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THE ROLE OF BANK LOANS AND DEPOSITS IN THE MONETARY TRANSMISSION MECHANISM IN MALAYSIA

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Abstract

This study attempts to determine the importance of the banking sector in the monetary transmission process in a developing economy. The study analyzes the Malaysian data focusing on three sample periods: the entire sample period (1989:01-2006:12); the pre-crisis period (1989:01-1996:12); and the post-crisis period (1999:01-2006:12). To achieve this objective, the study relies on two tests: first, the auto-regressive distributed lag (ARDL) model for the long-run relationship among the variables and second, the impulse response functions and variance decomposition analysis for the short-run relationship among the variables. The finding shows that both bank deposits and loans play crucial roles in the monetary transmission process in the economy, suggesting evidence for the money endogeneity theory of post-Keynesian economists. In particular, bank deposits and loans are shown to provide an important link from monetary policy to output. This underscores the importance of ensuring the soundness of banking system as a pre-requisite to economic stability in the absence of such market based tools as market-based actions on exchange rate or interest rates as monetary stabilisation tools.

Keywords: Monetary transmission, Bank loans, Bank deposits, Auto-regressive distributed lag model; Impulse response functions, Variance decompositions
JEL Classifications: E42, E51, G21

1. Introduction

While it is widely accepted that monetary policy affects macroeconomic outcomes in an economy, a central point of a continuing debate among the policy-making circles is on the transmission mechanism of monetary policy to the real economy. The debate arises from the importance of identifying the key link(s) since such link(s) will determine the effective instrument and reliable intermediate targets for monetary policy implementation. In view of this, identifying the relevant channels through which the impact of monetary policy is transmitted to the real economy has been one of the most challenging and crucial tasks in the conduct of monetary policy. A clear understanding of the monetary transmission channel can help in ensuring an effective and successful implementation of monetary policy. Besides, the post-Keynesian economists have emphasized the role of banking credits as the key transmission mechanism, although this paper is not directly testing that hypothesis. This aspect has yet been seriously studied, and the only study that exists of a developing country is that of Turkey.

Monetary policy affects the real economy *via* several channels, but the main two that are often mentioned in the literature are the "*money channel*" and "*credit channel*". The money channel, which emphasises the role of central bank's money in the monetary transmission process, has secured a strong footing in the economic literature (see, for example, Brunner and Meltzer, 1972, 1988, 1990; McCallum, 1990, 1999, 2001, 2004; McCallum and Nelson, 2005; Feldstein and Stock, 1993; Hess and Porter, 1993; Dotsey and Otrok, 1994; Meltzer, 1969, 1970, 2001; Christiano and Rostagno, 2001; and Nelson, 2003a, 2003b). According to this view, an expansionary monetary policy causes bank deposit and money supply to expand, which results in real interest rate to decline, thus it is also known as the interest rate channel.

Studies that are supportive of the existence and importance of the bank lending channel in general find that, bank loan behave in a predictable manner when a policy shock is exerted on the economy. When a central bank conducts open market operations to reduce liquidity in the system, bank's deposit and liquidity are reduced, thereby restricting the ability of banks to supply new loans. Credit is less available in the economy, resulting in firms to cut down on investment and production, thus lower aggregate output in the economy. On the other hand, studies that do not support the importance of the bank lending channel generally find that banks offset the decline in liquidity following a tight monetary policy by adjusting their balance sheet items. Such ability to do so renders monetary policy ineffective in influencing supply of bank loan remaining relatively unchanged even after the implementation of the tight policy stance. For example, Suzuki (2001) employs the VAR analysis to examine the bank lending channel using the Australian data and report that bank loans contracted following a tight monetary policy, the contraction. Studies by Morris and Sellon (1995) which used US data for 1974-1990 also show that bank loan is not an important channel for monetary policy since bank loan supply does not decline in response to tight monetary policy.

Earlier studies such as Scholnick (1996) and Tan (1997) on Malaysian situation adopted the credit-rationing model and estimated the disequilibrium model of lending rate. Both studies support the presence of credit rationing as the lending rate adjusted very slowly and did not clear the loan market. More recent studies such as Ibrahim (2005), Azali (2003), Tang (2000, 2002) and Vaithilingam et al. (2003) employed more recent investigation techniques such as the VAR that enable more detailed and conclusive findings. In general, these studies are supportive of the important role played by bank loan in the transmission of monetary policy.

The need to understand the interaction between bank loan and bank deposit with monetary policy indicator is critical, hence this study is motivated to address this issue. Bank lending accounted for more than 100 percent of the country's total gross domestic product (GDP) and is expected to remain high due to the moderate economic performance. Indeed, the important role played by bank lending in achieving the overall economic objective is clearly acknowledged by Bank Negara Malaysia. "As the nation's monetary authority, the Central Bank is responsible to the Government for promoting monetary stability and a sound financial structure, and for influencing the credit situation to help achieve the nation's overall economic objectives." (1994, p. 91). An aspect of novelty of this study is that not only that it uses the latest empirical methodology, it also considers two sub-sample periods following the crisis in 1997/1998.

The rest of this paper is organized as follows: the next section provides some background information on the monetary transmission process. Section 3 discusses the data and empirical framework. Section 4 presents the empirical findings and the discussions of the results. Lastly, Section 5 concludes this paper.

2. An Overview of Related Literature

Empirical studies analyzing the importance of the banking sector in the monetary transmission process focus on the relationship and impact of disturbances in the banking sector on the aggregate economic activity: see, for example Friedman,1984; Bernanke and Blinder, 1988 and 1992; Bernanke and Gertler, 1995; Bernanke and Mihov, 1998; Dale and Haldane, 1998; Domac and Ferri, 1998; Garretsen and Swank, 1998; Guender, 1998; Gertler and Gilchrist, 1993; Walsh and Wilcox, 1995 and Suzuki, 2001. In general, these studies measure the responses of selected macroeconomic variables such as output, unemployment rate and inflation and the major bank balance sheet variables, which are deposit (representing bank liability) and loan (representing bank asset) to changes in the monetary policy indicator such as interest rates.

