THE IMPACT OF MONETARY POLICY ON COMMERCIAL BANK LENDING IN MALAYSIA: THE INVESTIGATION ON AGRICULTURE, CONSTRUCTION & MANUFACTURING SECTORS

Dr. Mohd Amy Azhar Hj. Mohd Harif, Ph.D, C.A.(M)
(corresponding author)
Senior Lecturer/Franchise Consultant
Faculty of Finance and Banking
Universiti Utara Malaysia
06010 Sintok
Kedah Darul Aman
Fax : (60) 4 9285585
Tel : (60) 4 9285588
Email : amyazhar@uum.edu.my

Assoc. Prof. Dr. Mohd Zaini Abdul Karim
Dean of Academic Development
Universiti Utara Malaysia
06010 Sintok
Kedah Darul Aman
Fax : (60) 4 9286406
Email: zaini@uum.edu.my

Azira Bt. Abdul Adzis
Faculty of Finance and Banking
Universiti Utara Malaysia
06010 Sintok
Kedah Darul Aman
Fax : (60) 4 9286406
Tel : (60) 4 9286453
Email: azira@uum.edu.my

ABSTRACT

The purpose of this dissertation is to investigate the impact of monetary policy on commercial bank lending in Malaysia from 1970-2000. This dissertation is intended to answer two research questions: 1) Will a tightening of monetary policy in Malaysia affects commercial bank lending at the aggregate level? 2) Will a tightening of monetary policy in Malaysia affects commercial bank lending to agriculture, construction, and manufacturing sector?

The objectives of this dissertation is to determine the impact of monetary policy tightening on commercial bank lending at aggregate level and sectoral level namely, agriculture, construction, and manufacturing loan.

To achieve the objective, this dissertation employs the vector autoregression (VAR) technique. From the VAR analysis, the results suggested that a monetary policy tightening in Malaysia gives significant impact on commercial bank lending at both the aggregate level and sectoral level from 1970-2000.

The results also suggest that a monetary policy tightening in Malaysia gives larger impact on agriculture loan during the period of 1970-1996, while during the period of 1970-2000 (including the period of financial crisis), a monetary policy tightening in Malaysia gives larger impact on construction loan.

1. Introduction

The issue of monetary policy and bank lending in the developed countries have been widely studied. Most of the studies focus on the importance of bank lending channel as one of the transmission channels for monetary policy. According to the bank lending channel theory, banks will respond to a monetary tightening by reducing the supply of bank loans, which has a negative impact on real activity (Kakes 1998). In addition, most economists would agree that, at least in the short run, monetary policy could considerably influence the course of the real economy (Loupias, Savignac, and Sevestre, 2001).

A number of studies have investigated the timing between monetary policy tightening and bank lending. The concept of bank lending channel states that the contractionary of monetary policy can force bank to cut loans (Bernanke 1993). The contraction of monetary policy here means the increase in interest rate or the decrease in money supply.

In practice, the monetary authority has the power to influence domestic interest rate (Bank Negara Malaysia 1999). The high interest rate is seen to defend the currency, to restore confidence, and to attract capital flow (Domac 1999). However, some researchers argued that high interest rate could increase the fragility of the banking sector. For example, Feldstein (1998) argued that an increase in interest rate would lead to a widespread in bankruptcies, which will reduce the prospect of loan repayment.

Therefore, many studies have been done to ascertain this argument or contend that monetary policy tightening plays a major factor contributing to the decline in bank's loan. Several researchers such as Kashyap and Stein (1995), Loupias et al. (2001), Brissimis, Kamberoglou, and Simigiannis (2001), and Haan, Summer, and Yamashiro (2002) have studied the relationship between monetary policy and bank lending. Their results suggest that monetary policy tightening gives a significant impact on bank lending in the countries studied.

On the other hand, other researchers argued that the restrictive monetary policy does not give a significant impact on bank lending in the countries studied (Bernanke and Blinder 1992; Kakes et al. 1999; Kaufmann 2002; and Morris and Sellon 1995).

However, studies conducted in the developing countries on this issue are still lacking. Furthermore, most of these studies focus on the effect of monetary policy on bank lending in aggregate level, lending to commercial and industrial sector, real estate sector and consumer. However, only a few had focused on commercial bank lending to the agriculture, manufacturing , or construction sector. Hence, this paper attempts to provide some empirical evidence on the impact of monetary policy on commercial bank lending in Malaysia using time series data over the period 1970-2000.

Specifically, this paper intends to answer the following questions; First, will the tightening of monetary policy in Malaysia affect the commercial bank lending at the aggregate level? Second, will the tightening of monetary policy in Malaysia affect the commercial bank lending to agriculture, manufacturing, and construction sector? This issue is very pertinent because of the importance of the bank lending as a major source of funds and liquidity for the private sector in Malaysia (Public Bank Economic Review 2002).

The rest of the paper is organized as follows. Section 2 provides the background of monetary policy and commercial banks in Malaysia. Section 3 reviews the previous literature and hence, variables for measuring monetary policy and bank lending are identified in this chapter. In turn, Section 4 explains the methodology that is used to achieve the objectives of the study. Section 5 then analyzes the data to test the hypotheses. Finally, Section 6 evaluates the findings and provides the implication and recommendation for further study.

2. An Overview of Monetary Policy and Bank Lending in Malaysia

Theoretically, the bank lending channel in the transmission of monetary policy emphasizes on the effect of monetary policy on the supply of loans by the banking system (Bernanke and Gertler 1995). The contractionary of monetary policy can force banks to cut loans and reduced bank lending which in turn affects the firms that are wholly or partially dependent on banks for credit (Bernanke and Blinder, 1992). A tightening of monetary policy (by raising interest rate or reducing money supply) will cause the bank reserves and deposit to decline, which in turn leads to the decline in bank loans. As a result, investment spending and real output will decline (Mishkin 1992).

In Malaysia, the principle objective of monetary policy is to promote the highest sustainable rate of output growth, consistent with domestic price and exchange rate stability (See Yan 1992). The Central Bank of Malaysia is entrusted with the authority by the government to conduct monetary policy in promoting economic stability (Hock Lock 1987). Therefore, Central Bank of Malaysia frequently reviews the monetary policy framework to ensure that it remains relevant along with the active changes in the financial and economic environment (Bank Negara Malaysia 1999). In general, monetary policy strategies can be broadly categorized into four categories, namely exchange rate targeting, inflation targeting, monetary targeting, and interest rate targeting

Prior to the mid-1990s, the monetary policy strategy in Malaysia has been based on monetary aggregates targeting (Bank Negara Malaysia 1999). During that period, monetary targeting

had focused on M1. However, with financial liberalization and innovation, the central bank then used the broad monetary aggregate, M3 as the policy target.

Unfortunately, using the monetary targeting as the policy variable has prompted several limitations. First, the large capital flows in 1992-1993 have brought to the instability of monetary aggregates as targets. Second, globalization of financial markets and financial developments have altered the money demand function, making it much more difficult to predict the quantitative effects of monetary policy on its objective of price stability. Therefore, towards the mid-1990s, the Central Bank of Malaysia had shifted its strategy from monetary targeting to interest rate targeting (Bank Negara Malaysia 1999). The central bank views that interest rate stability is an important policy variable to support a stable financial system which will contribute towards a more effective transmission mechanism of monetary policy.

In addition, interest rates targets are also preferred due to their controllability and measurability. Furthermore, data on interest rates is available in a timely manner, compared to monetary aggregates where data is available only once a month (Bank Negara Malaysia 1999). Hence, for the purpose of this paper, only *interest rate* is considered to represent the monetary policy in Malaysia in investigating the effect of monetary policy on commercial bank lending in Malaysia from 1970-2000.

Lending activities is the most important activity of the commercial banks in Malaysia. For several decades, interest income from loans and advances have become the major source of income to the commercial banks in Malaysia (Bank Negara Malaysia 1999). According to Bank Negara Malaysia (1999), loans remained as the biggest and most important component of total assets of commercial banks with a share of approximately 60% of total assets. Taking for example, the total loans of commercial banks had increased from RM56.8 billion in 1988 to RM276.3 billion in 1997.

Bank lending has played an important role as the major source of funds and liquidity for the private sector in Malaysia (Public Bank Economic Review 2002). Though the development in the capital market in the country since 1997/1998, the role of bank lending in Malaysia has been growing in importance over time. This indicates that like other emerging economies, Malaysia continues to rely on bank lending to finance its economic activity. This paper will focus mainly on commercial bank lending due to the fact that the commercial banks in Malaysia are the major source of funds and liquidity for the private sectors.

3. Literature Review

Fourteen studies were reviewed based on the measure used in indicating monetary policy. 3-months interbank interest rate is a short-term interest rate that is used as a benchmark for inter-bank lending rates (Hock Lock 1987). There are several empirical studies that used the 3-months interbank interest rate as an indicator for monetary policy. Kakes and Sturm (2002) performed VAR analysis and used 3-months interbank interest rate as a variable for monetary policy to analyze the monetary transmission and bank lending in Germany. They used the 3-months interbank interest rate to reflect the unanticipated monetary policy shocks. The results of the study indicate that banks respond to a monetary contraction by adjusting their securities holdings, rather than reducing their loan portfolios. This shows that the tightening of monetary policy as measured by the innovation in 3-months interbank interest rate in their countries does not give a significant impact on bank lending.

