The Changing Malaysian Financial Environment and the Effects on Its Monetary Policy Transmission Mechanism

Mala Valliammai Raghavan

School of Economics and Finance, RMIT University
GPO Box 2467V, Melbourne, Victoria 3001, Australia
mala.raghavan@rmit.edu.au

In recent times, economists concur that economy's response to monetary policy is somewhat weaker then they were in the past. However, the cause of such change remains an open issue. One plausible reason for this change could be attributed to the financial reform processes that have brought significant structural changes in the financial systems through financial innovation, integration and market development. As a result, these changes in the financial systems have prompted a reassessment of the transmission mechanism through which monetary policy affects the final variables of income and prices.

In the Malaysian experience, major reforms were undertaken in the 90s that have opened up new avenues and opportunities for its financial market development. However, the changing financial environment posed great challenge to Bank Negara in the formulation and implementation of its monetary policy. This paper investigates to what extent the liberalisation processes in Malaysia have affected the transmission channels of monetary policy and their ability to achieve the ultimate goals of sustainable real income growth and price stability. The Johansen co-integrating technique and the error correction model are used to analyse the long run and the short run properties of the financial variables such as monetary aggregates, credit aggregates and interest rates with respect to ultimate goal variables. The empirical findings suggest that the credit and monetary aggregates are no longer reliable as the main intermediate target. Conversely, interest rates seem to have gained a significant role in the post reform period.

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1. Introduction

In economic literature, monetary policy is seen as a powerful policy instrument to achieve the ultimate economic goals of price stability and sustainable economic growth. There are several channels through which the monetary policy changes affect economic activity and inflation and they are collectively known as the transmission mechanism of monetary policy. The major channels that have been identified in the literature are interest rate channel, monetarist channel, exchange rate channel, wealth channel, asset price channel and bank lending channel.

In recent times, economists concur that economy's response to monetary policy is somewhat weaker then they were in the past (Kuttner and Mosser, 2002; Clinton and Engert, 2000; Boivin and Giannoni, 2002). However, the cause of such change remains an open issue. As stated in Gordon and Sellon (2002), one reason for the change in the monetary transmission mechanism could be due to the significant structural changes in the financial system. Since, the monetary transmission mechanism depends on banks and financial markets to channel monetary policy actions, changes in the structure of the financial system could alter the monetary transmission mechanism.

The financial liberalisation processes have brought many structural changes in the financial systems through financial market development, financial innovation, financial integration and etc. In this environment of liberalised financial system and strong capital flows, the effectiveness of monetary policy has often been questioned. It has actually altered the channels of monetary policy mainly affecting the relationship between monetary aggregates, credit aggregates, exchange rates and interest rates on income and prices. As a result, the reform processes prompted a reassessment of the transmission mechanism

through which monetary policy affects the aggregate demand and ultimately the final variables of prices and output (Raghavan, 2000).

This paper examines to what extent the financial market development and the liberalisation processes in Malaysia have affected the transmission channels of monetary policy and their ability to achieve the ultimate goals of sustainable real income growth and price stability. Section two of this paper identifies the important changes and major development that has taken place in the Malaysian financial structure. Section three provides the breakdown of the period of study and sources of data used in this work. Section four describes the econometric models used to analyse the relationship between the selected financial variables and the ultimate goal variables. In particular, the Johansen co-integration technique and the error correction model are used to investigate the long run and short run properties of the financial variables such as monetary aggregates, credit aggregates and interest rates with respect to income and prices. In section five, the empirical evidence on the long run properties of the financial variables are analysed to ascertain their appropriateness as target variables in the process of formulating a policy goal. The short run properties are also examined mainly to identify their information content in the monetary transmission mechanism during the pre and post liberalisation periods. Finally, section six concludes this paper.

2. The Financial Liberalisation Process in Malaysia

The modern economic analysis of financial policy started with the works of Ronald Mckinnon (1973) and Edward Shaw (1973). Both authors drew attention to the prevalent "financial repression" and argued that such repression was imposing a major cost on countries that practiced it. A repressed financial system can be described as a system with interest rate restrictions, domestic credit controls, high reserve requirements, and segmented financial markets, under developed money and capital markets and controls on international capital flows. As time passed by, it became apparent that severe financial repression had large costs in terms of growth and distribution on countries that practiced it.

With regards to the above mentioned problems, financial liberalization can be viewed as a set of policy measures, which are predominantly designed to deregulate and transform a hampered financial system in order to achieve a liberalized market oriented system with an appropriate regulatory framework. Financial liberalization can be perceived as a set of operational reforms that can lead to greater flexibility in interest rates, enhance the role for credit and foreign exchange allocations and increase the autonomy of the commercial banks. In addition, it is expected to provide greater depth for money, securities and foreign exchange markets, and increase the cross border flow of capital. On the whole, the broad thrust of financial liberalization was primarily to enhance efficiency through greater reliance on market forces and to reduce government intervention in the financial sector.

In the early 1980s, the waves of financial innovation and reforms, which were sweeping the advanced countries, also started spreading to the developing countries. Thereafter, financial liberalization became a worldwide phenomenon. Along with the scope of financial liberalization various aspects of reform processes emerged and they include financial sector reform, deregulation, re-regulation and financial innovation.

For Malaysia, the financial sector reforms have been a gradual, phased and continuing process. It was implemented in stages so as to allow financial markets and consumers to adjust to the new environment. There were tentative steps taken towards liberalization in the early 1970s. Nevertheless, as stated in Awang (1992), the major phase of liberalization commenced in October 1978 when the Central Bank of Malaysia, Bank Negara introduced a package of measures as a concrete step towards a more market-oriented financial system. Among the measures introduced were freeing the interest rate controls and reforming the liquidity requirements of the financial institutions. The liberalization of interest rates in 1978 indeed represented a conscious policy measure by Bank Negara to promote a more liberal and competitive financial system. Though Malaysia assumed the lead in interest-rate deregulation in the region, its reforms were not completed till the late 1980s. In fact there were some temporary policy reversals along the way. For example, the market determination of interest rates was suspended during the tight liquidity period from October 1985 to January 1987 and in September 1987.