However, it is often shown that the macroeconomic responses to policy-induced interest rate changes are larger than that implied by the money view. This gives rise to the lending channel, which suggests that bank loans may provide an additional channel for the monetary authority to affect the real economy. An influential study by Bernanke (1983) finds that the output decline in the US during the 1930-1933 Great Depression cannot be fully explained by monetary disturbances as described by the money view. Using the federal funds rate as an indicator for monetary policy, that study analyzed the responses of selected macroeconomic variables such as unemployment rate and inflation, and the bank balance sheet items to changes in the fed funds rate. It was found that in the short run, banks offset the decline in liquidity following a contractionary monetary policy by selling-off their securities holdings, thereby leaving the supply of loan in the economy virtually unchanged. However, in the longer term, the tight monetary policy causes banks to terminate the existing loans and stop making new loans. The brunt of the tight monetary policy is especially felt by borrowers who are dependent on bank lending. Consequently, the tighter monetary policy results in a decline in the aggregate economic output. Until now, the reduction in loan supply has often been quoted as one of the reasons for the depth and persistence of the Great Depression. As lessons learned from that crisis, the central banks the world over are loosening monetary policy since August 2007 in response to the sub-prime loan crisis of 2007/08.

In Malaysia, the banking system forms an integral part of a larger financial system which is made up of the financial institutions and the financial markets. The financial institutions can be grouped into the banking system and the non-bank financial intermediaries. The banking system is made up of commercial banks, finance companies and merchant banks, while the non-bank financial intermediaries comprised the provident and pension funds, insurance companies, development financial institutions, savings institutions and other financial intermediaries (such as cooperative societies, leasing and factoring companies, venture capital companies and housing credit institutions). The operations of Malaysia's banking system fall under the purview of the central bank, the Bank Negara Malaysia (BNM).

The financial system experienced a rapid growth in tandem with the robust economic performance during 1976-1996. By the end of 2006, the total assets of the financial system was about equal to the GDP of the country and it was RM2,091.2 or US$ 635 billion compared to RM329.3 billion in 1990 and RM74.2 billion in 1980. The rapid growth financial sector reflects the process of financial deepening due to increased demands for financial products and services in line with the structural transformation of the economy. More importantly, the banking system remained a major contributor to the total assets of the country's financial system.

Of the total assets of the financial system at end-2006, 68 percent were contributed by the banking system while 32 by the non-bank financial intermediaries. In terms of growth, the total assets of the banking system grew by approximately 11.3 percent in the period of 1990-2006, comparable to that of the financial system at 11.5 percent. Apart from its significant contribution to the growth of the country's financial system, the banking system has also been instrumental in financing the country's economic growth. This is well-reflected by the high ratio of total loan extended by the banking institutions to total gross domestic product (GDP) at more than 100 percent as at end-2006.

One important lesson learned from the 1997/98 Asian financial crisis was that fragility of the banking sector could lead to a loss of confidence which would affect the real economy negatively. In view of this, BNM banking policies in the post-crisis period are directed towards strengthening and increasing the resilience of the banking system as well as to preserve the integrity and stability of financial sector. In this regard, one of the major initiatives taken was to consolidate the banking institutions in order to create a core of strong domestic banking institutions with large capital base. Prior to the consolidation program, as at end-1997, the banking system comprised 35 commercial banks, 39 finance companies and 12 merchant banks. As a result of the consolidation program, as at end-2006, the number of commercial banks has been reduced to 22 operating within ten holding companies, with the operations of the finance companies fully being absorbed by the commercial banks and the merchant banks being re-categorized into the 14 investment banks comprising the merchant banks and discount houses. This led to a strong capital base of risk-weighted capital ratio at 13.5 percent as at end-2006. The non-performing loan ratio declined from above 13.9 percent in 1998 to 3.7 percent.

3. Data and Methodology

A. Data

The overnight rate, henceforth denoted as ONR is used as the monetary policy indicator, while the objective variables comprised of the bank balance sheet items, namely, bank loans (BL) and bank deposits (BD) and other variables which are consumer price index (CPI) and industrial production index (IPI). The CPI and the IPI are used as the proxies for inflation and level of economic activity, respectively. Given that the economy is a highly open one, the conduct of monetary policy may be influenced by foreign shocks, thus we also include real effective exchange rate (RER) as a control variable. All series are real (adjusted by price index with the year 2000 as base year) and variables are expressed in logarithm, except for the interest rate.

The study uses monthly data from January 1989 to December 2006. During this period, the economy experienced a financial crisis. To avoid the disturbance from affecting the results of the analysis, tests are done over separate sub-periods and also over the whole period. The pre-crisis period covers the period from January 1989 to December 1996. In this period, the data set excludes the period from 1997 to 1998, which were the heights of the East Asian financial crisis. The post-crisis period runs from January 1999 to December 2006. All data are sourced from BNM's *Monthly Statistical Bulletin*, except for the RER which is gathered from *International Financial Statistics* published by International Monetary Fund.

B. Empirical Framework

ARDL Bound Testing Approach

The long-run dynamic relationships between monetary policy variables and bank balance sheet items are estimated by using the newly proposed ARDL bound testing approach: Pesaran et al. (1996). The ARDL has numerous advantages. First, unlike the most widely used method for testing cointegration, the ARDL approach can be applied regardless of the stationary properties of the variables in the samples and it allows for inferences on long-run estimates, which is not possible under the alternative cointegration procedures. This procedure can be applied irrespective of whether the series are $I(0)$, $I(1)$, or fractionally integrated (Pesaran and Pesaran 1997; and Bahmani-Oskooee and Wing Ng, 2002), thus avoiding problems resulting from non-stationary time series data (Laurenceson and Chai, 2003). Second, the ARDL model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modelling framework (Laurenceson and Chai, 2003). It estimates $(p+1)^k$ number of regressions in order to obtain optimal lag-length for each variable, where p is the maximum lag to be used, k is the number of variables in the equation. Finally, the ARDL approach provides robust results for a smaller sample size of cointegration analysis. Since the sample size of our study is small, particularly for pre- and post-crisis sub-periods, this provides a motivation for the study to adopt this model.

Ideally, for the purpose of this study, we needed to incorporate all the variables in the model, but a VAR model can be poorly estimated in a finite sample, as the addition of a variable will quickly exhaust the degree of freedom. Following Gertler and Gilchrist (1993, 1994), we estimated a series of separate VAR models including INF, IPI, and RER, policy variable (ONR), and the bank balance sheet items. Thus, our models contain only five variables. The ARDL models for the bank balance sheet items used in this study can be written as follows:

$$BD_t = \delta_0 + \phi_1 ONR_t + \varphi_2 IPI_t + \gamma_3 RER_t + \mu_4 INF_t + \epsilon_t \tag{1.1}$$

$$BL_t = \delta_0 + \phi_1 ONR_t + \varphi_2 IPI_t + \gamma_3 RER_t + \mu_4 INF_t + \varepsilon_t \tag{1.2}$$