On the other hand, Brissimis et al. (2001) stressed that the tightening of monetary policy gives a significant impact on the supply of bank loans in Greece. Their study follows closely the study done by Kashyap and Stein (1995) in the United States which used the 3-months interbank interest rate as a proxy for monetary policy. The data was estimated using SUR weighted least squares. The finding shows that in Greece, using the 3-months interbank rate as an indicator for monetary policy could influence the supply of bank loans.

Loupias et al. (2001) supported the result of Brissimis et al. (2001). Using the GMM estimator, they revealed that monetary policy tightening in France gives a significant impact on bank lending at aggregate level. They used the 3-months interbank rate as a variable for monetary policy to reflect the interest rate elasticity. This indicates that in France, the innovation in 3-months interbank rate gives significant impact on bank lending.

In contrast, Kaufmann (2002) revealed that during economic recovery, the tightening of monetary policy has no significant effect on bank lending. Using the 3-months interbank interest rate to measure monetary policy, he also found that in time of economic recovery, the changes in interest rate have a positive effect on corporate loans. However, in our study we did not employ 3-months interbank interest rate for measuring monetary policy because the data on this short-term interest rate is not available in Malaysia from 1970-1980.

Effective fund target is the second variable used and is defined as the changes in the Federal Reserve's short-run operating targets (Morris and Sellon 1995). Indeed, not much literature used the effective fund target as a proxy for monetary policy. Morris and Sellon (1995) give the justification why they used this variable to measure monetary policy. Firstly, the use of short-term interest rate such as federal fund rate to measure monetary policy has created uncertainty to determine whether the changes in that interest rate reflect the changes in monetary policy or vice versa. Thus, the response of bank lending to interest rate changes that found in some studies may not be causes by monetary policy but may be by other factors. Secondly, the use of short-term interest rate to measure monetary policy may incorporate the effects of normal policy actions and special policy actions. For example, the monetary authority could impose direct credit controls on banks and raised the interest rates at the same time. Therefore, it is difficult to determine which of the policy gives significant impact on bank lending. In their study, Morris and Sellon (1995) found little evidence that restrictive monetary policy could influence bank lending in their country. They also revealed that, banks are able to offset a decline in core deposits by selling securities and issuing managed liabilities in order to maintain their business lending. In our study, the effective fund target cannot be used as a proxy for monetary policy because the data on Federal Reserve's short-run operating targets was not available in Malaysia.

The third variable for measuring monetary policy is call rate and is defined as seven-days call money rate. Two papers have used the call rate as policy variable in their studies. Samudram, Chung, and Abdul Kadir (1993) employed the call rate and money supply as a policy variable to determine the effect of monetary policy on economic activities in Malaysia. Using the VAR method, the results suggested that call rate (interest rate) plays a larger role in explaining variations in economic activities in Malaysia. This indicates that interest rate is a good indicator for monetary policy. On the other hand, Basile and Joyce (2001) used the call rate and broad money supply to represent the policy variable in investigating asset bubbles, monetary policy and bank lending in Japan. Their study however, did not examine the impact

of monetary policy on bank lending in Japan. The result suggested that monetary policy gives the significant impact on land market bubble.

Finally, the fourth variable used to measure monetary policy is *federal fund rate*. This short-term interest rate is defined as interest rate for overnight loans in the interbank market (Mishkin 1992). Six papers have used the federal fund rate as an indicator for monetary policy in their studies. Bernanke and Blinder (1992) employed a semi-structural VAR model to see the relationship between federal fund rate and the channels of monetary transmission. They stressed that the federal fund rate is a good indicator for monetary policy. Consequently, their empirical analysis found that tight monetary policy as measured by the innovation in federal fund rate leads to a reduction in the volume of bank's deposit with little effect on loans. Loans respond slowly to these innovations. Their study indicates that, the federal fund rate does not give significant impact on bank's loan.

In other study, Bernanke and Mihov (1995) used a semi-structural VAR to evaluate and develop measures of monetary policy based on reserve market indicators. Their results suggest that the federal fund rate is the best indicator for monetary policy during the periods of 1965-1979 and 1988-1994 in the Unites States.
Kashyap and Stein (1995) used micro data on bank balance sheets to identify the effects of monetary policy on bank lending. They divided banks into size categories and looked at the response of bank lending to monetary policy tightening, which they identified as an innovation in the federal fund rate. Contrary to result found by Bernanke and Blinder (1992), they found that bank lending declines after a monetary policy contraction except for large banks. This suggests that, using the federal fund rate to measure monetary policy in the United States gives significant impact on bank lending.

In other study in the U.S., Gibson (1997) employed the Pagan's Procedure to test the existence of a bank lending channel of monetary policy transmission in that country. Following Bernanke and Blinder (1992), Brunner (1994), the author used the federal fund rate as an indicator for monetary policy. He stressed that the federal fund rate is a good indicator for monetary policy because it is the best way to uncover monetary policy tightening. His finding shows that monetary policy tightening has a stronger effect on real GDP growth during the periods when bank lending channel should be operating.

On the other hand, Domac (1999) used VAR analysis to evaluate the responses of small and medium size industries (SMIs) and large manufacturing firms to monetary policy shifts in Malaysia. Following the other studies done by Bernanke and Blinder (1992), the author employed the federal fund rate to measure monetary policy in Malaysia. His empirical results suggested that monetary policy tightening has a larger impact on small medium size industries (SMIs) than it does on large manufacturing firms.

Consistent with previous finding, Haan et al. (2001) provided evidence that total loans were decreased during a monetary policy contraction that is measured by innovation in federal fund rate. This study employed structural VAR to determine the behavior of bank loan component of different regions in the US after monetary and non-monetary shocks. Their results also revealed that commercial and industrial loans are relatively stable during a monetary downturn.

In conclusion, most of the papers used federal fund rate as a measure of monetary policy and their findings have shown that the federal fund rate is a good indicator of monetary policy. Hence, in this paper federal fund rate were use as a measure of monetary policy in Malaysia. Previous literature on monetary policy in Malaysia has used the federal fund rate to measure monetary policy (Domac 1999).

4. Methodology and Data

The vector autoregression (VAR) technique is chosen for this study to determine the impact of monetary policy on commercial bank lending in Malaysia from 1970-2000. This VAR technique was pioneered by Sims (1980a) and has been used widely in macroeconomic modeling. VAR is a system in which every equation has the same right hand variables, and those variables contain lagged values of all the endogenous variables (Hall et al.1996). equation has the same right hand variables, and those variables contain lagged values of all the endogenous variables (Hall et al.1996).

VAR models use only the observed time series of data to forecast economic variables and have proven successful for forecasting systems of interconnected time series variables (Hall et al.1996). VAR model also commonly used for analyzing the active impact of different types of random instability on systems of variables. Regarding to this unique function, VAR model is commonly used as one of the tools for empirical studies on the monetary transmission mechanism.

Previous studies on monetary policy and bank lending have applied the VAR model to study the relationship between policy variables and bank lending [Among others, Kakes et al. (1999), Haan et al. (2001), and Domac (1999)].
The basic equation form of a VAR is:

$$y_t = A1\, y_{t-1} + \ldots\ldots + AN\, y_{t-N} + Bx_t + \varepsilon_t \qquad (1.1)$$

Where y_t is a vector of endogenous variables, x_t is a vector of exogenous variables, $A1,\ldots,AN$ and B are matrices of coefficients to be estimated, and ε_t is a vector of innovations that are correlated with each other but uncorrelated with their own lagged values and uncorrelated with y_{t-1} through y_{t-N} and x_t.

In this paper, the model used is as follows:

$$CBL_t = a_{10,0} + \sum_{i=1}^{I} a_{11,i}\, CBL_{t-i} + \sum_{i=1}^{I} a_{12,i}\, MP_{t-i} + \sum_{i=1}^{I} a_{13,i}\, INFL_{t-i} + \sum_{i=1}^{I} a_{14,i}\, GDP_{t-i} + u_{1t}$$

$$MP_t = a_{20,0} + \sum_{i=1}^{I} a_{21,i}\, CBL_{t-i} + \sum_{i=1}^{I} a_{22,i}\, MP_{t-i} + \sum_{i=1}^{I} a_{23,i}\, INFL_{t-i} + \sum_{i=1}^{I} a_{24,i}\, GDP_{t-i} + u_{2t}$$

$$INFL_t = a_{30,0} + \sum_{i=1}^{I} a_{31,i} CBL_{t-i} + \sum_{i=1}^{I} a_{32,i} MP_{t-i} + \sum_{i=1}^{I} a_{33,i} INFL_{t-i} + \sum_{i=1}^{I} a_{34,i} GDP_{t-i} + u_{3t}$$

$$GDP_t = a_{40,0} + \sum_{i=1}^{I} a_{41,i} CBL_{t-i} + \sum_{i=1}^{I} a_{42,i} MP_{t-i} + \sum_{i=1}^{I} a_{43,i} INFL_{t-i} + \sum_{i=1}^{I} a_{44,i} GDP_{t-i} + u_{4t} \quad (1.2)$$

Where:

CBL_t is commercial bank lending at time t;

MP_t represents the monetary policy which is consist of interest rate at time t;

$INFL_t$ is rate of inflation at time t;

GDP_t is gross domestic product at time t;

a is parameter to be estimated; and

u is an (n x n) matrix of residuals.

