

$$y_t = \alpha_0 + \alpha_1 x_t + \varepsilon_t$$

	Intercept		Slope		Adj. R2
	Coefficient	T-value	Coefficient	T-value	
CALL	1.12	24.09	0.10	19.92	0.697
DEP_3M	2.14	26.07	0.21	24.21	0.773
DEP_6M	2.87	21.83	0.30	21.70	0.732
DEP_1Y	3.53	18.43	0.38	18.80	0.672
DEP_2Y	3.80	19.30	0.40	19.34	0.684
DEP_3Y	4.13	20.60	0.42	19.56	0.689
DEP_5Y	4.46	20.11	0.48	20.32	0.705

Table 7: Short-term dynamics

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + v_t$$

	Beta ₁		Beta ₂		Adj. R2
	Coefficient	T-value	Coefficient	T-value	
D(CALL)	0.01	0.93	- 0.07	- 3.43	0.06
D(DEP_3M)	0.04	1.56	- 0.09	- 3.92	0.09
D(DEP_6M)	0.04	1.50	- 0.06	- 3.47	0.07
D(DEP_1Y)	0.04	1.26	- 0.04	- 3.12	0.05
D(DEP_2Y)	0.05	1.31	- 0.05	- 3.35	0.06
D(DEP_3Y)	0.05	1.28	- 0.05	- 3.51	0.06
D(DEP_5Y)	0.06	1.35	- 0.06	- 3.75	0.08

Table 8: Asymmetric Adjustment Speed

$$\Delta y_t = \delta_1 \Delta x_t + \delta_2 \lambda \hat{\epsilon}_{t-1} + \delta_3 (1 - \lambda) \hat{\epsilon}_{t-1} + \eta_t$$

	DELTA ₁		DELTA ₂		DELTA ₃	
	Coefficient	T-value	Coefficient	T-value	Coefficient	T-value
D(CALL)	0.009	0.83	-0.089	-3.53	-0.034	-1.21
D(DEP_3M)	0.036	1.50	-0.110	-3.63	-0.066	-1.74
D(DEP_6M)	0.039	1.37	-0.090	-3.90	-0.022*	-0.80
D(DEP_1Y)	0.036	1.12	-0.069	-3.88	-0.007**	-0.35
D(DEP_2Y)	0.040	1.16	-0.075	-4.04	-0.010**	-0.48
D(DEP_3Y)	0.042	1.14	-0.079	-4.06	-0.016**	-0.67
D(DEP_5Y)	0.053	1.21	-0.088	-4.26	-0.019**	-0.77

*indicates the coefficient of DELTA₂ is significantly different from that of DELTA₃ at 10% level based on the Wald test.

** indicates the coefficient of DELTA₂ is significantly different from that of DELTA₃ at 5% level based on the Wald test.