The error correction version of ARDL framework pertaining to the variables in the Equations (1.1) and (1.2) can be reproduced as follows:

$$\Delta BD_t = \delta_0 + \sum_{i=1}^{p}\theta_i \Delta BD_{t-i} + \sum_{i=0}^{p}\phi_i \Delta ONR_{t-i} + \sum_{i=0}^{p}\varphi_i IPI_{t-i} + \sum_{i=0}^{p}\gamma_i \Delta RER_{t-i} + \sum_{i=0}^{p}\mu_i \Delta INF_{t-i} + \\ + \lambda_1 BD_{t-1} + \lambda_2 ONR_{t-1} + \lambda_3 IPI_{t-1} + \lambda_4 RER_{t-1} + \lambda_5 INF_{t-1} + \notin_{1t} \tag{2.1}$$

$$\Delta BL_t = \delta_0 + \sum_{i=1}^{p}\theta_i \Delta BL_{t-i} + \sum_{i=0}^{p}\phi_i \Delta ONR_{t-i} + \sum_{i=0}^{p}\varphi_i IPI_{t-i} + \sum_{i=0}^{p}\gamma_i \Delta RER_{t-i} + \sum_{i=0}^{p}\mu_i \Delta INF_{t-i} + \\ + \lambda_1 BL_{t-1} + \lambda_2 ONR_{t-1} + \lambda_3 IPI_{t-1} + \lambda_4 RER_{t-1} + \lambda_5 INF_{t-1} + \varepsilon_{1t} \tag{2.2}$$

In the above equations, the terms with the summation signs represent the error correction dynamics, while the second part (term with λs) correspond to the long-run relationship. The null of no cointegration in the long-run relationship is defined by H_0: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_{5\,=}\, 0$ which is tested against the alternative of H_0: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$, by the means of familiar F-test. However, the asymptotic distribution of this F-statistic is non-standard irrespective of whether the variables are $I(0)$ or $I(1)$. Pesaran et al. (1996) have tabulated two sets of appropriate critical values. One set assumes all variables are $I(1)$ and another assumes that they are all $I(0)$. This provides a bound covering all possible classifications of the variables into $I(1)$ and $I(0)$ or even fractionally integrated. If the F-statistic lies above the upper-bound level, the null hypothesis is rejected, which indicates the existence of cointegration. However, if the F-statistic falls below the bound level, the null cannot be rejected, showing that no cointegration exists. If, however, it falls within the band, the result is inconclusive. Finally, in order to determine the optimal lag-length incorporated into the model and select the ARDL model to be estimated, the study employs the Akaike Information Criteria (AIC).

Impulse Response Functions and Variance Decompositions

We estimate VAR models and generate impulse-response functions to study the impacts of interest rate shocks on the systems as indicated in equations 1.1 and 1.2. An impulse response function (IRF) measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamical system (Pesaran and Shin, 1998). The approach is well-suited because not only that it allows for the relative strength of various shocks to be quantified in terms of their contributions to variations in a particular variable of interest, but it also enables the pattern and direction of the transmission of shocks to be traced.

Meanwhile, the Variance Decomposition Analysis (VDA) shows the fraction of forecast error variance of a variable attributed to shocks in other variable particularly to inference of relative strength of innovations in the variable of interest. It is a method of providing a literal breakdown of the change in the value of a variable in a given period arising from changes in the same variable and in other variables during previous periods. Variance decomposition analysis provides an indication of the dynamic properties of the system. VDC, which is termed an out-of-sample causality tests, by partitioning the variance of forecast error of a certain variable into proportions attributable to innovations (or shocks) in each variable in the system including its own, can provide an indication of these relatives. According to Sims (1992), a variable optimally forecast from its own lagged values will have all its forecast error variance accounted for by its own disturbances. It is generally observed that in applied research, it is typical for a variance to explain almost all its forecast error variance at short horizons and smaller proportions at longer horizons.

4. Empirical Results and Analysis

A. Results based on the ARDL Model

In estimating the long-run relationships between the monetary policy variable and the objective variables (consisting of the bank balance sheet items and the selected macroeconomic variables), we needed to determine the lag-length of the first-differenced variables. Bahmani-Oskooee and Bohl (2000) have shown that the results of this first step are usually sensitive to the lag-length. To verify this, we imposed the optimal lag length of 12 on the first difference of each variable to compute the F-statistics for the joint significance of lagged levels of variables for Equations (2.1) and (2.2). However, only selected computed F-statistics for lag-lengths for all models are reported as in Table 1.

As reported in Table 1, the test outcome of the significance levels for the ARDL models varies with the choice of lag-length. For the entire sample period, the computed F-statistics are significant at least at 0.90 level when the order of lags ranges from 1 to 9 for the deposit and at 0.99 level when the order of lags ranges from 1 to 3 for loan. This suggests that there are cointegrating relationship among the selected variables with bank loans and deposits in the whole sample period, implying that there is a tendency for the variables to move together towards a long-run equilibrium.

However, a breakdown of the whole sample period to pre-crisis period and post-crisis period shows somewhat puzzling results. For the pre-crisis period, the computed F-statistics is found to be significant when the order of lags = 1 and 3 at the 90% level for deposits but not for loans. Similarly, in the post-crisis period, only the computed F-statistic for deposit is found to be significant at 0.05 probability level at lag-length 3 and 5, but not for loan. This suggests that in the pre- and post-crisis periods, there are cointegrating relationships among the selected variables and deposit, thus the deposit tend to move together towards a long-run equilibrium with other selected variables, but not loans. These results are considered preliminary and indicate that in estimating equations (1.1) and (1.2) we must retain the lagged level of variables.

Table 1: F-statistics for Testing the Existence of a Long-run Equation

Lag-Length	**Entire Sample** (1989:1 to 2006:12)		**Pre-Crisis Period** (1989:1 to 1996:12)		**Post-Crisis Period** (1999:1 to 2006:12)	
	Deposit	**Loan**	**Deposit**	**Loan**	**Deposit**	**Loan**
1	6.2445***	11.4565***	4.2705**	3.2333	2.2765	2.3551
3	4.8321**	7.8294***	3.5698*	1.0575	4.2278**	1.2158
5	5.0051**	6.0578***	1.6817	1.9647	4.3039**	1.8131
7	4.4483*	3.6087	2.3935	3.0527	3.3626	1.4383
9	5.3777**	2.9743	3.4045	2.4663	2.9822	2.3469
11	4.0312	2.432	3.001	2.1263	2.324	1.6912

Note: the relevant critical value bounds for the pre- and post-crisis periods are given in Table C1.iii (with unrestricted intercept and no trend; the number of regressors = 4). They are 3.74 – 5.06 at the 99% significance level; 2.86 – 4.01 at the 95% significance level; and 2.45 – 3.52 at the 99% significance level (see Table C1.iii, Pesaran et al., 2001). Meanwhile, the relevant critical value bounds for the entire sample period are given in Table C1.v (with unrestricted intercept and unrestricted trend; the number of regressors = 4). They are 4.40 – 5.72 at the 99% significance level; 3.47 – 4.57 at the 95% significance level; and 3.03 – 4.06 at the 99% significance level (see Table C1.v, Pesaran et al., 2001). *, **, and *** denotes that F-Statistics falls above the 90%, 95% and 99% upper bound, respectively.