Another major phase of financial reforms was undertaken in January 1989, whereby Bank Negara introduced a package of reforms to broaden, deepen and modernize the financial system. The reforms included the appointment of principal dealers, the issuing of Malaysian Government Securities by auction, conducting Bank Negara's open market operations through principal dealers and freeing of discount house operations. This period also witnessed several significant developments with far reaching impact on the development of capital market. As part of Bank Negara's continuing efforts to develop the private debt securities market, the country's first credit rating agency, the Rating Agency Malaysia Berhad was established in 1990 to rate debt issues by corporations. Another significant development in the capital market was the setting up of the "market watch dog" in the form of Securities Commission in March 1993. In 1997, the financial futures and

options markets began their operation, namely the Kuala Lumpur Futures Market (KLFM) and the Kuala Lumpur Options and Financial Futures Exchange (KLOFFE).

The financial liberalization and reforms undertaken in Malaysia have opened up new avenues and increased opportunities for financial market development. However, in the new environment with closer financial integration and strong capital flows, the effectiveness of monetary policy has often been questioned. Financial liberalization had important implications for both the transmission mechanism, and the operating procedure of monetary policy. It has actually altered the channels of monetary policy mainly affecting the relationship between monetary aggregates, credit aggregates and interest rates on income and prices. These changes posed a major challenge in the formulation and implementation of monetary policy. As a result, the reform processes prompted a reassessment of the appropriate intermediate targets of monetary policy.

In the 1980s, Malaysian monetary policy was based on targeting monetary aggregates; however the policy was not formally announced to the public. This strategy was selected based on evidence that monetary aggregates were closely linked to the ultimate goals of monetary policy. By controlling the supply of money, Bank Negara was able to influence the major market variables of aggregate demand and inflation. In the early 1980s, the emphasis was on M1, as it had been empirically found to have a stable and consistent relationship with aggregate income (BNM, 1999).

The substantial financial liberalization and innovation in the 1980s has however rendered M1 less reliable for policy targeting. The changes in the liquidity preferences of the public and persistently high interest rates led to structural changes in the demand for money. Rising sophistication in the financial system and the demand for money by the public resulted in savers becoming increasingly sensitive to interest rate movements (BNM, 1994). Consequently, the traditional relationship of M1 to aggregate income was compromised and the focus inevitably shifted to the broader monetary aggregates.

According to Bank Negara report, a correlation test conducted using quarterly data from 1980-1992, showed a positive and high correlation between broad monetary (M3) growth and inflation (BNM, 1999). Since price stability was an ultimate goal of monetary policy, broad monetary targeting was seen as a suitable target. In mid-1980s, Bank Negara selected M3 as the policy target.

In the 1990s, the far-reaching changes in the economy and the financial system weakened the relationship between monetary aggregates and the ultimate goal variables. The annual growth of money supply as measured by M3 was extremely volatile during the period of large capital flows (1992-1993) and the large swings in the monetary aggregates reduced the viability of M3 as intermediate target. The growth in money supply was largely contributed by the expansion of financial networks, and the widening of the range of banking instruments and services, the increase in the role of money in the economy, and the rapid monetization process. Hence, during this period, monetary velocities and ratios of nominal GDP to various monetary aggregates have shown frequent and marked departures from their historical patterns making the monetary aggregates unreliable as indicators of economic activity and as guides for stabilizing prices. This highlighted the problems associated with using monetary aggregates as policy target.

The liberalisation processes and consequently the changes in the financial system posed a major challenge to Bank Negara in the formulation and implementation of monetary policy. In view of the changing financial environment, the monetary policy should adhere to a suitable policy framework so that it can remain as an effective policy in promoting economic growth and maintaining price stability.

3. Period of Study and Sources of Data

In order to see the impact of financial liberalization on monetary policy, the period of study, which covers 1973:4 to 2000:1, will be broken down as follows:

1973:4 to 1989:4

Represents the period before the *major* shift in the implementation of monetary policy in Malaysia. During this period, the Malaysian Financial System had been subjected to the widely practiced mechanism of financial repression such as interest rate regulation and preferential credit scheme.

1979:1 to 2000:1

Represents the post-liberalization period in Malaysia. At the end of 1978 interest rates were deregulated and thus representing the beginning of the era of financial reforms. The international economic and financial environment in the post liberalization period posed new challenges for national economic management and the operation of monetary policy.

1990:1 to 2000:1

Represents the period after the *major* shift in the implementation of monetary policy, whereby Bank Negara embarked on a series of financial reforms to improve and modernize the financial system.

Quarterly series were utilized for the empirical analysis. A total of nine financial aggregates are employed and they are three monetary aggregates, three credit aggregates and three interest rates. The quarterly gross domestic product is used to proxy economic activity, the consumer price index is used to represent the price level and Federal government expenditure is used to represent the fiscal variable. Variables, descriptions and sources are provided in Table A in the Appendix.