The above model is valuable in looking at the estimated impact of the left-hand side variables on the dependant variable, but the unanticipated portion ($u_i's$) cannot be analyzed as they are contemporaneously correlated, for example, Covariance $(u_{it,} u_{jt}) \neq 0, i \neq j$. The standard way to overcome this is to 'orthogonalise' them by using the Choleski decomposition whereby the covariance matrix is decomposed such that:

$\sum = H^{-1} H^{-1'}$ (H^{-1} is a lower triangle matrix).

The matrix H is not unique unless $H = I$ or $\sum = I$. If the $u_i's$ are highly correlated, different ordering of the variables will result in a different model being estimated, thus producing different results in the subsequent analysis.

Data

This study employed yearly data series over the period of 1970 to 2002 in order to investigate the impact of monetary policy on commercial bank lending in Malaysia. Most of the previous studies have used quarterly data to analyze the relationship between monetary policy and bank lending. However in Malaysia, published data on quarterly basis are limited. Due to this constraint, this study utilized yearly data for all the variables.

All data were obtained from various issues of the Bank Negara Quarterly Bulletin, Bank Negara Monthly Statistical Bulletin and Statistic Department of Malaysia. At the same time, some of the data series were taken from other publications of Bank Negara Malaysia such as Money and Banking in Malaysia 1959-1989, and The Central Bank and the Financial System in Malaysia 1989-1999.

All data with the exception of federal fund rate and inflation rate were in natural logarithmic form and in real terms, and are not seasonally adjusted.

Justification of variables

The justifications of the variables are as follows:

Monetary policy (MP) variables. Interest rate is used as a proxy for monetary policy because the interest rate has been recognized as the main instrument of monetary policy of most central banks to reach inflation stability, output stability and maybe exchange rate stability. Furthermore, in the mid-1990s, monetary policy strategy in Malaysia has shifted from monetary targeting towards interest rate targeting due to the developments in economy and financial system (Bank Negara Malaysia 1999).

In this study, federal fund rate is chosen to represent the interest rate because the innovation in the short-term interest rate reflects unexpected monetary policy shocks (Kakes et al. 1999). Furthermore, Brunner (1994) stated that, the proper way to discover monetary policy shocks is to regress the federal fund rate on lags of appropriate variables that are in the Fed's information set. Additionally, most of the previous literatures have used the federal fund rate as a proxy for monetary policy.

Commercial bank lending (CBL) variables. Total loan and advances of commercial banks is used as a proxy for bank lending in aggregate level. We also used total loan by sector namely agriculture, manufacturing and construction loan to evaluate the impact of monetary policy on bank loans to each sector. The reason why these three sectors is chosen because:

a) The manufacturing sector has been one of the most rapidly expanding sectors in Malaysia (Bank Negara Malaysia 1989). Malaysia had become one of the world's largest exporters of semiconductors, a major producer of colour television sets and room air-conditioners by early 1990s (Bank Negara Malaysia 1999). Additionally, manufacturing sector contributes strongly in the upturn of economic activity in Malaysia in year 2000 (Bank Negara Malaysia Report 2000).

   Furthermore, the strong expansion in manufacturing output enabled the sector to become a leading contributor to GDP, increasing its share further to 33.4% in 2000, from 30% in 1999. Consequently, loan to manufacturing sector in year 2000 contributed to the large portion of total disbursements, accounted for 26% (RM93 billion) of total outstanding loan in that year.

b) Besides manufacturing sector, the construction sector also contributed mainly to the GDP growth in Malaysia with average growth of 12.9% during the period 1988-1997 (Bank Negara Malaysia 1999). However, due to the financial crisis in 1997, it contribution towards GDP is became smaller with average growth of 4.8% per year.

   It is important to study the impact of monetary policy on construction sector because this sector experienced drastically increases in bank lending in 1980s and 1990s. The excess lending on this sector has caused the commercial banks in Malaysia experienced the high NPL at end-1988 and at-end 1990s due to the economic recession in 1985-86 and financial crisis in 1997 (Bank Negara Malaysia 1999, 2000).

c) The agriculture sector is chosen because Malaysia is a trade-oriented economy based largely on agriculture since 1957 before manufacturing sector take place as a premier sector in the economy in 1987 (Bank Negara Malaysia 1989).

In its early days of independence, Malaysia had become the world's larger producer and exporter of natural rubber, tin metal, palm oil, tropical hardwoods, cocoa and pepper (Bank Negara Malaysia 1989). As a result, this sector contributed mainly to the economic growth in Malaysia over the several decades.

Other variables. Gross domestic product (GDP) and inflation are used in this study to represent the control variables. Both of the variables were included in this study in order to account for the impact of the macroeconomic environment on banks' loan (Loupias et al. 2001).

In addition, Bernanke and Mihov (1995) suggested that GDP is the best indicator for broad macroeconomic condition while Kakes et al. (1999) stressed that GDP is useful to measure for real activity. This is because real activity and prices are the main variables that reflect eventual effects of monetary policy (Kakes et al. 1999). Furthermore, monetary policy also can be seen as the only policy instrument to control inflation (Arestis and Sawyer 2002).

5. Results and discussion

This section discusses and interprets the results of each test that has been carried out. The results were then relate to the hypotheses and will be discussed in section 5.2.

Unit Root Test

First, all the series in level were tested for stationarity using the ADF test. The results of the test is shown in Table 1. As has been discussed earlier, the hypothesis of a unit root will be rejected if the *t*-statistic is larger than the critical value. The result shows that all the *t*-statistic are smaller than 5% the critical value. This shows that we cannot reject the null hypothesis of a unit root. Hence, all the series are not stationary in level. The ADF test was then done on the series in first difference. Table 1 shows the result of ADF test for the series in first differences. The result shows that the hypothesis of a unit root can be rejected for some of the series. This shows that some of the series are stationary while others are not.

The series were then test again for stationary using the Phillips-Perron test. Phillips-Perron (PP) test is an alternative test for a unit root. The method of PP is similar to the ADF test, except for there are no lagged difference terms in the former. Table 1 also shows the result of using Phillips-Perron test on the series in first difference. The result shows that, all the t-statistic is larger than the 5% critical value. This indicates that we can reject the null hypothesis of a unit root for all series, suggesting that the series are stationary. As a conclusion, based on Phillips-Perron test that has been carried out, all series can be considered as I(1) variables. Since cointegration can be established for all specifications, the model in this study is estimated as unrestricted VAR where each series is included in first differences.

Impulse response function

The impulse response functions trace out the responses of an endogenous variable to a change in one of the innovations (Hall et al. 1996 p. 266). Explicitly, it traces the effect on current and future values of the endogenous variable of a one standard deviation shock to one of the innovations.

Figure 1 to 8 show the response of total loan and loan by sector to one standard deviation innovation in total loan, loan by sector, federal fund rate, GDP and inflation. The lag length of each test is two while the ordering is [GDP, total loan, inflation, federal fund rate] or [GDP, loan by sector, inflation, federal fund rate]. This ordering, consistent with the Central Bank's behaviour in practice, assumes that monetary authority looks at the contemporaneous state of economic growth, loan growth, and inflation before deciding on interest rate. The variables also were tested with different ordering, but the results were almost similar. The tests were conducted using two different sample periods: 1) 1970 to 1996 and 2) 1970 to 2000. First sample period does not include financial crisis on 1997 while the second sample period includes financial crisis on 1997. Therefore, we can see the effect of monetary policy tightening in Malaysia on commercial bank lending before and after the financial crises.

Figure 1 shows that the tightening of monetary policy gives the significant impact on commercial bank lending at aggregate level in Malaysia from 1970-1996. Monetary policy shocks have a negative impact on total loan in the first seven years, and thereafter, dies away. More specifically, the restrictive monetary policy has the largest impact on total loan in period 2 where a 1 percent standard deviation shock to federal fund rate reduces total loan by around 2 percent. The restrictive monetary policy in Malaysia also gives the significant impact on GDP and inflation where the innovation in interest rate has caused the GDP and inflation to fall for several years.

Meanwhile, Figure 2 also suggests that the restrictive monetary policy in Malaysia during the period of 1970-2000 gives the significant impact on commercial bank lending at aggregate level. Monetary policy shocks have a negative impact on total loan in the first six years, die away thereafter, and then heading back to a negative zone starting from the period 9 to the period 10. This suggest that the monetary policy tightening gives the significant impact on commercial bank lending at aggregate level during the financial crisis in 1997. The monetary policy shock also gives negative impact on GDP during the financial crisis in 1997 as the line of response of GDP to OVRT is heading toward negative zone starting from the period 9 to 10. However, both sample period shows that the monetary policy shock did not give significant impact to the inflation.

Figure 3 suggests that the restrictive monetary policy by raising the interest rate gives only a small impact on commercial bank lending to construction sector. The biggest impact is in only at the early stage as shown in the period 2 and 3 where a 1 percent standard deviation shock to federal fund rate reduces construction loan by less than 1 percent. Except for the period 4 to 6, the monetary policy shock shows a slightly significant impact through out the sample period of 1970 to 1996.