The findings from this section suggests that there seems to be a long run cointegration among the bank deposit (BD), overnight interest rate (ONR), industrial production index (IPI), inflation (CPI), and real effective exchange rates (RER) during all periods of the study. However, the bank loan are only found to be cointegrated with other selected variables during the entire period of the study, while no cointegration is found during the pre- and post-crisis periods. For further analysis, the study only focuses on the cointegrated variables.

The next step involves estimating equations (2.1) and (2.2) using the appropriate lag-length and model selection criterion based on the Akaike Information Criterion (AIC). Note that the loan variable is only included in the entire sample period but not in the pre-and post-crisis sample periods based on the earlier findings that there is no long run cointegration relationship between loan and the rest of the variables in the pre- and post crisis periods. As suggested in Table 1, the appropriate lag length for the estimated equations is 1 for pre-crisis and entire sample periods and 5 for post-crisis period. The study simply selects the order of lags for the estimated models based on the higher value of the computed F-statistics.

Table 2: The Long-run ARDL Model Estimates

	Entire Sample (1989:1 to 2006:12)		**Pre-Crisis Period** (1989:1 to 1996:12)	**Post-Crisis Period** (1999:1 to 2006:12)
	Deposit [1,1,0,0,0]	**Loan [1,0,0,1,0]**	**Deposit [1,1,0,0,0]**	**Deposit [1,2,0,1,0]**
C	-4.4052 (-0.6233)	14.1914 (0.4186)	-11.1661 (-0.9931)	2.8885 (0.9479)
ONR	0.0788** (2.4103)	0.0442 (0.8610)	-0.0729 (-0.7338)	0.0978 (1.4564)
ln*IPI*	1.9806* (1.8358)	7.9258 (1.0274)	-1.7030 (-0.5643)	-.10683 (-0.5144)
ln*INF*	0.1594 (0.0606)	-10.6086 (-.6009)	8.4568 (1.1535)	3.7116*** (4.9072)
ln*RER*	1.3481 (1.4034)	2.0268 (0.7363)	-1.2292 (-0.4168)	-1.4554*** (-3.4990)
	Adj-R^2 = 0.998 D-W = 1.977	Adj-R^2 = 0.996 D-W = 1.993	Adj-R^2 = 0.995 D-W = 1.7534	Adj-R^2 = 0.997 D-W = 2.066

Note: *, ** and *** denotes significantly at 10%, 5% and 1% level of significance, respectively. Figures in the parentheses and squared parentheses are the *t*-statistics values and the selected ARDL model. D-W denotes Durbin-Watson test for autocorrelation. Dummy variable is included in the entire sample period; D = 0 for the non-crisis period (pre- and post-crisis periods), while D = 1 is incorporated during the crisis period.

The results for the long run estimates based on the ARDL model are provided in Table 2. For the entire sample period, the results provide evidence that deposits are significantly affected by ONR and IPI. In the context of this study, we highlight the significant and positive effect of monetary policy variable, the overnight interest rate, on deposits in the long run. However, none of the variables including the monetary policy variable is significant in affecting loans in entire sample period. In the context of monetary transmission mechanism, this result implies that monetary policy shock is transmitted through bank deposits (the money view) and not through bank loan (the credit view).

Test results from a breakdown of the entire sample period into the pre- and post-crisis periods show that monetary policy variable is not significant in affecting deposits in both the periods. In particular, none of the selected variables are significant in affecting deposits in the pre-crisis period. In contrast, in the post-crisis period, inflation and real exchange rate are significant in affecting deposit in the long run.

B. Results based on the Impulse Response Functions

The impulse response functions (IRF) allow for the analysis of the impacts of interest rate shocks on the bank balance sheet items of both banking groups. The IRF shows the magnitude and timing of the responses of the objective variables (the bank balance sheet items) to a shock in the interest rate variable. This enables a comparison of the extent of responses of the bank balance sheet items to the policy shocks. In all cases, impulse response functions are reported for 36 months. To provide some idea of uncertainty surrounding the estimated response, based on Sim and Zha (1995), one standard deviation of confidence bands have been obtained by Monte Carlo integration methods with 1000 replications.

Figure 1 provides the impulse response functions of the responses of the macroeconomic variables to shocks in bank deposit and bank loan for the entire sample period (1989:1 to 2006:12). In terms of the relevance of the bank balance sheet items to monetary policy shocks, the short run analysis indicates that bank deposit responds positively and significantly to changes in the policy interest rate. The impact started to be significant in the fifth month and remained significant until about the 25th month. In contrast, bank loan does not respond significantly to changes in the overnight rates. However, the monetary policy indicator seems to respond positively and significantly to changes in bank loan, implying that the monetary authority reacts to changes in bank loan. Bank loan, therefore, can be termed as the "trigger variable" for monetary policy.

With respect to the responses of the macroeconomic variables to changes in bank deposit and bank loan, data for the whole sample period indicates that the only significant response is that of real output (denoted by IPI) to changes in bank loan, where output increases following a positive innovations in bank loan. This finding implies that bank loan is important in influencing monetary policy direction and economic output in the short run.

To gain some insights of the changes in the relationship among the variables in the period before and after the Asian financial crisis in 1997/1998, the whole sample period is being divided into the pre-crisis and post-crisis periods. Figure 2 shows the IRF results for the pre-crisis period. As shown in the figure, there seems to be a puzzling result when bank deposit responds negatively significant to changes in the policy interest rate. There is also a significant negative response of ONR to changes in bank deposit, implying in the pre-crisis period, monetary policy has primarily been used in respond to changes in deposit. Bank deposit, however, is insignificant in affecting other macroeconomic variables in the short run in the pre-crisis period. Turning to bank loan, clearly, bank loan is insignificant in the implementation of monetary policy in the pre-crisis period as reflected by the insignificant responses of either bank loan to ONR and ONR to bank loan. However, changes in bank loan are shown to have significant impacts on IPI (IPI responds positively and significantly to changes in BL), CPI (CPI responds positively and significantly to changes in BL) and RER (RER responds negatively and significantly to changes in BL).

