FINANCIAL DISINTERMEDIATION IN THE 1990s:
IMPLICATIONS ON MONETARY POLICY IN MALAYSIA

Anthony C.K. Tan
Kim-Leng Goh*

Faculty of Economics & Administration
University of Malaya
50603 Kuala Lumpur
MALAYSIA

Tel: + 60 3 79673608
Fax: + 60 3 79673738

Email: klgoh@um.edu.my

Paper prepared for the 15th Annual Conference on Pacific Basin Finance, Economics, Accounting and Management, 20 & 21 July, Ho Chi Minh City, Vietnam.

March 2007

* Corresponding author.

FINANCIAL DISINTERMEDIATION IN THE 1990s: IMPLICATIONS ON MONETARY POLICY IN MALAYSIA

ABSTRACT

Evidence in the literature suggests that monetary policy appears to have less of an impact on real activity than it once had, and financial disintermediation offers a possible explanation. An increased financial disintermediation characterizes the Malaysia's financial system since the early 1990s. Using quarterly data from 1980:1 to 2005:4, we demonstrate that the dynamics of monetary transmission mechanism have changed significantly since the early 1990s. The increased financial disintermediation has contributed towards changes in the said transmission mechanism. A greater effectiveness of monetary policy prevails during the pre-1990:3 period, but the post-1990:3 period poses much difficulty for the conduct of monetary policy. Innovations in the financial market appeared to have led to lower output and price variability. Further, when the real interest rate is made a function of financial disintermediation, the real interest rate appeared to have lost its significance in influencing real variables in the post-1990:3 period. This study did not, however, find evidence in support of the significance of the real interest rate in affecting real variables through the direct financing channel via the capital market.

Keywords: bank lending channel, capital market, cointegration, VAR.

JEL classification: E44, E52

I. INTRODUCTION

Modern empirical research in monetary economics places emphasis on the ability of policy to stabilize the macroeconomy (Friedman and Schwartz (1963)). Changes in policy are important insofar as they affect aggregate real activities in an economy. Essentially, this requires the existence of some form of nominal rigidities which would then allow monetary policy action to be translated into changes in real variables. Accordingly, a well-developed financial system is both crucial and critical for the conduct of monetary policy.

Financial developments over the past three decades, including capital market developments (as an alternative to bank intermediation), appear to have had altered the conduct of monetary policy both in developed and developing economies. Accordingly, it has been argued specifically by several authors that monetary policy appears to have less of an impact on real activity than it once had (see Hussein (1992), Azali (1998), Ghazali (1998), Boivin and Giannoni (2002), Kuttner and Mosser (2002)). In spite of this general observation, the cause of this perceived change however, remains an open question. Structural changes affecting the monetary transmission mechanism and the conduct of monetary policy may in fact be non-financial in nature as it is often posited.

The Malaysian financial system is becoming more market-based, as both public and private sectors are increasingly relying on direct (or market) financing, as compared to indirect (or intermediated) financing. Indeed, the amount of funds raised from the Malaysian capital market has increased significantly from 1980 to 2005. The annual growth rate of new listings on Bursa Malaysia over the 26-year period is on average, approximately 20.7%. Following positive developments in the Malaysian capital market[1], there is now greater access to debt and equity markets for large classes of borrowers and investors. The process of financial disintermediation – defined here as the process where deficit financial units, in meeting their financing needs, bypass financial institutions in favour of the capital markets has become more apparent.

On one hand, firms (notably large corporations) are no longer constrained by the banking system for funds. On the other hand, it is acknowledged that access to the capital market for funds, even with better information dissemination may not be readily available, particularly to the small and medium-size enterprises (SMEs). It is more likely that these SMEs would still rely heavily on the banking system for their financing needs. In Malaysia, the banking system is an important conduit for the propagation of monetary transmission mechanism. A study by Mansor (2002) confirms that bank deposits and bank loans served as important channels of monetary transmission mechanism during the pre-Asian crisis for Malaysia. Unfortunately, it is not readily apparent from this study whether the increasing trend of financial disintermediation implies a weakening of the bank lending channel of monetary transmission mechanism.