Similar to Figure 3, Figure 4 also suggest that the restrictive monetary policy gives the slightly impact on commercial bank lending to construction sector during the financial crisis 1997 as the line of the graph hovering below 1% from period 1 to 7, and thereafter die away. The largest impact is in period 5 where a 1 percent standard deviation shock to federal fund rate reduces construction loan by around 1.2 percent.

Figure 5 displays the response of manufacturing loan to the innovation in federal fund rate. The result shows that, monetary policy tightening gives a larger impact on manufacturing loan compared to construction loan for the period of 1970-1996. A one percent standard deviation shock to federal fund rate has reduced manufacturing loan by around 3.9 percent in

period two. This monetary shock also have a negative and significant impact on manufacturing loan in the first five years and thereafter, they are insignificant until the period 10. This fact is true for both of the sample period as shown in the Figure 6.
As mentioned earlier, Figure 6 also suggests that monetary policy tightening gives a larger impact on manufacturing loan compared to construction loan for the period of 1970-2000. A one percent standard deviation shock to federal fund rate has reduced manufacturing loan by around 3.9 percent in period two. This monetary shock also have a negative and significant impact on manufacturing loan in the first five years and thereafter, they are insignificant until the period 10.

Figure 7 presents the response of agriculture loan to the shocks in federal fund rate from 1970-1996. It shows that, agriculture loan experiences the continuously declines following a monetary policy tightening for over the period. More specifically, the effect of monetary policy shock has the largest significant impact on agriculture loan in period 3 where a 1 percent standard deviation shock to federal fund rate has reduced agriculture loan by around 5.0 percent, which is the largest decline compared to construction and manufacturing loan.

In contrast, Figure 8 suggests that the restrictive monetary policy did not give a significant impact on the agriculture loan in period 1 and 2 for the sample period 1970-2000. However, in period 3, the monetary shocks gives the largest significant impact on agriculture loan where a 1 percent standard deviation shock to federal fund rate has reduced agriculture loan by around 4.0 percent. This monetary policy shocks have a negative impact on agriculture loan in period 3 to 6, and thereafter, die away.

In conclusion, based on the impulse response functions above, the monetary policy tightening in Malaysia gives the significant impact on commercial bank lending at aggregate level and by sector from 1970-1996 and 1970-2000. More specifically, the restrictive monetary policy in Malaysia before financial crisis gives the largest significant impact on agriculture loan rather than construction and manufacturing loan. On the other hand, the monetary policy tightening gives a significant impact on commercial bank lending to manufacturing sector after the 1997 financial crisis.

Variance decomposition
The variance decomposition of a VAR gives information about the relative importance of the random innovations (Hall et al. 1996 p. 270). The first column of the result of variance decomposition shows the forecast error of the variable for different forecast horizons. The source of this forecast error is variation in the current and future values of the shocks.

The residual columns of the result give the percentage of variance due to specific innovations. One period ahead, all the variation in a variable comes from its own innovation and hence, the first number is always 100 percent.

Figure 9 to 16 display the results of variance decomposition for total loan and loan by sector with ordering similar to impulse response function for both the sample period.

The results in Figure 9 suggests that 20 percent of the forecast error variance (FEV) of total loan accounted for innovations in GDP, 30 percent due to the its own innovations, 32 percent due to the innovations in inflation, and 17 percent due to the innovations in federal fund rate.

It appears that innovations in all endogenous variables give high percentage in explaining variations in total loan.

Meanwhile, Figure 10 shows the variance decomposition of total loan for the period of 1970-2000. The results suggest that 30 percent of the forecast error variance (FEV) of total loan accounted for innovations in GDP, 28 percent due to the its own innovations, 21 percent due to the innovations in inflation, and 10 percent due to the innovations in federal fund rate. It appears that innovations in all endogenous variables give high percentage in explaining variations in total loan.

Figure 11 displays the variance decomposition of construction loan for the period before financial crisis. It appears that 9 percent of the forecast error variance (FEV) of construction loan accounted for innovations in GDP, 75 percent due to the its own innovations, 12 percent due to the innovations in inflation, and only 0.1 percent due to the innovations in federal fund rate. It appears that innovations in all endogenous variables give low percentage in explaining variations in construction loan and more specifically, innovation in federal fund rate explains only 0.1 percent of the FEV of construction loan for the period of 1970-1996.

On the other hand, Figure 12 displays the variance decomposition of construction loan for the period after financial crisis. It appears that 20 percent of the forecast error variance (FEV) of construction loan accounted for innovations in GDP, 60 percent due to the its own innovations, 10 percent due to the innovations in inflation, and only 0.1 percent due to the innovations in federal fund rate. It appears that the variance decomposition for both of the sample period produced the similar results.

Figure 13 displays the variance decomposition of manufacturing loan during the period of 1970-1996. The results show that 18 percent of the forecast error variance (FEV) of manufacturing loan accounted for innovations in GDP, 50 percent due to the its own innovations, 18 percent due to the innovations in inflation, and 10 percent to due to the innovations in federal fund rate. It appears that innovations in all endogenous variables give almost similar percentage in explaining variations in manufacturing loan.

In other way, Figure 14 displays the variance decomposition of manufacturing loan during the period of 1970-2000. The results show that 30 percent of the forecast error variance (FEV) of manufacturing loan accounted for innovations in GDP, 40 percent due to the its own innovations, 10 percent due to the innovations in inflation, and 12 percent to due to the innovations in federal fund rate. It appears that innovations in GDP give the highest percentage in explaining variations in manufacturing loan for the period after crisis. In addition, the variance decomposition for both of the sample period shows almost similar results.

Figure 15 presents the variance decomposition of agriculture loan for the period of 1970-1996. 35 percent of the FEV of the agriculture loan due to innovation in GDP, 40 percent due to the its own innovations, 15 percent due to the innovations in inflation, and 19 percent to due to the innovations in federal fund rate. The results suggest that innovations in GDP give the higher percentage in explaining variations in agriculture loan compared to inflation and federal fund rate. It also appears that the innovation in federal fund rate contribute the highest percentage (19 percent) in explaining variations in agriculture loan compared to 0.1 and 10 percent in explaining variation in construction and manufacturing loan, respectively.

Figure 16 displays the results of variance decomposition of agriculture loan for the period of 1970-2000. 10 percent of the FEV of the agriculture loan due to innovation in GDP, 79 percent due to the its own innovations, 2 percent due to the innovations in inflation, and 5 percent to due to the innovations in federal fund rate. The results also suggest that innovations in all endogenous variables give the lower percentage in explaining variations in agriculture loan compared to previous figure.

As a conclusion, the empirical results of variance decomposition supports the impulse response function analysis which is confirmed that the monetary policy tightening in Malaysia gives the significant impact on commercial bank lending at aggregate level and by sector. The results also confirm that the restrictive monetary policy in Malaysia gives the most significant impact on agriculture loan compared to construction loan and manufacturing loan for the period of 1970-1996.

However, for the period of 1970-2000, the restrictive monetary policy in Malaysia gives the most significant impact on manufacturing loan compared to construction loan and agriculture loan. This finding also confirms earlier studies, mainly on Western countries where the contraction in monetary policy can reduce bank lending. The next section will discuss the hypotheses.

The interpretation of results in section 5.2 also suggests that the restrictive monetary policy in Malaysia gives the significant impact on construction, manufacturing and agriculture loan. However, among the three sectors, monetary policy tightening in Malaysia gives the most significant impact on agriculture loan for the period of 1970-1996, while for the period of 1970-2000, the restrictive monetary policy in Malaysia gives the most significant impact on manufacturing loan.

The analysis also shows that GDP become the most influential variable in explaining the upturn in commercial bank lending in Malaysia. This can be interpreted that the economic growth plays an important factor in stimulating the lending activities of commercial banks in Malaysia.

6. Conclusion

The purpose of this paper is to analyze the impact of monetary policy tightening on commercial bank lending in Malaysia. Our study extends the previous literatures by studying the impact of monetary policy tightening on bank lending to agriculture, construction and manufacturing sector. The results show that a monetary policy tightening in Malaysia gives significant impact on agriculture, construction, and manufacturing loan where increase in interest rate has reduced the loan to this three sector. More specifically, the restrictive monetary policy in Malaysia has the largest impact on agriculture loan during the period of 1970-1996, while during the period of 1970-2000 (including the period of financial crisis), the monetary policy tightening in Malaysia gives the most significant impact on construction loan. The results supports the bank lending channel theory where the monetary policy tightening in Malaysia reduced the commercial bank lending at aggregate level and sectoral level. The results have policy implications. First, during economic expansion, banks should increase their lending to the construction and manufacturing sector since loan to these sectors did not affected much by monetary policy tightening during that period. While in time of economic recession, banks should increase their lending to the agriculture sector because loan

to this sector is not affected much by monetary policy tightening during that period. Second, monetary authority should monitor the interest rate so that the monetary policy can assist the development of certain sectors such as agriculture sector and construction sector which was affected much in time of restrictive monetary policy for the period of 1970-1996 and period of 1970-2000, respectively. Since the agriculture sector generally has a higher risk due to natural disaster, natural disease and the longer payback period, a loan facility that is more flexible should be devise. The central bank can conceivably devise suitable loan arrangements with attractive interest rate for agriculture loan or construction loan so as to enable it to expand its operations more rapidly. In addition, the central bank also should provide a guideline to the commercial banks in time of restrictive monetary policy in term of the amount of each loan that should be raised, the number of loans to be raised during the year, the timing of each loan, the various maturities to be offered in each of the loans, and the rate of interest to be paid on each of the maturities offered under each loan. Therefore, this guideline could assist certain sector from the effect of restrictive monetary policy in Malaysia.