Figure 3 provides the IRF results for the post-crisis period. During this period, bank loan seems to play a lesser role in the transmission process of monetary policy, with the exception of bank deposit which seems to respond positively significant to changes in ONR in the first three- to four-month period. Despite this, bank deposit seems to be significant in influencing CPI as the IRF shows that the CPI respons significantly positive to changes in bank deposit. There are still evidences that bank loan is significant in influencing output and a clear indication that bank loan is significant in influencing real exchange rate as shown by the positive and significant IRF.

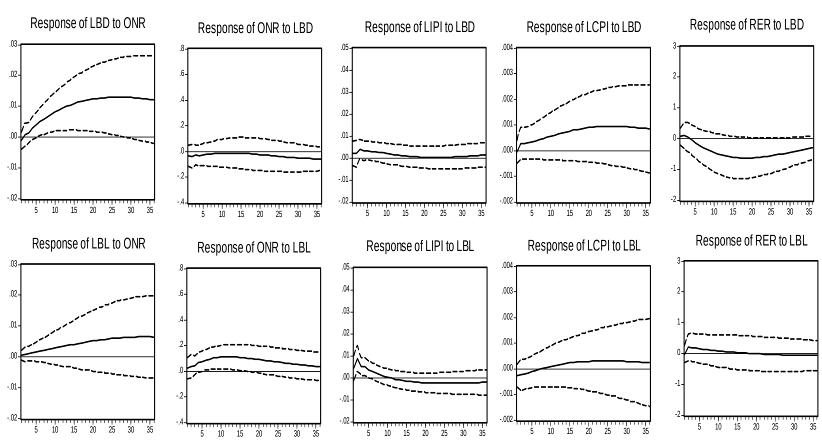

Figure 1: Generalized Impulse-Response Functions, Entire Sample-1989:1 to 2006:12

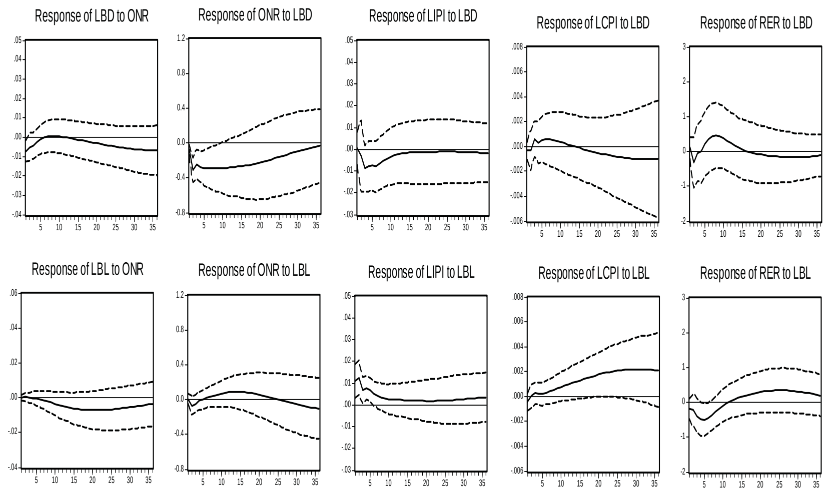

Figure 2: Generalized Impulse-Response Functions Pre-Crisis Period-1989:1 to 1996:12

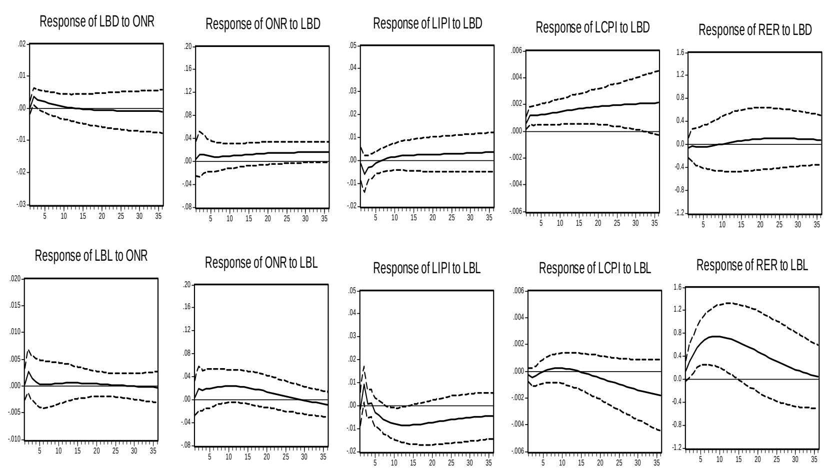

Figure 3: Generalized Impulse-Response Functions Post-Crisis Period-1999:1 to 2006:12

Table 3: Variance Decomposition, Q1:1989 to Q2:2006 (*continuied*)

Horizon	Explained by shocks in BD on:									
(Monthly)	BD	ONR	BD	ONR	BD	IPI	BD	CPI	BD	RER
1	100.000	0.000	0.345	99.655	0.260	99.187	0.027	95.673	0.104	89.156
2	99.382	0.468	0.624	98.212	0.420	93.980	0.390	95.922	0.134	84.238
3	98.305	0.876	0.602	96.554	0.983	92.847	0.542	95.688	0.109	82.506
6	91.432	3.860	0.630	91.226	1.732	87.546	0.942	92.231	0.272	78.425
9	81.246	7.777	0.555	85.072	2.085	81.704	1.492	85.987	1.161	74.782
12	70.538	11.677	0.499	79.709	2.139	75.665	2.190	79.042	2.617	71.329
16	57.776	16.191	0.474	74.070	2.004	68.250	3.239	70.580	5.035	67.282
19	49.884	18.962	0.505	70.775	1.868	63.431	4.013	65.314	6.920	64.818
23	41.565	21.922	0.644	67.303	1.701	58.043	4.902	59.743	9.200	62.378
27	35.384	24.195	0.924	64.646	1.564	53.775	5.550	55.576	10.985	60.831
31	30.865	25.925	1.348	62.641	1.466	50.497	5.937	52.507	12.192	59.972
36	26.908	27.495	2.021	60.866	1.425	47.527	6.104	49.825	12.980	59.485