4. Methodology

The co-integration technique advocated by Johansen (1988) was utilized to determine the long run relationship between the financial variables, income and price. As demonstrated in Greene (1997) and Tan (1996) the advantage of using the Johansen technique is that it allows for the possible existence of multiple co-integrating vectors and their identification particularly in regressions involving more than two variables. The aim of the co-integration test is mainly to identify if the variables in question are drifting apart or together. To carry out the Johansen co-integration test, the following VAR must first be estimated.

$$Y_t = \Gamma_1 Y_{t-1} + \Gamma_2 Y_{t-2} + ... + \Gamma_p Y_{t-p} + e \qquad \textbf{(1)}$$

The order of the model p must be determined in advance. If the above model involves N variables then $Y_t = [y_1, y_2, \ldots\ldots. yn]$, which are individually I(1) and as a result N x 1 vector can be formed and Γ_i is an N x N matrix of parameters. Re-parameterising the system of equations above in an error correction representation yields the following:

$$\Delta Y_t = \Pi_p Y_{t-p} + \Pi_1 \Delta Y_{t-1} + ... + \Pi_{p-1} \Delta Y_{t-p+1} + e_t \qquad \textbf{(2)}$$

or

$$\Delta Y_t = \Pi_p Y_{t-p} + \sum_{i=1}^{p} \Pi_i \Delta Y_{t-i} + e_t \qquad \textbf{(3)}$$

where i = 1, 2, ……(p – 1).

The long run relationship among the variables in the VAR is embodied in the matrix Π_p and thus this matrix controls the co-integration properties. As mentioned before, in the above model, Y is a vector of I (1) variables while ΔY_t, $\Sigma_{i=1} \Pi_i \Delta Y_{t-i}$ and e_t are stationary. All the possible combinations of the levels of Y that yield high correlation with the I (0) elements in equation (2) are then estimated and these combinations are referred as the co-integrating vectors.

The rank of the matrix Π_p is determined by the number of co-integrating vectors r among the elements of Y. There are three possible cases:

Case 1:

Π_p is a full rank N, then any linear combination of Y_{t-1} is stationary and by implication, the elements in vector Y are not I (1).

Case 2:

Π_p has rank between 0 and N, then there exits r co-integrated vectors which are identifiable and incorporatable into error correction model. Since the maximum number of co-integrating vectors can only be N – 1, r must be smaller than N.

Case 3:

Π_p has rank zero and thus no linear combinations of Y_{t-1} are stationary implying that the elements in vector Y are I(1) but not co-integrated.

If Π_p has less than full rank, we can express it as follows:

$$\Pi_p = \gamma\alpha' \qquad (4)$$

The above equation involves estimating the matrix α (i.e. an N x r matrix) that contains all the possible co-integrating vectors and the γ matrix containing the corresponding set of error correction coefficients. If there are r co-integrating vectors, then α and γ each have r columns (Cochrane, 1997).

Rewriting equation (2) with α and γ, shows the error correction representation:

$$\Delta Y_t = -\gamma\alpha' Y_{t-p} + \Pi_1 \Delta Y_{t-1} + ... + \Pi_{p-1} \Delta Y_{t-p+1} + e_t \qquad (5)$$

$\alpha' Y_{t-p}$ must be stationary so that $\gamma\alpha' Y_{t-p}$ will also be stationary. Thus α is the matrix of co-integrating vectors. If elements in Y_t do co-integrate then at least one of the α_t vectors

will be statistically significant. Thus by virtue of Granger representation theorem, γ_i must also contain at least one non-zero element.

The rank of the matrix Π_p can be determined by referring to the eigenvalues λ_I derived from the maximization of the concentrated likelihood function of equation (5). Hence, the number of co-integrating vectors r can be determined by using the following maximal eigenvalue statistics.

$$\varsigma_r = -T \sum_{i=r+1}^{n} \ln(1-\lambda_i) \qquad (\mathbf{6})$$

where r = 0,1,2,3,……..,n-2, n-1

The null hypothesis is that there are at most r co-integrating vectors against the alternative hypothesis of r+1 co-integrating vectors.

The error correction model (ECM) noted by Engle & Granger (1987) is a model which forces gradual adjustments of the dependent variable towards some long run values with explicit allowances made for the short run dynamics. In this study, the ECM is used to test the short run relationship connecting the growth rate of financial variables to the growth rate of income and prices. In order to investigate the predictive relationship of monetary aggregates, credit aggregates and interest rates to economic activity, the following ECM equations were estimated. Equations (7) and (8) represent the real income equation while equations (9) and (10) represent the price equation. The Δy_t, Δp_t, Δx_t, and Δg_t are respectively the difference of log of real income, price index, financial variable and government expenditure. Meanwhile, EC_t and S_i represent the error correction term and the seasonal dummy variables respectively. The α, β_i, γ_i, λ_i, δ_i and θ_i are coefficients to be estimated while the ε_t are disturbance terms.

$$\Delta y_t = \alpha EC_{t-1} + \sum_{i=1}^{n} \beta_i \Delta x_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta p_{t-i} + \sum_{i=1}^{n} \delta_i \Delta y_{t-i} + \sum \theta_i S_i + \varepsilon_t \quad \textbf{(7)}$$

$$\Delta y_t = \alpha EC_{t-1} + \sum_{i=1}^{n} \beta_i \Delta x_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta p_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta_i g_{t-i} + \sum_{i=1}^{n} \delta_i \Delta y_{t-i} + \sum \theta_i S_i + \varepsilon_t \quad \textbf{(8)}$$

$$\Delta p_t = \alpha EC_{t-1} + \sum_{i=1}^{n} \beta_i \Delta x_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta p_{t-i} + \sum_{i=1}^{n} \delta_i \Delta y_{t-i} + \sum \theta_i S_i + \varepsilon_t \quad \textbf{(9)}$$

$$\Delta p_t = \alpha EC_{t-1} + \sum_{i=1}^{n} \beta_i \Delta x_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta p_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta_i g_{t-i} + \sum_{i=1}^{n} \delta_i \Delta y_{t-i} + \sum \theta_i S_i + \varepsilon_t \quad \textbf{(10)}$$

The error correction term EC_{t-1} is constructed by using the coefficients from the co-integration regressions. The first difference terms in the above equations captures the short run dynamics while the error correction terms captures the adjustments towards long run equilibrium. In this study, the F-statistics tests the null hypothesis that the coefficients of the financial variables indicated are zero. Testing the significance of coefficients of the selected financial variables assesses the information content of these variables.