REFERENCES

_____ 2002, 'Bank Lending Channel of Monetary Transmission', *Public Bank Economic Review*, Kuala Lumpur.

_____1989, *Money and Banking in Malaysia*, Bank Negara Malaysia, Kuala Lumpur.

_____1999, *The Central Bank and the Financial System in Malaysia: A Decade of Change*, Bank Negara Malaysia, Kuala Lumpur.

_____ 1998/1999, *Economic Report*, Ministry of Finance, Malaysia.

Arestis, P. and Sawyer, M. 2002, 'Can Monetary Policy Affect the Real Economy?', *Working Paper No. 355*, Federal Reserve Bank of New York.

Bank Negara Malaysia, *Monthly Statistical Bulletin*, various issues.

Bank Negara Malaysia, *Quarterly Bulletin*, various issues.

Bank Negara Malaysia, *Annual Report*, various issues.

Basile, A. and Joyce, J.P. 2001, 'Asset Bubbles, Monetary Policy and Bank Lending in Japan: An Empirical Investigation', *Applied Economics*, Vol. 33, p1737-1744.

Bernanke, B.S. and Blinder, A.S. 1988, 'Credit, Money, and Aggregate Demand', *American Economic Review*, Papers and Proceedings, Vol. 78, p 435-9.

Bernanke, B.S. and Blinder, A.S. 1992, 'The Federal Funds Rate and the Channels of Monetary Transmission', *American Economic Review* 82 (September), pp. 901-921.

Bernanke, B.S. and Mihov, I. 1995, 'Measuring Monetary Policy', *Working Paper No. 5145*, National Bureau of Economic Research, Cambridge.

Brissimis, S.N., Kamberoglou, N.C. and Simigiannis, G.T. 2001, 'Is There A Bank Lending Channel of Monetary Policy in Greece? Evidence from A Bank Level Data', *Working Paper Series*, European Central Bank.

Brunner, A. 1994, 'The Federal Fund Rate and the Implementation of Monetary Policy: Estimating the Federal Reserve's Reaction Function, *International Finance Discussion Paper No. 466*, Board of Governors of the Federal Reserve System, Washington.

Feldstein, M. 1998, 'Refocusing the IMF', *Foreign Affairs*, March/April 1998, pp. 20-33.

Gibson, M.S. 1997, 'The Bank Lending Channel of Monetary Policy Transmission: Evidence from A Model of Bank Behavior that Incorporates Long-term Customer Relationships', *International Finance Discussion Papers*, Board of Governors of the Federal Reserve System, US.

Haan, W.J., Summer, S. and Yamashiro, G.M. 2001, 'Behavior and Importance of Bank Loan Components after Monetary and Non-Monetary Shocks', Academic Paper, Department of Economics, University of California at San Diego and California State University at Long Beach.

Hock Lock, L. 1987, *Central Banking in Malaysia – A Study of the Development of the Financial System and Monetary Management*, Butterworths, Singapore.

Kakes, J. and Sturm J.E. 2002, ',Monetary Policy and Bank Lending Evidence from German Banking Groups', *Journal of Banking and Finance*, Vol. 26 Issue 11, p2077.

Kashyap, A.K. and Stein, J.C. 1993, 'Monetary Policy and Bank Lending', *NBER Working Paper Series*, National Bureau of Economic Research.

Kashyap, A.K. and Stein, J.C. 1995, 'The Impact of Monetary Policy on Bank Balance Sheets', *Carnegie Rockester Conference Series on Public Policy*, Vol. 42, pp. 151-95.

Kaufmann, S. 2002, 'Asymmetries in Bank Lending Behavior: Austria During the 1990s', *Working Paper 56*, Oesterreichische Nationalbank, Economic Studies Division and University Of Vienna, Department of Economics.

Loupias, C., Savignac, F. and Sevestre, P. 2001, 'Monetary Policy and Bank Lending in France: Are There Asymmetries?', *Working Paper Series*, European Central Bank.

McCallum, B.T. 2002, 'The Use of Policy Rules in Monetary Policy Analysis', Shadow Open Market Committee.

Mishkin, F.S. 1992, *The Economics of Money, Banking, and Financial Markets*, 3rd Edition, HarperCollins Publishers Inc., New York.

Morris, C.S and Sellon, G.H. 1995, 'Bank Lending and Monetary Policy: Evidence on a Credit Channel', *Economic Review*, Federal Reserve Bank of Kansas City.

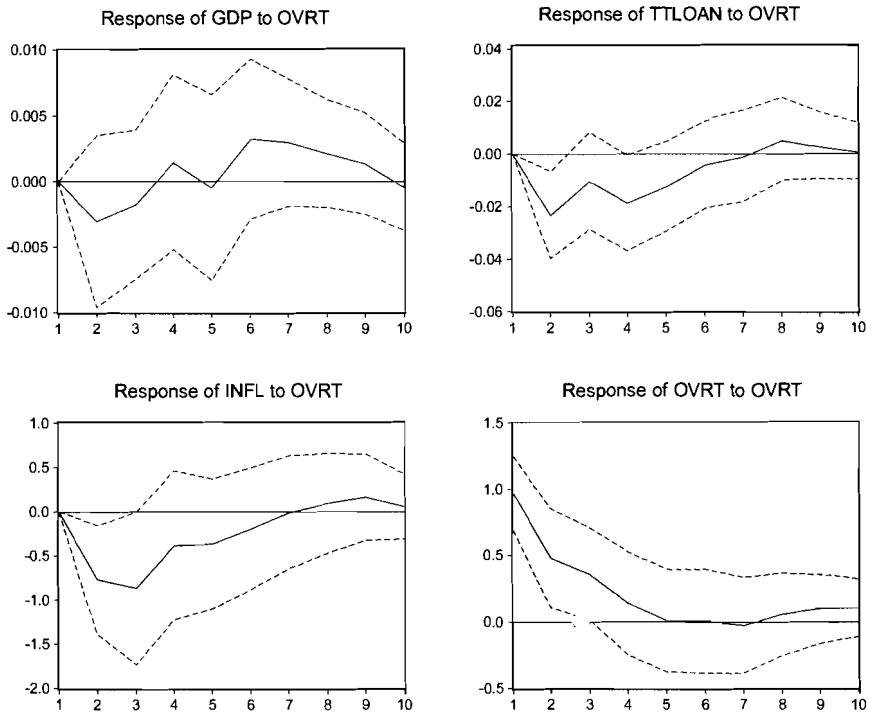
See Yan, L. 1992, 'Monetary Exchange Rate Policies in An Open Economy: The Malaysian Case, 1959-1992', *National Conference on Economic Globalization: Issues, Challenges and Responses*, Langkawi, Malaysia.

Table 1
Unit Root Test (Period 1970-2000)

Variables name	In level ADF *t*-statistics with		First difference	
	Intercept	Trend and Intercept	ADF	PP
1. Log of total loan	-2.235776	-2.038037	-3.753549	-4.150177*
2. Log of manufacturing loan	-1.680389	-1.388431	-3.389609	-4.586000*
3. Log of construction loan	-1.274020	-3.235454	-4.052406	-3.7321128*
4. Log of agriculture loan	-1.330859	-1.723317	-2.835567	-4.270467*
5. Federal fund rate	-2.823043	-2.755708	-3.554831	-5.994429*
6. Log of GDP	-0.735940	-2.584661	-3.618132	-4.232506*
7. Inflation	-3.750204	-4.582279	-5.483196	-5.509090*

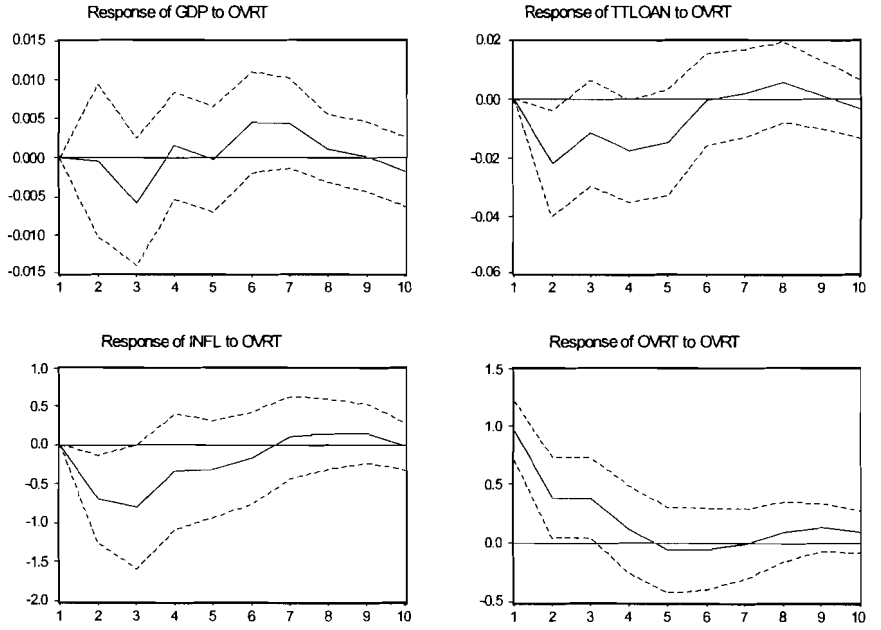
Number of lag = 1
*indicates significant at 5% level