Table continues on the next page

Table 3: Variance Decomposition, Q1:1989 to Q2:2006

Horizon (Monthly)	Explained by shocks in BL on:									
	BL	**ONR**	**BL**	**ONR**	**BL**	**IPI**	**BL**	**CPI**	**BL**	**RER**
1	100.000	0.000	0.056	99.944	1.203	98.372	0.287	95.830	0.011	89.236
2	99.215	0.036	0.261	98.871	5.433	92.037	0.247	96.567	0.272	84.468
3	96.992	0.123	0.386	97.231	5.626	91.018	0.198	96.518	0.275	82.994
6	88.579	0.468	1.651	91.934	6.476	85.560	0.137	93.214	0.167	79.429
9	80.468	0.813	3.127	85.703	6.078	80.133	0.319	86.995	0.216	76.457
12	73.509	1.147	4.417	80.282	5.579	74.598	0.706	80.158	0.436	73.777
16	65.659	1.621	5.571	74.630	5.164	67.780	1.389	72.047	0.924	70.665
19	60.609	2.029	6.013	71.362	5.030	63.311	1.928	67.162	1.384	68.693
23	54.827	2.665	6.183	67.968	4.941	58.276	2.590	62.165	2.057	66.549
27	50.017	3.418	6.080	65.440	4.835	54.288	3.136	58.557	2.739	64.928
31	46.060	4.281	5.888	63.615	4.668	51.278	3.548	55.966	3.385	63.769
36	42.119	5.485	5.690	62.128	4.398	48.676	3.887	53.718	4.101	62.847

Table 4: Variance Decomposition, Pre-Crisis Period M1:1989 to M12:1996 (*continued*)

Horizon (Monthly)	Explained by shocks in BD on:									
	BD	**ONR**	**BD**	**ONR**	**BD**	**IPI**	**BD**	**CPI**	**BD**	**RER**
1	100.000	0.000	5.545	94.455	0.454	99.434	0.460	99.255	0.475	84.310
2	99.364	0.103	38.942	60.034	0.538	97.822	0.431	96.972	2.561	79.896
3	96.482	0.457	41.170	55.841	2.651	93.293	2.447	95.082	1.824	75.403
6	84.302	4.047	50.165	42.303	5.014	82.899	4.688	93.394	1.889	63.031
9	72.878	8.541	56.576	31.393	6.005	71.584	7.049	87.770	4.543	57.064
12	64.807	12.602	60.628	23.661	5.689	63.843	7.347	80.011	5.800	51.944
16	56.832	17.083	61.942	17.692	5.186	58.017	5.961	70.903	5.422	46.836
19	51.799	19.692	60.910	15.567	4.947	55.562	4.931	66.394	5.397	45.001
23	45.953	22.036	58.665	14.541	4.695	53.393	4.274	63.010	5.977	43.822
27	41.117	23.035	56.509	14.563	4.513	51.633	4.437	61.550	6.807	43.059
31	37.276	22.859	54.809	15.011	4.441	49.913	5.179	61.164	7.607	42.395
36	33.682	21.520	53.336	15.710	4.552	47.665	6.509	61.446	8.418	41.656

Table continues on the next page

Table 4: Variance Decomposition, Pre-Crisis Period M1:1989 to M12:1996 (*continued*)

Horizon (Monthly)	Explained by shocks in BL on:									
	BL	**ONR**	**BL**	**ONR**	**BL**	**IPI**	**BL**	**CPI**	**BL**	**RER**
1	100.000	0.000	0.182	99.818	10.165	89.828	1.606	97.323	2.073	82.220
2	99.520	0.445	2.732	95.084	19.463	79.361	0.928	94.261	2.681	79.961
3	96.136	0.280	2.569	91.983	19.538	78.016	0.864	92.924	3.879	75.476
6	87.632	0.115	2.393	83.183	22.735	73.250	0.795	93.152	7.526	66.053
9	82.561	0.283	6.557	66.615	24.022	69.773	1.472	93.640	8.409	62.771
12	79.834	0.678	12.731	49.385	24.735	66.712	3.078	92.836	8.411	62.304
16	77.982	1.448	19.735	33.300	25.556	63.039	6.841	89.435	8.726	61.722
19	77.260	2.132	23.359	26.169	26.273	60.579	10.843	85.247	9.373	60.657
23	76.703	3.085	26.505	20.843	27.444	57.659	17.342	78.005	10.533	58.804
27	76.310	3.998	28.372	18.315	28.866	55.068	24.389	69.815	11.741	56.965
31	75.883	4.803	29.431	17.317	30.500	52.721	31.134	61.723	12.799	55.448
36	75.162	5.597	30.047	17.147	32.743	50.039	38.338	52.811	13.785	54.143

Table 5: Variance Decompositions: Post-Crisis Period-1999:1 to 2006:12 (*continued*)

Horizon (Monthly)	Explained by shocks in BD on:									
	BD	**ONR**	**BD**	**ONR**	**BD**	**IPI**	**BD**	**CPI**	**BD**	**RER**
1	100.000	0.000	0.004	99.996	1.243	98.262	7.986	92.013	0.966	87.788
2	93.727	5.860	0.292	98.863	3.196	93.530	15.791	80.825	0.589	88.418
3	91.922	6.842	0.569	97.905	3.258	92.610	18.209	74.957	0.473	88.577
6	87.808	5.408	1.097	93.306	2.923	82.850	23.831	62.561	0.245	87.742
9	80.974	3.698	1.536	87.599	2.380	70.112	28.928	55.333	0.196	86.757
12	72.920	2.849	2.039	82.529	2.165	61.052	33.895	50.980	0.248	85.848
16	63.013	2.631	2.882	77.700	2.213	53.556	39.750	47.378	0.402	84.853
19	56.931	2.792	3.640	75.294	2.403	49.937	43.140	45.409	0.549	84.267
23	50.597	3.143	4.777	73.097	2.793	46.536	46.030	43.130	0.761	83.667
27	45.893	3.502	6.008	71.492	3.297	44.049	47.168	41.003	0.977	83.226
31	42.384	3.814	7.281	70.063	3.888	42.070	46.971	38.997	1.189	82.897
36	39.175	4.123	8.865	68.167	4.716	40.003	45.592	36.729	1.442	82.583

Table continues on the next page

Table 5: Variance Decompositions: Post-Crisis Period-1999:1 to 2006:12

Horizon (Monthly)	Explained by shocks in BL on:									
	BL	**ONR**	**BL**	**ONR**	**BL**	**IPI**	**BL**	**CPI**	**BL**	**RER**
1	100.000	0.000	0.005	99.995	0.477	99.181	0.481	99.239	2.546	87.804
2	97.315	0.854	0.870	97.928	4.517	91.702	0.791	96.651	6.602	83.697
3	96.722	0.716	1.428	96.712	3.906	92.565	0.567	96.284	11.366	79.428
6	95.753	0.702	4.285	91.918	4.720	88.496	0.888	96.252	27.697	63.468
9	94.770	1.192	7.769	87.086	8.945	77.839	1.456	95.484	39.352	52.359
12	93.715	1.650	10.873	83.189	14.018	67.295	1.449	94.370	46.396	45.614
16	91.888	2.108	13.677	79.806	19.404	56.593	1.120	92.422	51.496	40.587
19	90.090	2.350	14.832	78.312	22.088	50.891	1.156	90.543	53.536	38.474
23	87.155	2.561	15.496	77.104	24.278	45.400	1.840	87.619	55.003	36.844
27	83.772	2.673	15.587	76.256	25.417	41.446	3.097	84.538	55.700	35.966
31	80.156	2.714	15.434	75.409	25.921	38.426	4.629	81.603	56.008	35.485
36	75.577	2.700	15.176	74.113	26.043	35.442	6.578	78.383	56.134	35.161

c. Results based on the Variance Decomposition Analysis

The variance decomposition analysis is used to asses the dynamic interactions between the monetary policy indicator and the bank balance sheet items. At the same time, we provide the variance decomposition of the macroeconomic variables to show the contribution of bank deposits and loans in explaining the variations in the macroeconomic variables. The results from the variance decomposition analysis (VDA) are shown in tables 3, 4 and 5. In general, these results further substantiate our earlier findings based on the IRFs.