5. Empirical Results and Analysis

Prior to assessing the relationship amongst variables based upon the notion of co-integration and vector autoregression, their univariate time series properties have to be examined. Test for the stationarity of a time series was carried out using the Augmented Dickey-Fuller (ADF) test. The Hylleberg, Engel, Granger and Yoo (HEGY) test was carried out to ascertain whether each of the series in question possess a unit root at some frequency other than the usual zero frequency such as biannual and or annual frequencies. Both the tests suggest that the time series stationarities can be achieved simply by first order differencing. The HEGY test implies that there is no seasonal unit root problem for the variables and thus no need to worry about the application of the seasonal co-integration technique.

The long run relationship between the selected variables and the economic activities is examined by using the co-integration test. First, a simple bivariate co-integration test mainly involving residuals was carried out using the ADF test. The results in Table 1 show that in the case of financial variable-income relationship, the ADF test statistics of the residuals for all three monetary aggregates, ALR and IBR3 are rejected at 5% significance level. The empirical results thus indicate that these variables are co-integrated with income and a large part of the movements in income are anchored by the long run movements of these financial variables. On the other hand, the credit aggregates and TBR3 failed the test and therefore are not co-integrated with income. As in the case of the financial variable-price relationship, the ADF test statistics are only significant for the IBR3 (5% significance level) and ALR (10% significance level). The other financial variables failed the significance test and thus have no tendency to return to an equilibrium relationship.

Tables 2 and 3 provide the results of the applications of the Johansen techniques to the identifications of long run relationships of the various financial variables with income, price level and fiscal variable along with a dummy variable D78Q4. The dummy variable D78Q4 is intended to reflect a switch in the Malaysian interest rate regime initiated in October 1978.

The estimation results presented in Tables 2 and 3, suggest that, with the exception of the TBR3, for all the other financial variables, with or without the inclusion of the fiscal variable, there exist one co-integrating vector at the 5% significance level. A necessary condition for the target indicator to be effective in the implementation of the monetary policy is that the financial variables should co-integrate with the income and price. Overall, the Johansen co-integrating results provided strong evidence of a stable long run relationship amongst most of the financial variables with income and prices.

Using the co-integration technique, an error correction (EC) term was obtained and it is normalized to real income and the equation is as follows:

I. Three variable system:

$$EC = C + LRY + \alpha_1 LNP + \alpha_2 LRX + \alpha_3 D78Q4 \qquad \textbf{(11)}$$

II. Four variable system:

$$EC = C + LRY + \alpha_1 LNP + \alpha_2 LRG + \alpha_3 LRX + \alpha_4 D78Q4 \qquad \textbf{(12)}$$

Table 4 shows the error correction terms for all the financial variables in the three and four variables system. These error correction terms represent the co-integration relationship and are interpreted as deviations from the long run equilibrium.

The error correction models (ECM) as noted by Engle and Granger (1987), is a model which forces gradual adjustments of the dependent variables towards some long run value with explicit allowance made for the short run dynamics. The ECM model is estimated based on the general autoregressive distribution with an error correction term formed by the

relevant estimated co-integrating vector and seasonal dummies. To investigate the predictive relationship of the financial variables, equations (7) to (10) were estimated nine times for each sub-period (i.e. the three monetary aggregates, the three credit aggregates and the three interest rates). The lag length for the models was determined after subjecting each model to a series of ARCH correlation LM test ranging from the first order to fourth order. A three-lag period seems to be appropriate and was therefore used uniformly in the multivariate ECM models.

Tables 5 and 6 shows the t-statistics of the coefficients of the error correction term (α) and the coefficient of determination (R^2) of the real income equation and price equation respectively for each sub-period. In all estimations of real income equation, the t-statistics of the coefficient of the error correction (EC) term shows a significant level, thus implying that, there is a high tendency for income to adjust towards some long run values with explicit allowance made on the short run dynamics. Moreover, the coefficient of determination R^2 is also reasonably high, where more than 80% of the variation in the dependent variable real income can be explained through the models. As for price equation, the t-statistics of the coefficient of the error correction (EC) terms are insignificant and thus indicating that there is low tendency for the price to adjust towards an equilibrium relationship. The coefficient of determination R^2 is also not very high whereby the price equation models can only explain about 40 to 50% of the variation in price.

The F-statistics are obtained from the Wald test and Tables 7 and 8 summarize the F-statistics for the significance of the financial variables in real income equation. As shown in the two tables, real M1 seems to be significantly related even at 1% level with real income throughout the sample periods. Though M2 and M3 are inherently co-integrated with economic activity in the long run, in the short run they failed to provide the necessary information about the future income movements. Therefore the money-income relationship

does not satisfy the stringent condition that would be required to render the strict use of broad money as an intermediate target.

The null hypothesis of $\beta_i = 0$ for all three credit aggregates are not rejected even at 10% level throughout the period of study. Even with the inclusion of a fiscal variable as a control variable in the error correction model, did not have any effect on the significance level. Both ALR and IBR3 contained statistically significant information about the future fluctuations in income especially in the post liberalization periods. The move towards a liberalized financial system has actually enhanced the role of interest rates in the monetary transmission mechanism. As for TBR3, the F-statistics are insignificant throughout the sample period because the development of the market for these bills is still shallow and thus could not provide the necessary information needed to predict income.