Figure 1: Impulse response functions:Total loans (1970-1996)



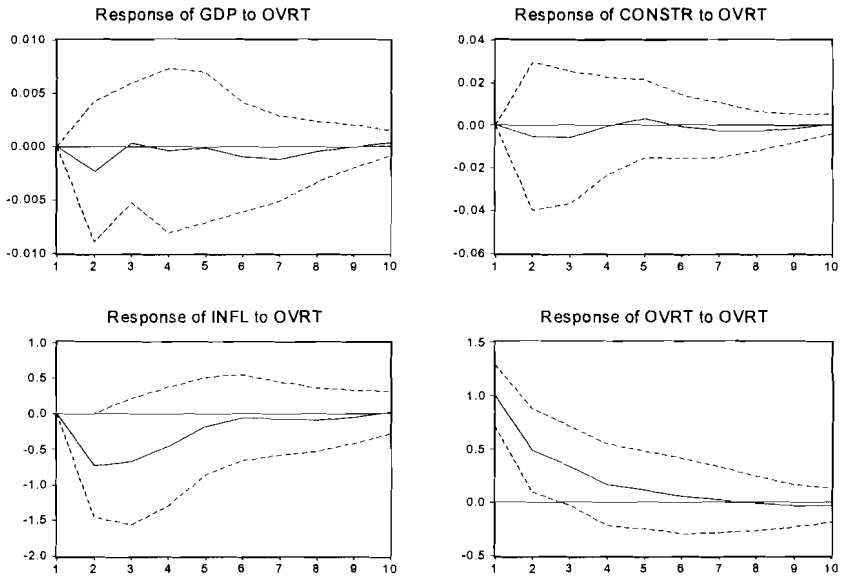
Note: OVRT stand for federal fund rate, TTLOAN stand for total loan, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 2: Impulse response functions: Total loan (1970-2000)



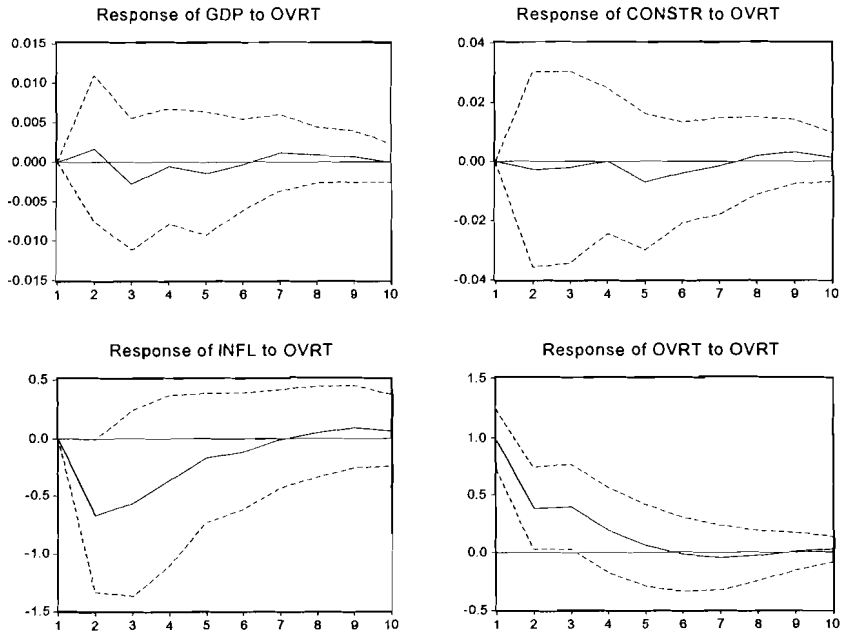
Note: OVRT stand for federal fund rate, TTLOAN stand for total loan, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 3: Impulse response functions: Construction loan (1970-1996)



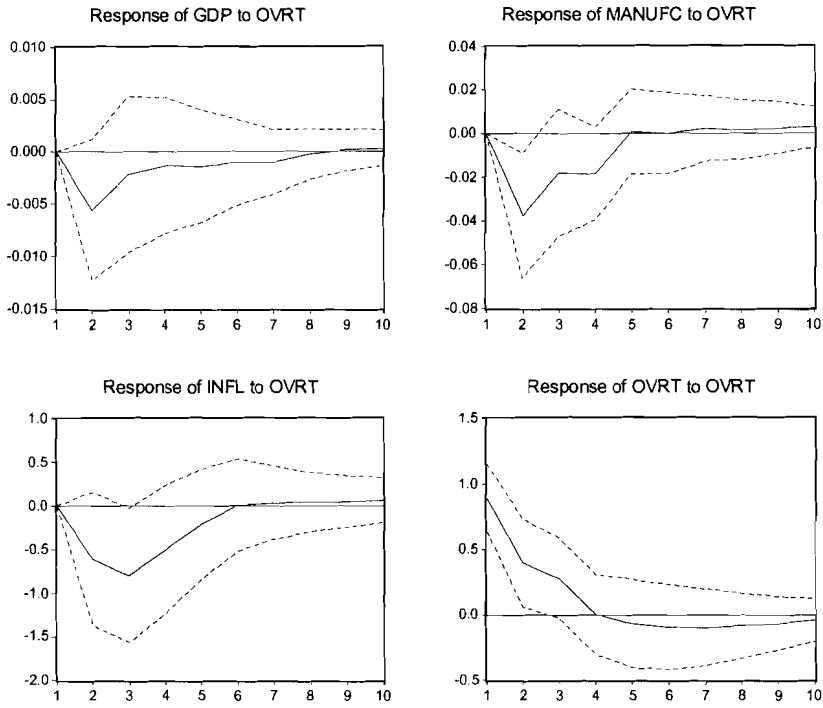
Note: CONSTR stand for construction loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 4: Impulse response functions:Construction loan (1970- 2000)



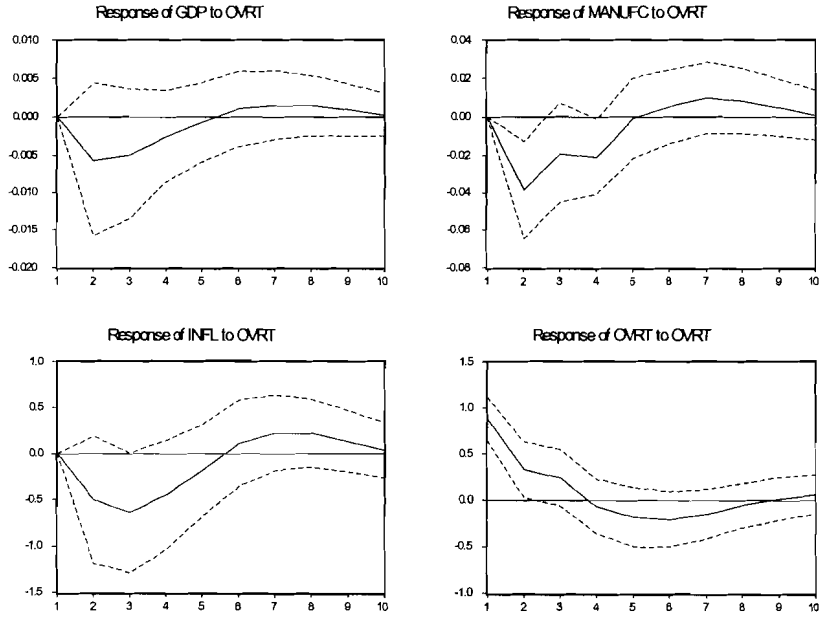
Note: CONSTR stand for construction loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 5: Impulse response functions: Manufacturing loan (1970-1996)



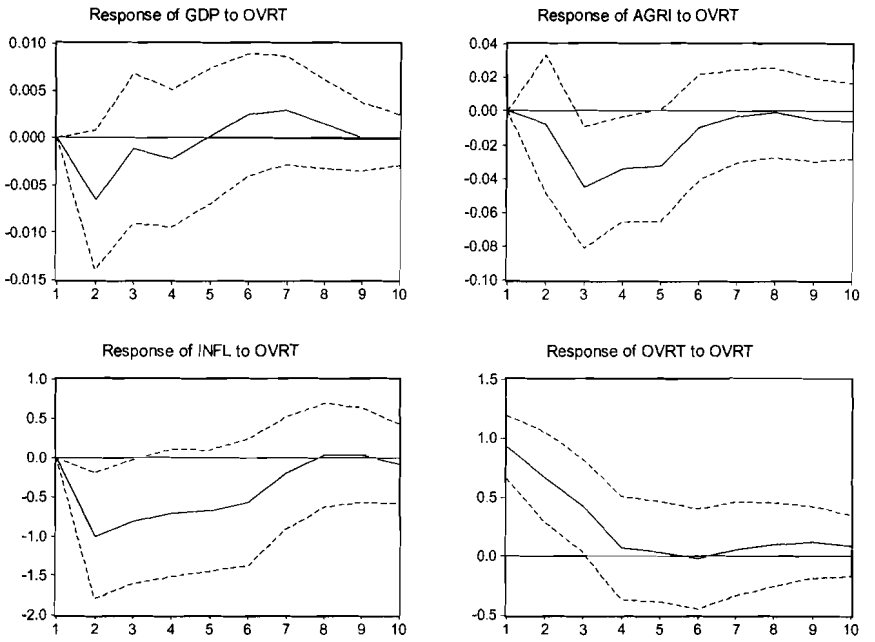
Note: MANUFC stand for manufacturing loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 6: Impulse response functions: Manufacturing loan (1970-2000)