Table 3 provides the VDA results for the entire sample period. The results show that the innovations in ONR are highly significant in accounting for the variations in bank deposit. In particular, innovations in ONR account for around 27 percent of the forecast error variance of deposit at the 36-month horizon. In contrast, ONR only accounts for about 6 percent of the forecast error variance of bank loan at the 36-month horizon. Bank deposit therefore, is a significant variable in transmitting monetary policy effects to the economy. Bank loan, however, is shown as a rather important variable to trigger appropriate monetary policy action. Innovations in bank loan account for around 6 percent of the forecast error variance of ONR compared to bank deposit which contribute only around 2 percent of the forecast error variance of ONR.

The role of bank deposit in explaining the forecast error variance of the objective variables is only significant in real exchange rate, where around 13 percent of the forecast error variances in RER are explained by the variations in bank deposit. The contribution of bank loan in explaining the forecast error variances of the objective variables are rather insignificant, ranging from 3 to 6 percent.

Statistics on the tables 4 and 5 are referred to now. For the pre-crisis period, the VDA shows that innovations in ONR are significant in accounting for the forecast error variance of bank deposit, contributing to a maximum of 23 percent at the 27-month horizon. Innovations in ONR, however, are small in accounting for the forecast error variances of bank loan, at around 6 percent maximum. Innovations in bank deposit and loan are significant in accounting for the forecast error variances of ONR, accounting for around 60 percent and 30 percent, respectively. As for the objective variables, bank loan seem to be significant in accounting for the variances in IPI (33 percent of the forecast error variances), CPI (38 percent of the forecast error variances) and RER (around 14 percent of the forecast error variances).

There are clear changes in the relationship in the relationship of the variables in the post-crisis period compared to the pre-crisis period. In particular, innovations in ONR account for smaller contribution in accounting for the forecast error variances in both bank deposit (around 7 percent maximum) and bank loan (around 3 percent maximum). Innovations in bank loan remains high in explaining the forecast error variances of ONR at around 16 percent maximum, while that of bank deposit decline to around 9 percent. In this period, there is an obvious contribution of the innovations in bank deposit in accounting for the forecast error variances of CPI (around 47 percent maximum), and significant contribution of the innovations in bank loan in accounting for the forecast error variances in RER (around 56 percent maximum) and IPI (around 26 percent maximum).

5. Conclusion

In conclusion, the study shows that both bank loans and deposits play crucial role in the monetary transmission process in the economy. Based on the empirical evidence, there is a clear link between the bank loans and deposits and the real economic activity. The credit is a relevant and important channel for monetary transmission in the economy. In view of the important role played by bank lending in the economy, this study re-emphasises the importance of ensuring the stability of banking system. Not only that a healthy and stable banking system ensures an effective implementation of monetary policy, it is indeed a pre-condition towards the overall economic stability. In view of the heavy dependency of the economy on bank lending and the critical role that it plays towards economic stability, it is also good to diversify this dependence away from banks to financial markets.

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References

Altunbas, Y., Fazylov, O., and Molyneux, P. (2002). Evidence on the bank lending channel in Europe. *Journal of Banking and Finance*, *26*(11), 2093-2110.

Azali, Mohamed (2003). *Transmission mechanism in a developing economy: Does money or credit matter?* (2nd ed.). University Putra Malaysia Press.

Bahmani-Oskooee, M., and Bohl, M.T. (2000). German monetary unification and the stability of the German M3 money demand function. *Economics Letters*, *66*, 203-208.

Bahmani-Oskooee, M., and Wing Ng, R.C. (2002). Long-run demand for money in Hong Kong: An application of the ARDL model. *International Journal of Business and Economics*, *1*(2), 147-155.

Bank Negara Malaysia. *Monthly Statistical Bulletin* (Various issues).

Bank Negara Malaysia. (1994). *Money and Banking in Malaysia: 35th anniversary edition 1959-1994* (4th ed.).

Bank Negara Malaysia. (1999). *The central bank and the financial system in Malaysia: A decade of change* (1st ed.).

Bernanke, B. S. (1983). Non-monetary effects of the financial crisis in the propagation of the Great Depression. *American Economic Review*, *73*, 257-276.

Bernanke, B.S., and Alan S. B. (1988). Credit, money and aggregate demand. *AEA Papers and Proceedings*, *78*(2), 435-39.

Bernanke, B.S. (1992). The federal funds rate and the channels of monetary transmission. *American Economic Review*, *82*(4), 901-921.

Brissimis, S. N., Kamberouglou, N. C., and Simigiannis, G. T. (2001). *Is there a bank lending channel of monetary policy in Greece? Evidence from bank level data*. European Central Bank. Working Paper (Series No. 104).

Brunner, K., and Allan, H. M. (1972). Money, debt, and economic activity. *Journal of Political Economy*, *80*(5), 951-77.

Brunner, K. (1988). Money and credit in the monetary transmission process: Is it money or credit, or both, or neither? *AEA Papers and Proceedings*, *78*(2), 446-450.

Brunner, K. (1990). Money supply. Chapter 9. In *Elsevier's handbook of monetary economics*.

Christiano, L., and Massimo, R. (2001). *Money growth monitoring and the Taylor rule*. National Bureau of Economic Research. Working Papers (No. 8539).

Dale, S., and Andrew, G. H. (1995). Interest rates and the channels of monetary transmission: Some sectoral estimates. *European Economic Review*, *39*, 1611-1626.

Dotsey, M., and Christopher, O. (1994, Winter). M2 and monetary policy: A critical review of the recent debate. Federal Reserve Bank of Richmond. *Economic Quarterly*, 41-49.

Driscoll, J. C. (2004). Does bank lending affect output? Evidence from the U.S. states. *Journal of Monetary Economics*, *51*(3), 451-471.