Tables 9 and 10 provide the summary of the F-statistics for the significance of the financial variables in the price equations. Overall, the three monetary aggregates seem to be insignificantly related to price. The inclusion of fiscal variable also did not improve the predictive power of the monetary aggregates. As for the credit aggregates, with the exception of the sub-period 1990:1 to 2000:1, in all the other sub-periods, the real CR1 and CR3 are statistically significant at 5% level and thus upheld their role in forecasting future price movements. On the contrary, the F-statistics of the ALR and IBR3 are statistically significant in the 1990s, thus highlighting the growing importance of the interest rates in the monetary transmission mechanism.

6. Conclusion

The Malaysian experience in moving towards a liberalized financial system brought many new challenges for Bank Negara and these challenges mainly relate to the way in which monetary policy is formulated and implemented. Based on the empirical evidence, it would not be unreasonable to conclude that the evolution of the economy and the financial system had a great impact on both the transmission mechanism and the operating procedures of monetary policy. With respect to operating procedure of monetary policy, financial liberalization has also affected the setting of policy targets.

After the major reform in the late 1980s, it was found that the relationships between broad monetary aggregates and economic activities have changed. Though the co-integration test supports the existence of the long-term relationship between the financial variables with income and price level, the error correction model (ECM) which mainly captures the short run dynamics, found the monetary aggregate M1, average lending rates and three month inter-bank rates to be significantly affecting income. As for price level, only interest rates are found to be significant in the post liberalization period.

The broad monetary aggregates M2 and M3 failed to provide the necessary information about the future income and price movements and thus raised some pertinent questions about the ability of monetary target to serve as a communication device. These results bear strong negative implications for many familiar monetary policy frameworks that centred the design and implementation of policy on broad money. This is because, the money–income or money-price relationship does not satisfy the stringent conditions that would be required to render the strict use of money as an intermediate target.

This study's important finding with potentially positive implications for monetary policy is the reliance on interest rates. The average lending rates and the three-month inter-bank

rates contained the information about subsequent movements in real income and price level and it is highly significant in the 1990s. In the post liberalisation period, interest rate seems to play a significant role in the monetary policy framework. The major developments in the Malaysian financial structure have increased the effectiveness of interest rate as a monetary policy variable and thus appeared to be an appropriate and necessary target for an effective implementation of monetary policy.

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Appendix

Table A. Variables, Descriptions And Sources

Variables		Descriptions	Sources
Y	Real Income	Real Gross Domestic Product by expenditure components in constant prices (1987=100).	BNM & Tilak
P	Price Level	Consumer Price Index (1994=100)	BNM
G	Real Fiscal Variable	Federal Governments current expenditure plus development expenditure.	BNM
M1	Monetary Aggregate Real M1	Currency in circulation plus demand deposits.	BNM
M2	Monetary Aggregate Real M2	M1 plus savings deposits plus fixed deposits plus NIDs plus Repos plus foreign currency deposits.	BNM
M3	Monetary Aggregate Real M3	M2 plus deposits placed with other banking institutions.	BNM
CR1	Total Real Domestic Credit	Monetary Survey's claims on central Government, state & local Governments, non-financial public enterprises, private sectors, other banking institutions and non-bank financial institutions. Monetary Authorities and Deposit Money Bank's data consolidated into a Monetary Survey.	IFS
CR2	Real Monetary Survey's Claims On Private Sectors	It is the sum of Monetary Authorities claims on private sectors plus Deposit Money Banks' claims on private sector.	IFS
CR3	Real Deposit Money Bank's Claims On Private Sectors	Deposit Money Banks comprise commercial banks and other financial institutions.	IFS
ALR	Average Lending Rates	Commercial banks average lending rates.	BNM
IBR3	Three Month Inter-bank Rates	Inter-bank money market rates.	BNM
TBR3	Three Month Treasury Bill Rates	Average discount rate on Treasury bills.	BNM

Notes:
1. BNM is referred to Quarterly and Monthly Bulletin, Central Bank of Malaysia.
2. IFS is referred to International Financial Statistics of International Monetary Fund.
3. Tilak is referred to Tilak & Lee (1996).

Tables

Table 1. Tests For Stationary Financial Variable-Income And Financial Variable-Price Relationships (Augmented Dickey- Fuller Test)

Financial Variables	Income	Price
	ADF; t_τ	ADF; t_τ
LRMI	-6.3578*	-1.8949
LRM2	-6.5128*	-2.1080
LRM3	-5.6523*	-2.0450
LRCR1	-3.2645***	-2.8768
LRCR2	-3.2019	-2.8729
LRCR3	-3.0795	-2.4459
ALR	-2.9035**	-2.8168
IBR3	-3.4036**	-3.3733***
TBR3	-2.3746	-2.3192**

Notes:

1. Unit root tests summary of statistics for residuals for sample period covering from 1973:4- 2000:1.
2. There are 106 observations.
3. All variables are in natural logarithm and real terms except for interest rates.
4. The lag length was determined after subjecting each regression to a series of LM tests for serial correlation at five-percent level ranging from first order to fourth order. One lag period seems to be appropriate and was used uniformly for all the variables.
5. (***), (**) And (*) denotes rejection of the null hypothesis of the unit root at the 10%, 5% and 1% level respectively.