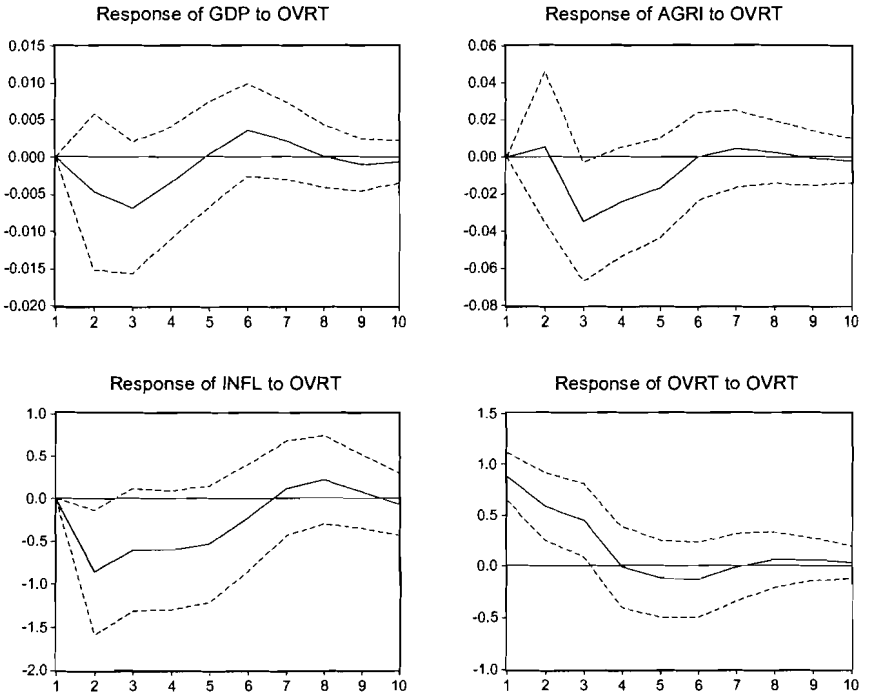
Note: MANUFC stand for manufacturing loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 7: Impulse response functions: Agriculture loan (1970-1996)



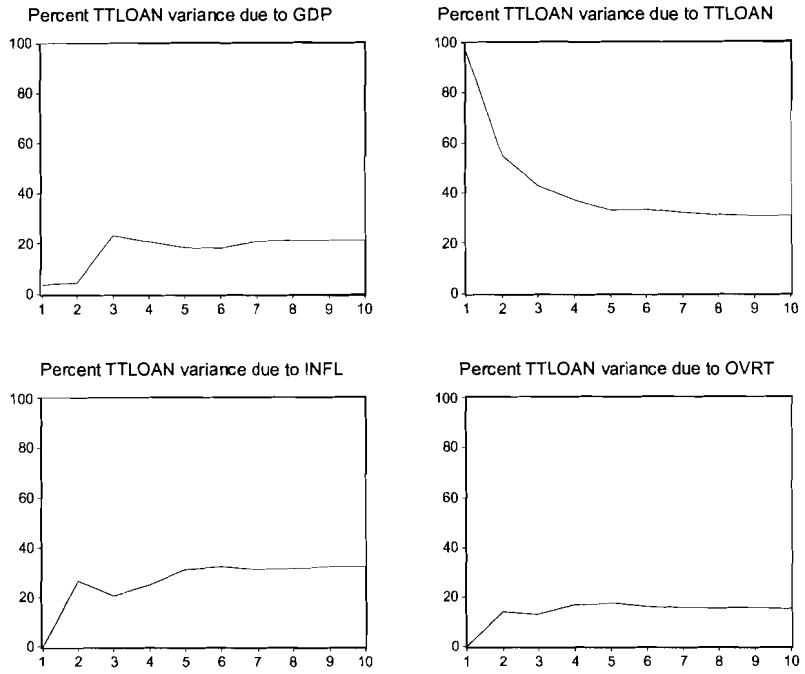
Note: AGRI stand for agriculture loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 8: Impulse response functions: Agriculture loan (1970-2000)



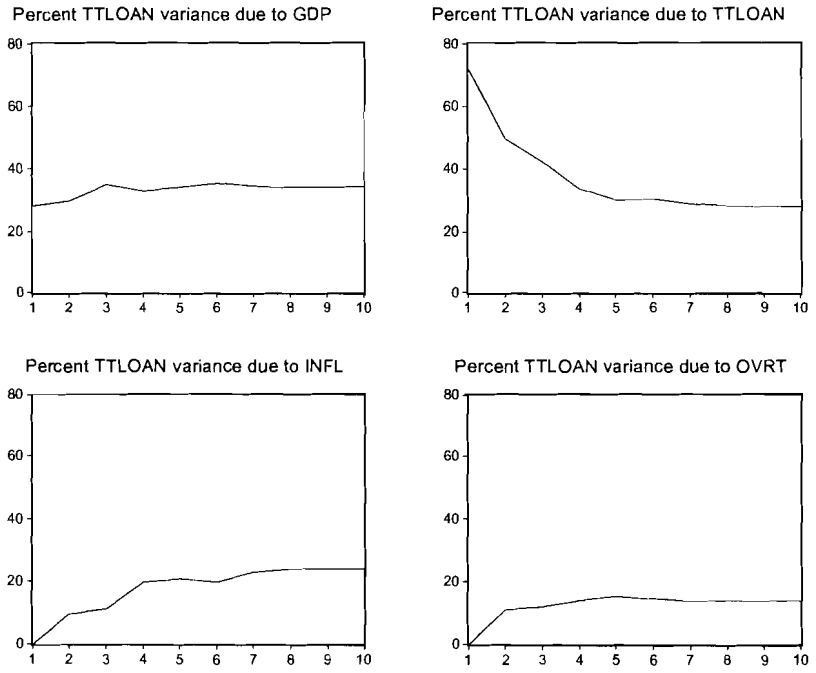
Note: AGRI stand for agriculture loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP. The dashed lines are two standard error bands.

Figure 9: Variance decompositions: Total loan (1970-1996)



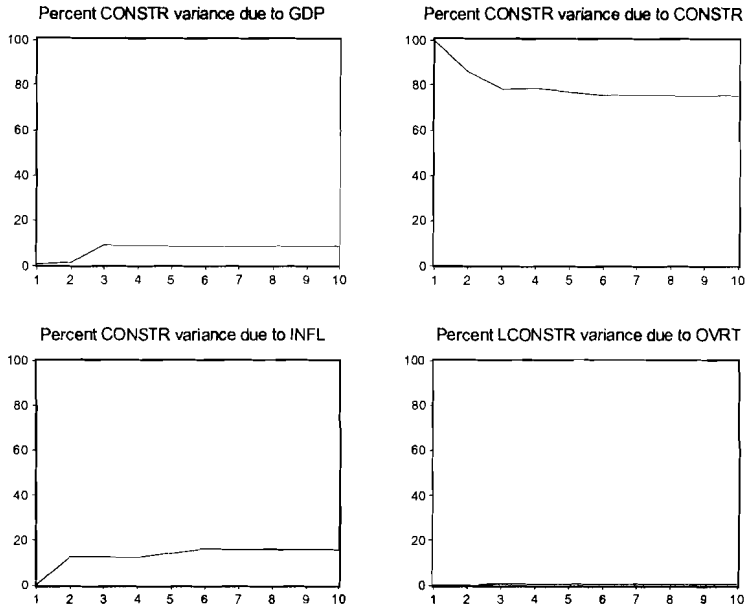
Note: TTLOAN stand for total loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 10: Variance decompositions: Total loan (1970-2000)