[1] See Attila (2000) for an overview of the Malaysian capital market as well as recent developments.

Apart from financial disintermediation, another recent trend that could be observed in Malaysia is the significant growth of mortgage and consumption credit extended by the banking system to the household sector – defined as individual persons and non-incorporated businesses. In response to the increased financial disintermediation, banking institutions have shifted their composition of lending from large corporations to SMEs, including the more aggressive marketing of consumer and mortgage loans. The rising households' medium- to long-term debts which are financed by the banking system suggest that the strength of the bank lending channel in Malaysia may not likely be compromised.

According to Sellon, Jr (2002), the above finding is consistent with that of the US economy, where the fall in corporate borrowings brought about by the process of financial disintermediation has likely been offset by an increased in household borrowings. This implies that the optimal design and conduct of monetary policy since the 1990s could no longer be undertaken without taking into account capital market developments, as well as greater household access to medium- to long-term financing.

The effect of changes in the real interest rate elasticity of the output gap offers an indicative measure of the effectiveness of monetary policy. From the New-Keynesian interest rate point of view, the effect of such changes is ambiguous. On one hand, increased financial disintermediation may have removed or limited the impact of an exogenous monetary policy shocks on real activity. In this respect, Bean, Larsen and Nikolov (2002) argued that when firms and/or households are unconstrained in their access to credit, output (and inflation) tends to be stabilized because firms and households would become relatively less sensitive to current and/or expected changes in economic conditions. Following rational expectations as well as the optimizing behaviour of firms and households, innovations in the policy interest rate will tend to affect output (and inflation) thereby lowering the persistence of moves in the output gap. In view that real interest rates are an important monetary policy tool in the transmission mechanism, Bean, Larsen and Nikolov (2002) further argued that a reduction in financial friction associated with financial deepening and/or disintermediation would tend to lower the persistent movements in the output gap, leading to a corresponding reduction in the real interest rate elasticity of the output gap (referred hereafter as real interest rate elasticity). Accordingly, this argument suggests a lower amplification of an exogenous monetary policy shock. On the other hand, the greater degree of access to interest-sensitive financial assets and liabilities may have exposed firms and households directly to interest rate fluctuations. To the extent that a larger segment of borrowers and lenders may now be directly affected by interest rate variations, the output gap will appear to be relatively more interest-sensitive.

A monetary policy tightening is likely to cause credit-constrained firms (whom are mostly bank-dependant) to face difficulty in securing financing for their investments even from the banking system since the problem of adverse selection is likely to be more pronounced. And since 'state verification' is costly, lenders would therefore demand an external finance premium to compensate them for this 'state verification' cost. Empirical evidence in the US suggests that the estimated premium on external finance was found to be very low during expansionary period in 1997 to 1999, but rose sharply in 2000 especially for higher-geared firms (Levin, Natalucci and Zakrajsek (2004)). In general equilibrium, such a setting/mechanism has the potential to provide amplification and propagation, causing persistent movements in firms' average cost of capital and therefore investment (and ultimately, output).

Essentially, the presence of financial frictions in the form of credit market imperfections could potentially cause greater output persistence [2] since the costly external finance premium would discourage firms from investing and/or caused their investments to be limited to the availability of their retained profits. In this respect, the presence of financial market frictions would likely produce an IS curve with relatively greater real interest rate elasticity since the output gap tends to be larger as compared to a model that is free from financial frictions.

Although the argument that greater financial disintermediation may imply the reduction of financial frictions, leading to a likely reduction in real interest rate elasticity, it is also plausible that the concept of 'relationship-banking' renders bank lending less interest rate sensitive as compared to direct financing (which is relatively more price-sensitive). Bank lending contracts are implicit in nature, allowing the possibility of re-negotiation and risk-sharing amongst the parties involved – a feature that may not be reflected in market interest rates. Consequently, greater financial disintermediation would tend to increase the real interest rate elasticity following an exogenous monetary policy shock. Given that there is no theoretical consensus on the effect on real interest rate elasticity, the net impact of these changes could only be assessed empirically.