Table 2. Summary Of Test Statistics For The Number Of Co-integrating Vectors In A Three Variable System (Johansen Co-integration Test)

Financial Variables	r = 0	r ≤ 1	r ≤ 2	Number of CVs
LRM1	54.243 **	22.331	6.889	1
LRM2	52.892 **	21.469	7.811	1
LRM3	58.158 *	21.087	6.619	1
LRCR1	66.605 *	27.458	5.677	1
LRCR2	49.522 **	18.609	6.054	1
LRCR3	54.603 *	20.166	6.568	1
ALR	66.492 *	25.442	5.287	1
IBR3	61.041 *	22.995	5.892	1
TBR3	39.293	15.498	5.312	0

Notes:

1. **CV** represents co-integrating vectors and **r** represents number of co-integrating vectors.
2. Three-variable system includes real income, price index and financial variable along with the dummy variable D78Q4.
3. Test assumption: Linear deterministic trend in the data series.
4. The co-integrating vectors were estimated with a provision for three lags and the lag length was determined after subjecting each variable system to a series of ARCH serial correlation LM tests.
5. Sample period covering from 1973: to 2000:1 and total number of observations are 106.
6. (**) and (*) denotes rejection of null hypothesis at 5% and 1% respectively.

Table 3. Summary Of Test Statistics For The Number Of Co-integrating Vectors In A Four Variable System (Johansen Co-integration Test)

Financial Variables	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	Number of CVs
LRM1	83.571 *	41.288	14.724	4.999	1
LRM2	74.851 **	42.299	21.990	8.420	1
LRM3	87.032 *	45.782	24.487	9.903	1
LRCR1	80.291 *	41.850	23.035	6.019	1
LRCR2	82.469 *	46.029	17.481	7.409	1
LRCR3	85.023 *	48.412 *	19.268	5.535	2
ALR	91.512 *	46.869	23.061	4.928	1
IBR3	92.695 *	41.942	16.591	6.914	1
TBR3	74.068 **	40.581	15.442	5.618	1

Notes:

1. **CV** represents co-integrating vectors and **r** represents number of co-integrating vectors.
2. Four-variable system includes real income, price index, financial variable and fiscal variable with D78Q4.
3. Test assumption: Linear deterministic trend in the data series.
4. The co-integrating vectors were estimated with a provision for three lags and the lag length was determined after subjecting each variable system to a series of ARCH serial correlation LM tests.
5. Sample period covering from 1973: to 2000:1 and total number of observations are 106.
6. (**) and (*) denotes rejection of null hypothesis at 5% and 1% respectively.

Table 4. Error Correction Terms For The Three And Four Variables System

Error Correction Equation	
Financial Variable	**Three Variable System**
M1	*EC=1.909 + LRY – 0.591LNP – 1.060LRM1 – 0.103D78Q4*
M2	*EC = 0.577 + LRY - 2.204LNP – 0.002LRM2 + 0.223D78Q4*
M3	*EC = 1.934 + LRY – 0.867LNP – 0.387LRM3 + 0.149D78Q4*
CR1	*EC = 3.834 + LRY + 0.447LNP - 0.747LRCR1 + 0.223D78Q4*
CR2	*EC = 2.243 + LRY – 0.851LNP – 0.389LRCR2 + 0.273D78Q4*
CR3	*EC = 2.619 + LRY – 0.505LNP – 0.491LRCR3 + 0.265D78Q4*
ALR	*EC = 18.565 + LRY + 0.284LNP + 0.794ALR – 1.033D78Q4*
IBR3	*EC = -1.606 + LRY - 2.569LNP - 0.153IBR + 0.761D78Q4*
Four Variable System	
M1	*EC = 1.014 + LRY + 1.341LNP – 0.483LRG1 - 1.054LRM1 – 0.015D78Q4*
M2	*EC = 0.155 + LRY – 1.021LNP – 0.437LRG1 – 0.156LRM2 – 0.264D78Q4*
M3	*EC = 2.370 + LRY – 0.674LNP + 0.057LRG1 - 1.054LRM3 – 0.123D78Q4*
CR1	*EC = 1.099 + LRY – 2.226LNP + 0.193LRG1 – 0.104LRCR1 + 0.281D78Q4*
CR2	*EC = 2.929 + LRY – 1.286LNP + 0.319LRG1 – 0.408LRCR2 – 0.213D78Q4*
CR3	EC_1 *= -5.603 + LRY – 2.128LRG1 +0.248LRCR3 + 0.665D78Q4* EC_2 *= -10.412 + LNP – 2.817LRG1 + 0.892LRCR3 + 0.527D78Q4*
ALR	EC = -2.725 + LRY – 6.122LNP + 1.828LRG1 – 0.257ALR + 0.419D78Q4
IBR3	*EC = 1.729 + LRY – 4.375LNP + 1.236LRG1 – 0.062IBR + 0.280D78Q4*
TBR3	*EC = 1.270 + LRY – 2.932LNP + 0.452LRG1 – 0.031TBR – 0.207D78Q4*

Table 5. Summary Of The t-statistics Of The Coefficient of Error Correction Term (α) And The Coefficient Of Determination (R^2) In Real Income Equation