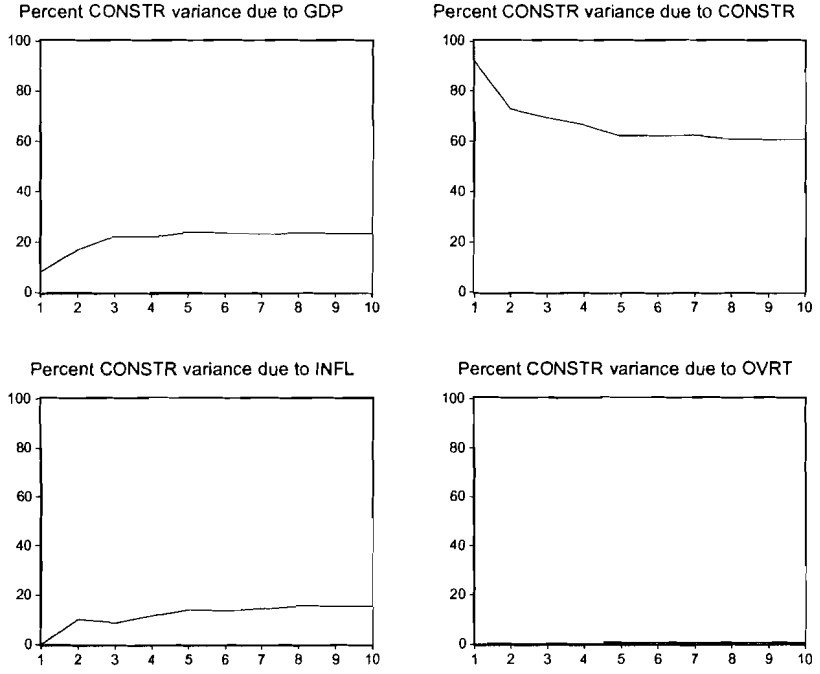
Note: TTLOAN stand for total loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 11: Variance decompositions: Construction loan (1970-1996)



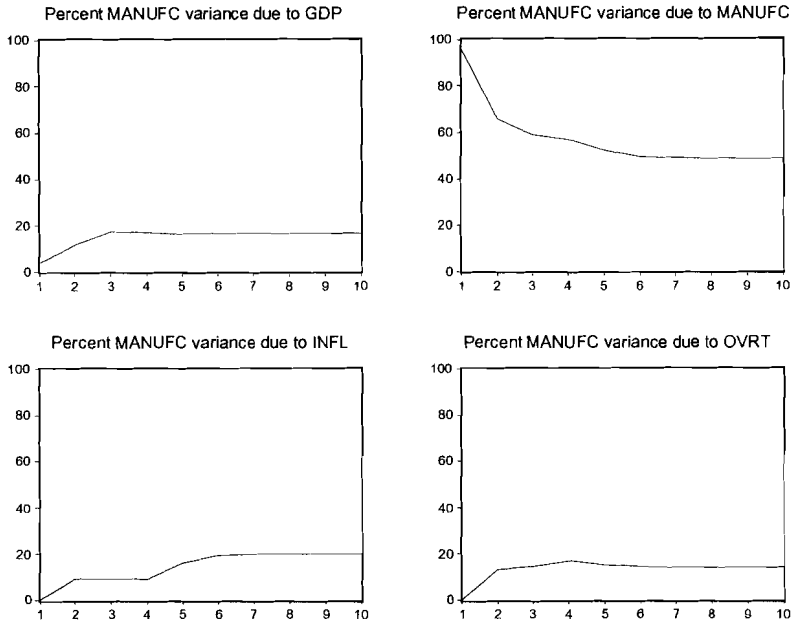
Note: CONSTR stand for construction loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 12: Variance decompositions: Construction loan (1970-2000)



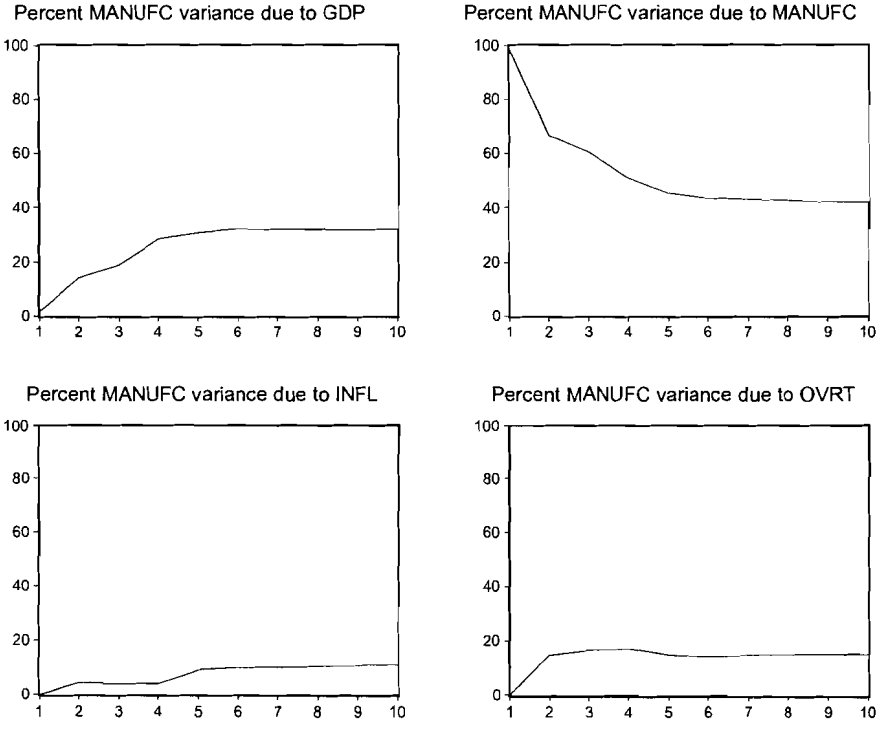
Note: CONSTR stand for construction loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 13: Variance decompositions: Manufacturing loan (1970-1996)



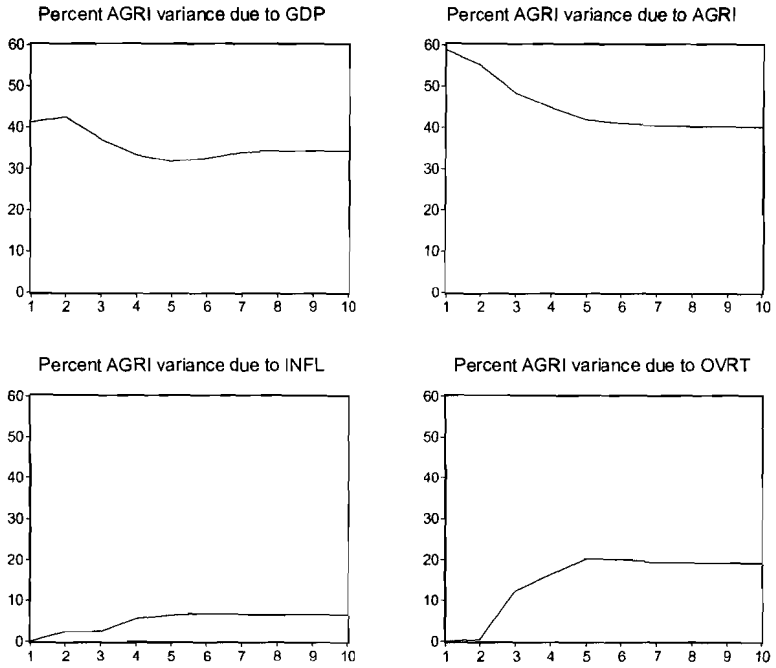
Note: MANUFC stand for manufacturing loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 14: Variance decompositions: Manufacturing loan (1970-2000)



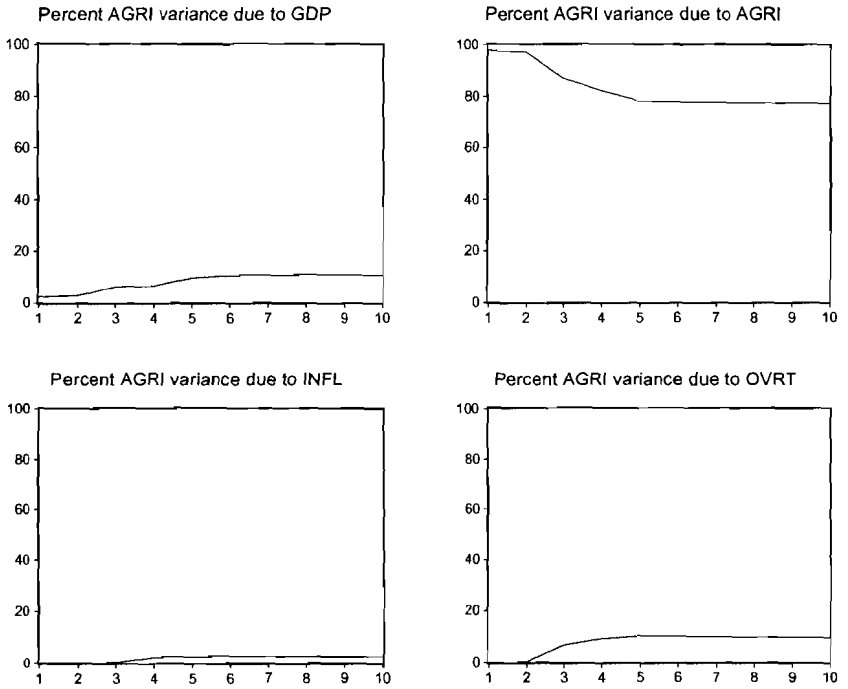
Note: MANUFC stand for manufacturing loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 15: Variance decompositions: Agriculture loan (1970-1996)



Note: AGRI stand for agriculture loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.

Figure 16: Variance decompositions: Agriculture loan (1970-2000)



Note: AGRI stand for agriculture loan, OVRT stand for federal fund rate, INFL stand for inflation, and GDP is GDP.