Studies on monetary transmission mechanism in Malaysia either concentrated on the traditional interest rate, monetary aggregate and/or following Bernanke and Blinder (1988) and Bernanke and Gertler (1995)[3], to include credit aggregates as channels of monetary transmission mechanism (see Tan and Cheng (1995), Masih and Masih (1996), Azali and Matthews (1999), Shanmugam, Nair and Ong (2003)). An analysis of monetary policy, and therefore its effectiveness in influencing target variables could benefit from a more explicit consideration of the evolving role of the Malaysian capital market.

Studies on monetary transmission in Malaysia have focused solely on variables such as bank loans (Mansor (2002)) or commercial banks' claim on the private sector (Azali and Matthews (1999)), without drawing specific reference to variables characterizing capital market developments. Further, there does not seem to appear studies that explicitly consider the implication of monetary policy on the output gap following the increasingly important role played by the Malaysian capital market. Although Ghazali (1998) concluded the case for a reduced effectiveness of monetary policy in light of financial liberalization and innovation for Malaysia, this particular study evaluated the response of banks'

[2] Of course, as argued by Clarida, Gali and Gertler (1999), there may be a number of features other than financial frictions which can generate endogenous output persistence. For example, investment adjustment costs and habit persistence in consumption can both be used to motivate output persistence. But even so, the presence of financial frictions should generate greater output persistence than in their absence.

[3] In examining monetary transmission mechanism, Bernanke and Gertler (1995) argued specifically that it is difficult to explain the magnitude, timing and composition of the economy's response to monetary policy solely in terms of the traditional interest rate channel of monetary transmission mechanism. Consequently, the broad credit channel (namely bank lending and balance-sheet channels) was proposed by Bernanke and Blinder (1988) to fill the gap in the traditional story.

portfolio allocation (notably bank loans) to changes in BNM's policy interest rate. The scope of study has been rather limited.

The effect of changes in BNM's policy interest rate, specifically the degree of interest rate pass-through to the commercial banks' average lending rate has also been documented for Malaysia. The recent study by Tee (2001), however, requires further examination. The degree of interest rate pass-through, despite rapid in Malaysia, could be extended to account for the implications on the output gap. Of primary importance is whether the decline in output following a positive monetary policy shock is often followed by greater or lesser degree of output persistence.

This paper seeks to examine the effect of financial disintermediation – the greater use of market-based financing by the non-financial corporate sector (NFCS) and the change of composition of lending by the banking institutions – on the conduct of monetary policy. It is of particular interest to ascertain whether the increased financial disintermediation since the early 1990s could have had altered the propagation of monetary transmission mechanism. Our primary objective is to draw statistically justifiable conclusion which would enable us to judge the relative effectiveness of monetary policy in recent years by placing an emphasis on capital market activities. We wish to ascertain whether (1) the dynamics of monetary transmission mechanism have changed following structural changes that took place in the early 1990s, and (2) whether the increased financial disintermediation that took place during the corresponding period is amongst one of the cause of this change.

The remaining sections are organized as follows. Section II introduces the data and data sources, model specifications, as well as the methodology of analysis. The methodology of analysis is divided into two sub-sections in view of two distinct techniques of analysis. This is followed by Section III where we report the results of our findings. Finally, in the concluding section, we present a discussion as well as evaluation of the results obtained, including some policy recommendations.

II. METHODOLOGY OF STUDY

In order to test our hypotheses and propositions, quarterly data from 1980:1 to 2005:4 are analyzed. In view of the apparent increased in capital market activities and rising household mortgage and consumption credit since the early 1990s, two sub-periods are distinguished. The first sub-period is from 1980:1 to 1990:3, while the second sub-period is from 1990:4 to 2005:4. In determining these two sub-periods, the breakpoint – 1990:3 has been determined exogenously by examining the patterns revealed by the indicators of financial disintermediation (see discussions below). The variables and the specification of the variables, as well as the sources of data used in our study are set out in Tables 2 and 3 respectively.