	Sample Period															
	1973:4 to 2000:1				1973:4 to 1989:4				1978:4 to 2000:1				1990:1 to 2000:1			
	3 Variable System		4 Variable System		3 Variable System		4 Variable System		3 Variable System		4 Variable System		3 Variable System		4 Variable System	
Financial Variables	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**
ΔLRM1	-3.781*	0.866	-4.110*	0.872	-4.477*	0.914	-4.572*	0.920	-3.497*	0.870	-4.282*	0.882	-2.659**	0.874	-2.941*	0.881
ΔLRM2	-3.463*	0.815	-4.383*	0.832	-3.197*	0.888	-4.311*	0.901	-3.887*	0.814	-5.196*	0.841	-3.229*	0.837	-2.221**	0.847
ΔLRM3	-3.589*	0.824	-4.405*	0.830	-3.213*	0.891	-4.503*	0.907	-4.003*	0.810	-5.254*	0.839	-2.908*	0.825	-2.339**	0.837
ΔLRCR1	-3.372*	0.822	-4.211*	0.828	-2.624**	0.926	-4.337*	0.903	-4.125*	0.809	-5.127*	0.836	-2.930*	0.801	-2.537**	0.823
ΔLRCR2	-4.085*	0.823	-4.710*	0.837	-3.824*	0.894	-4.243*	0.904	-4.299*	0.815	-5.443*	0.847	-2.862*	0.828	-2.981*	0.846
ΔLRCR3	-3.727*	0.817	-2.891*	0.831	-3.409*	0.888	-1.510	0.900	-4.073*	0.809	-3.375*	0.845	-3.158*	0.808	-0.121*	0.804
ΔALR	-4.652*	0.838	-3.629*	0.833	-3.422*	0.889	-3.586*	0.895	-5.449*	0.843	-4.611*	0.845	-3.485*	0.848	-3.711*	0.871
ΔIBR3	-4.786*	0.835	-4.606*	0.843	-4.225*	0.901	-4.263*	0.907	-5.336*	0.841	-5.808*	0.861	-3.504*	0.856	-3.818*	0.878
ΔTBR3	-	0.787	-4.226*	0.828	-	0.864	-4.510*	0.908	-	0.765	-5.217*	0.839	-	0.772	-2.921*	0.838

Notes:

1. Three-variable system and four-variable system are represented by real income equation 7 and 8 respectively.
2. (**) and (*) denotes rejection of the null hypothesis at 5% and 1% respectively.

Table 6. Summary Of The t-statistics Of The Error Correction Term (α) And The Coefficient Of Determination (R^2) In Price Equation

	Sample Period															
	1973:4 to 2000:1				1973:4 to 1989:4				1978:4 to 2000:1				1990:1 to 2000:1			
	3 Variable System		4 Variable System		3 Variable System		4 Variable System		3 Variable System		4 Variable System		3 Variable System		4 Variable System	
Financial Variables	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**	**t-stats**	**R^2**
ΔLRM1	2.172**	0.408	2.101**	0.423	1.529	0.564	1.539	0.577	2.010**	0.384	1.013	0.409	2.514**	0.431	2.212**	0.471
ΔLRM2	1.021	0.460	0.905	0.431	0.747	0.568	1.120	0.618	0.824	0.400	-0.575	0.437	1.833**	0.339	1.426	0.378
ΔLRM3	1.091	0.401	0.965	0.428	0.555	0.563	1.022	0.608	0.959	0.340	-0.070	0.424	1.967**	0.341	1.506	0.379
ΔLRCR1	1.888**	0.427	1.620	0.443	1.109	0.593	1.322	0.617	2.053*	0.423	0.804	0.452	1.918**	0.365	1.490	0.409
ΔLRCR2	1.449	0.428	1.593	0.463	0.837	0.582	0.869	0.613	1.637	0.388	0.800	0.411	2.744*	0.434	4.054*	0.631
ΔLRCR3	1.344	0.445	-1.382	0.466	0.755	0.588	-1.136	0.623	1.463	0.397	-0.584	0.561	1.989**	0.385	-2.174**	0.457
ΔALR	1.396	0.411	1.686	0.418	1.837	0.541	1.725	0.561	2.047**	0.381	0.796	0.409	2.501**	0.483	1.820	0.487
ΔIBR3	2.487*	0.413	2.345**	0.453	1.814	0.556	2.042**	0.608	2.206**	0.364	0.942	0.414	2.667**	0.566	2.863*	0.611
ΔTBR3	-	0.367	1.932**	0.409	-	0.512	1.772	0.569	-	0.338	0.882	0.397	-	0.339	2.275**	0.475

Notes:

1. Three-variable system and four-variable system are represented by price equation 9 and 10 respectively.
2. (**) and (*) denotes rejection of the null hypothesis at 5% and 1% respectively.

Table 7. F-Statistics For The Significance Of The Financial Variables In The Three Variable Real Income Equation

Financial Variables	Sample Period							
	1973:4 to 2000:1		1973:4 to 1989:4		1978:4 to 2000:1		1990:1 to 2000:1	
	F-stats	Prob	F-stats	Prob	F-stats	Prob	F-stats	Prob
ΔLRM1	11.0434 ***	0.0000	5.4534 ***	0.0026	11.6745 ***	0.0000	5.9011 ***	0.0029
ΔLRM2	0.8523	0.4691	0.4672	0.7065	0.7877	0.5046	2.3879 *	0.0893
ΔLRM3	0.6931	0.5587	0.9651	0.4171	0.2503	0.8609	1.5453	0.2239
ΔLRCR1	0.3599	0.7821	0.6465	0.5891	0.0416	0.9886	0.2747	0.8431
ΔLRCR2	0.5303	0.6626	1.5059	0.2249	0.5085	0.6776	1.0179	0.4001
ΔLRCR3	0.2260	0.8780	0.6433	0.5909	0.2084	0.8902	0.6487	0.5901
ΔALR	4.0897 ***	0.0091	0.8303	0.4838	5.4206 ***	0.0020	3.2578 **	0.0363
ΔIBR3	3.7872 **	0.0131	2.6094 *	0.0622	5.2296 ***	0.0025	3.7233 **	0.0227
ΔTBR3	0.0745	0.9735	0.9725	0.4133	0.2002	0.8959	0.4717	0.7043

Notes:

1. The Error Correction Models were estimated with a provision of three lags and the lag length was determined after subjecting each variable to a series of ARCH serial correlation LM tests.
2. The F-statistics was obtained from the Wald Test and was tested for the null hypothesis that all the coefficients of the financial variable indicated are zero.
3. (***), (**) and (*) denotes the rejection of the null hypothesis at 1%, 5% and 10% respectively.