Ehrmann, M., et al. (2001). *Financial systems and the role of banks in monetary policy transmission in the Euro area*. European Central Bank. Working Paper (Series No. 105).

Farinha, L., and Marques, C. R. (2001). *The bank lending channel of monetary policy: Identification and estimation using Portugese micro bank data*. European Central Bank. Working Paper (Series No. 102).

Feldstein, M., and James, H. S. (1993). *The use of monetary aggregates to target nominal GDP*. National Bureau of Economic Research. Working Papers (No. 4304).

Garretsen, H., and Swank, J. (1997). *The bank lending channel in the Netherlands: The impact of monetary policy on households and firms*. De Nerlandesche Bank. Working Papers (No. 567).

Garretsen, H. (1998). The transmission of interest rate changes and the role of bank balance sheets: A VAR analysis for the Netherlands. *Journal of Macroeconomics*. *20*(2), 325-339.

Gertler, M., and Gilchrist, S. (1993). The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence. *Scandinavian Journal of Economics*, *95*(1), 43-65.

Gertler, M., and Gilchrist. (1994). Monetary policy, business cycles and the behavior of small manufacturing firms. *Quarterly Journal of Economics*, *109*(2), 309-340.

Hallsten, K. (1999). *Bank loan and the transmission mechanism of monetary policy*. Sveriges Riksbank. Working Paper (Series No. 73).

Hess, G.D., and Richard, D.P. (1993). Comparing interest-rate spread and money growth as the predictors of output growth: Granger causality in the sense Granger intended. *Journal of Economics and Business*, *45*(3-4), 247-268.

Hubbard, G. R. (1994). *Is there a credit channel for monetary policy?* National Bureau of Economic Research. Working Papers (No. 4977).

Ibrahim, M. H. (2001). Financial factors and the empirical behaviour of money demand: A case study of Malaysia. *International Economic Journal*, *15*(3), 55-72.

Ibrahim, M. (2002, November). Money, credit, asset prices and monetary transmission mechanism: Evidence from Malaysia. Paper presented at the 8th Convention of the East Asian Economic Association, Kuala Lumpur.

Ibrahim, M. (2005). Sectoral effects of monetary policy: Evidence from Malaysia. *Asian Economic Journal*, *19*(1), 83-102.

Jansen, D., and Chang, J. C. (2005). The effect of monetary policy on bank lending and aggregate output: Asymmetries from non-linearities in the lending channel. *Annals of Economics and Finance*, *6*, 129-153.

Kakes, Jan. (1998). *Monetary transmission and bank lending in the Netherlands*. SOM Research Institute, University of Gronigen. Research Report (No. 98C30).

Kassim, S. (2006). *Bank lending and monetary policy in Malaysia* (Doctoral Dissertation, International Islamic University Malaysia).

Kashyap, A., and S., J. C. (1994). *The impact of monetary policy on bank balance sheets*. National Bureau of Economic Research. Working Papers (No. 4821).

Kashyap, A., and Stein, J. C. (1995). *Monetary policy and bank lending*. National Bureau of Economic Research. Working Papers (No. 4317).

Kashyap, A., and Stein, J. C. (1997a). *What do a million banks have to say about the transmission of monetary policy*. National Bureau of Economic Research. Working Papers (No. 6056).

Kashyap, A., and Stein, J. C. (1997b). *The role of banks in monetary policy: A survey with implications for the European Monetary Union.* Federal Reserve Bank of Chicago, Economic Perspectives, 2-18.

Kuppers, M. (2002). Curtailing the black box: German banking groups in the transmission of monetary policy. *European Economic Review*, *45*, 1907-1930.

Laurenceson, J., and Chai, J. C. H. (2003). *Financial reform and economic development in China.* Cheltenham, UK: Edward Elgar.

Mateut, S., Spiros, B., and Paul, M. (2003). Trade credit, bank lending and monetary policy transmission. *Royal Economic Society Annual Conference*, (No. 149).

McCallum, B. T. (1990). Could a monetary base rule have prevented the Great Depression? *Journal of Monetary Economics, 26*(1), 3-26.

McCallum, B. T. (1999). Recent developments in monetary policy analysis: The roles of theory and evidence. *Journal of Economic Methodology, 6*(2), 171-198.

McCallum, B. T. (2001). Should monetary policy respond strongly to output gaps? *American Economic Review, 91*(2), 258-262.

McCallum, B. T. (2004). Monetary policy in economies with little or no money. *Pacific Economic Review, 9*(2), 81-92.

McCallum, B. T., and Edward, N. (2005). *Targeting vs. instrument rules for monetary policy.* National Bureau of Economic Research. Working Papers (No. 10612).

Meltzer, A. (1969). Money, intermediation and growth. *Journal of Economic Literature*, *7*(1), 27-56.

Meltzer, A. (1970). Is there an optimal money supply? A discussion. *Journal of Finance*, *25*(2), 450-53.

Meltzer, A. (2001, July). Money and monetary policy: An essay in honor of Darryl Francis. *Review*, 23-32.

Nelson, E. (2003a). The future of monetary aggregates in monetary policy analysis. *Journal of Monetary Economics*, *50*(5), 1029-1059.

Nelson, E. (2003b). *Money and the transmission mechanism in the optimizing IS-LM specification*. Center for Economic Policy Research. Discussion Papers (No. 3898).

Pesaran, M.H., Shin, Y., and Smith, R. J. (1996). *Testing for the existence of a long-run relationship*. DAE Working Paper (No. 9622). Department of Applied Economics, University of Cambridge.

Pesaran, M.H. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *6*, 289–326.

Pesaran, M.H., and Pesaran, B. (1997). *Working with Microfit 4.0: Interactive econometrics analysis*. Oxford University Press.

Scholnick, B. (1996). Asymmetric adjustment of commercial bank interest rates: Evidence from Malaysia and Singapore. *Journal of International Money and Finance, 15*(3), 485-496.

Suzuki, T. (2001). *Is the lending channel of monetary policy important in Australia*? The Australian National University. Working Papers in Economics and Econometrics (No. 400).

Tan, E.C. (1997). Money demand amid financial sector developments in Malaysia. *Applied Economics*, *29*(9), 1201-1215.

Tang, T. C. (2000). Commercial bank lending and economic growth in Malaysia: An empirical studies. *Borneo Review*, *11*(1), 60-71.

Tang, T. C. (2002). Banks lending and economic growth in Malaysia: Revisited. *Jurnal Analisis*, *10*(1), 69-87.

Vaithilingam, S., Guru, B. K., and Shanmugam, B. (2003). Bank Lending and Economic Growth in Malaysia. *Journal of Asia-Pacific Business,* 5(1).