The methodology employed in our study involves two stages. In Stage One, our objective is to ascertain whether there has been a change in the dynamics of monetary transmission mechanism since the early 1990s. For this purpose, we adopt an unrestricted VAR as our technique of analysis. Next, in Stage Two, we introduce a simple structural IS model in order to examine further the cause of the change in the monetary transmission mechanism, if any, following our result in Stage One. The objective is to ascertain whether increased financial disintermediation has contributed to changes in the dynamics of monetary transmission mechanism in Malaysia.

Stage One Analysis

Firstly, we examine whether there has been a change in the characterization of monetary transmission mechanism following increased capital market activities, beginning in the early 1990s. For this purpose, we employ a VAR to track such changes.

Before proceeding with the VAR estimation, unit root tests of the time series variables are first conducted in order to ascertain their stationarity properties. This issue arises due to the well-acknowledged non-stationarity of most macroeconomic variables (Nelson and Plosser (1982)). For this purpose, we subject the said variables to a unit root test following Dickey and Fuller (1979), and Phillips and Perron (1987). In these widely applied stationarity tests, it is acknowledged that these conventional unit root tests do not allow for the existence of structural break in the time series. Accordingly, an adjusted augmented Dickey-Fuller (ADF)-type unit root test as proposed by Perron (1989) is applied to the full sample period and the second sub-period in order to account for the possible break in trend following Malaysia's adoption of capital control and pegged exchange rate regime on 1 September 1998.

Possible changes in both the intercept and slope of the trend function are therefore considered, and the regression to test the null hypothesis for the presence of a unit root is of the form,

$$y_t = \mu + \beta t + \theta_1 DU_t + \theta_2 DT_t + \gamma y_{t-1} + \sum_{i=1}^{m} \phi_i \Delta y_{t-i} + \varepsilon_t$$

where the dummy variables, DU_t and DT_t are defined as:

$$DU_t = \begin{cases} 1 \; if \;\; t > T_B \\ 0 \; otherwise \end{cases}, \quad DT_T = \begin{cases} t \; if \;\; t > T_B \\ 0 \; otherwise \end{cases}$$

and the breakpoint, T_B is fixed at 1998:2.

The asymptotic distribution of the *t*-statistic for testing $H_0: \gamma = 1$ is given by Perron (1989). The percentage points for the test are dependent on the value of the break function, T_B/n. The optimal lag length for the unit root testing is determined by the Schwarz Information Criterion (BIC). Once the stationarity properties of the variables are established, it is necessary to decide the particular specification of the VAR. Estimate of VARs in levels run the risk of being spurious if the variables are integrated series or non-stationary. On the other hand, VARs specified in differences when the variables are non-stationary will generate efficient estimates, but at the cost of ignoring potential long-run relationship(s) that is/are of importance.

There are generally three specifications of VAR. Firstly, a VAR can be specified in levels without imposing any restrictions. Secondly, a VAR can be specified in their differences.[4] And thirdly, a VAR can be specified by way of a vector error correction model (VECM). Engle and Granger (1987a) demonstrated that if the variables under consideration are cointegrated, i.e. long-run equilibrium relationship exists amongst the variables, the dynamic relationship between those variables could be more appropriately represented using VECM.

VECM is essentially a restricted VAR model which imposes long-run constraints among levels of the variables as implied by their cointegration. Accordingly, VECM generates efficient estimates without running into the problem of loosing information about the long-run relationships amongst the variables of interests. Since macroeconomic time series data are usually integrated of order one, I(1) VAR should be estimated using VECM with the reduced rank estimation given by Johansen (1998). Ramaswamy and Sloek (1997) argued that imposing inappropriate cointegration relationships can lead to biased estimates and hence bias the impulse-responses derived from the reduced-form VARs. This is especially true whenever the true cointegrating relationships are unknown, and/or these cointegrating relationships are not the focus of analysis.