Table 8. F-Statistics For The Significance Of The Financial Variables In The Four Variable Real Income Equation

Financial Variables	Sample Period							
	1973:4 to 2000:1		1973:4 to 1989:4		1978:4 to 2000:1		1990:1 to 2000:1	
	F-stats	Prob	F-stats	Prob	F-stats	Prob	F-stats	Prob
ΔLRM1	9.9896 ***	0.0000	4.5016 ***	0.0076	9.5471 ***	0.0000	9.2826 ***	0.0008
ΔLRM2	0.9220	0.4338	0.7557	0.5249	1.1686	0.3279	1.8676	0.1609
ΔLRM3	0.4053	0.7495	1.6847	0.1837	0.4736	0.7016	1.2641	0.3080
ΔLRCR1	0.2684	0.8480	0.9879	0.4070	0.3275	0.8054	0.4168	0.7424
ΔLRCR2	0.5743	0.6334	1.2245	0.3118	0.7204	0.5432	1.1164	0.3619
ΔLRCR3	0.1351	0.9388	0.6169	0.6077	0.8272	0.4834	0.8048	0.5035
ΔALR	3.2895 **	0.0245	0.5715	0.6366	4.6084 ***	0.0053	3.4128 **	0.0329
ΔIBR3	2.9438 **	0.0374	1.7273	0.1749	4.7386 ***	0.0046	4.4009 **	0.0128
ΔTBR3	0.2718	0.8456	1.8797	0.1466	0.7594	0.5206	1.2236	0.3220

Notes:

1. The Error Correction Models were estimated with a provision of three lags and the lag length was determined after subjecting each variable to a series of ARCH serial correlation LM tests.
2. The F-statistics was obtained from the Wald Test and was tested for the null hypothesis that all the coefficients of the financial variable indicated are zero.
3. (***), (**) and (*) denotes the rejection of the null hypothesis at 1%, 5% and 10% respectively.

Table 9. F-Statistics For The Significance Of The Financial Variables In The Three Variable Price Equation

Financial Variable	Sample Period							
	1973:4 to 2000:1		1973:4 to 1989:4		1978:4 to 2000:1		1990:1 to 2000:1	
	F-stats	Prob	F-stats	Prob	F-stats	Prob	F-stats	Prob
ΔLRM1	1.2007	0.3141	1.1354	0.3438	1.3229	0.2733	1.9347	0.1453
ΔLRM2	1.0719	0.3604	1.2502	0.3015	2.0170	0.1187	0.2659	0.8493
ΔLRM3	0.7526	0.5237	1.0280	0.3882	1.2538	0.2964	0.2562	0.8563
ΔLRCR1	2.1746 *	0.0964	2.3495 *	0.0836	3.0617 **	0.0332	0.6272	0.6030
ΔLRCR2	1.4731	0.2271	1.8251	0.1545	0.6861	0.5633	0.2908	0.8316
ΔLRCR3	3.2213 **	0.0263	2.0998	0.1120	1.8594	0.1437	0.9811	0.4147
ΔALR	1.1933	0.3168	0.1267	0.9438	1.0931	0.3573	2.9736 **	0.0473
ΔIBR3	1.5337	0.2111	0.8044	0.4973	0.5266	0.6653	5.7007 ***	0.0032
ΔTBR3	0.4174	0.7408	0.2701	0.8466	0.7820	0.5076	1.6825	0.1910

Notes:

1. The Error Correction Models were estimated with a provision of three lags and the lag length was determined after subjecting each variable to a series of ARCH serial correlation LM tests.
2. The F-statistics was obtained from the Wald Test and was tested for the null hypothesis that all the coefficients of the financial variable indicated are zero.
3. (***), (**) and (*) denotes the rejection of the null hypothesis at 1%, 5% and 10% respectively.

Table 10. F-Statistics For The Significance Of The Financial Variables In The Four Variable Price Equation

Financial Variable	Sample Period							
	1973:4 to 2000:1		1973:4 to 1989:4		1978:4 to 2000:1		1990:1 to 2000:1	
	F-stats	Prob	F-stats	Prob	F-stats	Prob	F-stats	Prob
ΔLRM1	1.0641	0.3685	0.6224	0.6040	0.9519	0.4202	1.7195	0.1868
ΔLRM2	1.5699	0.2023	2.3653 *	0.0829	2.0541	0.1140	0.1329	0.9395
ΔLRM3	1.3407	0.2663	1.8610	0.1491	1.5821	0.2011	0.1099	0.9535
ΔLRCR1	2.1582 *	0.0957	2.3303 *	0.0863	2.8732 **	0.0421	0.6098	0.6144
ΔLRCR2	1.8383	0.1461	2.1347	0.1084	0.9269	0.4323	1.0461	0.3887
ΔLRCR3	3.2526 **	0.0254	2.5585 *	0.0662	1.8778	0.1409	1.1464	0.3482
ΔALR	1.2089	0.3112	0.2244	0.8789	1.0459	0.3760	2.3140 *	0.0983
ΔIBR3	2.8109 **	0.0440	1.9189	0.1394	1.1655	0.3289	5.6232 ***	0.0039
ΔTBR3	0.3906	0.7600	0.3145	0.8147	0.4583	0.7122	1.8161	0.1680

Notes:

1. The Error Correction Models were estimated with a provision of three lags and the lag length was determined after subjecting each variable to a series of ARCH serial correlation LM tests.
2. The F-statistics was obtained from the Wald Test and was tested for the null hypothesis that all the coefficients of the financial variable indicated are zero.
3. (***), (**) and (*) denotes the rejection of the null hypothesis at 1%, 5% and 10% respectively.