Engle and Granger (1987a) demonstrated that the aforementioned long-run constraints imposed among levels of the variables as implied by their cointegration are also satisfied asymptotically in an unrestricted VAR. Provided that the variables under consideration are cointegrated, both approaches (restricted VAR and unrestricted VAR) are appropriate for modeling the dynamic interaction among the times series variables. In view that monetary transmission mechanism is a short to medium-run phenomenon, it is therefore not surprising that estimating the unrestricted VAR for the cointegrated variables seemed to be the normal route taken by many researchers in the literature.[5]

Likewise, for the purpose of our study, we approach the issue of non-stationarity by pre-testing the variables in our study using the Johansen (1998) procedure for multivariate cointegration for both the baseline and the extended models (see further explanation below). In the event cointegration is found, we shall then proceed to estimate an unrestricted VAR (hereafter referred to as VAR) in levels as our preferred VAR specification. VAR models are commonly used since this technique allows the researcher to address the simultaneity problem associated with the effects of monetary policy. The fact that monetary authority would usually loosen policy when the economy weakens and tightens when the economy strengthens shows that such endogenous response of policy to economic conditions is one reason why it is difficult to identify the effects of policy.

---

[4] This is valid only when the variables are both non-stationary and non-cointegrated. Care must be exercised however, to ensure that no I(1) variables are used to explain I(0) variables, since the regression in such manner makes no sense. The dependent variable and independent variable have such vastly different temporal properties (Engle and Granger (1987b)).

[5] Empirical studies on monetary transmission mechanism that adopted the unrestricted VARs in levels are amongst others, Bernanke and Blinder (1992), Mansor (1992), Dale and Haldane (1994), Christiano, Eichenbaum and Evans (1994), and Ramaswamy and Sloek (1997).

The evolution of the vector $\boldsymbol{X}_t$ which contains the macroeconomic variables whose behaviour we seek to understand, depends both on unexpected disturbances, $\boldsymbol{u}_t$ and on a systematic component, $\boldsymbol{A}_0 + \boldsymbol{A}_1\boldsymbol{X}_{t-1} + \boldsymbol{A}_2\boldsymbol{X}_{t-2} + \ldots + \boldsymbol{A}_p\boldsymbol{X}_{t-p}$, that determines how shocks are propagated to the rest of the economy. The estimates of $\boldsymbol{A}_0, \boldsymbol{A}_1, \boldsymbol{A}_2, \ldots, \boldsymbol{A}_p$ are obtained by applying ordinary least squares (OLS), and the estimate of $E(\boldsymbol{u}_t\boldsymbol{u}'_t)$ is given by the sample variance-covariance matrix of the OLS residuals. In this study, we consider a baseline VAR containing four variables. The vector of $\boldsymbol{X}_t$ is given by,

$$\boldsymbol{X}_t = [\, i_t, s_t, y_t, P_t]'$$

The above baseline VAR provides a very simplistic description of the economy, but it contains the minimum set of variables that are crucial for any discussion of monetary policy. The above baseline VAR is then extended with a block of financial variable to reflect the prominence of the credit channel in the literature of monetary transmission mechanism. These variables are namely (1) quantity variables, BL_t (capturing the role/existence of alternative sources of financing for the NFCS), M_t and C_t (capturing increased households access to medium- to long-term financing), and (2) price variable, D_t – capturing the role of broad external finance premium in the monetary transmission mechanism. Our augmented vector $X_t^{augmented}$ is therefore,

$$X_t^{augmented} = [i_t, s_t, D_t, BL_t, C_t, M_t, y_t, P_t]'$$

As noted earlier, the objective at this stage is to determine whether there is/are statistical evidence(s) in support (or against) of significant changes in the characterization of monetary transmission mechanism beginning in the early 1990s. For this purpose, we subject the estimated individual equations in both VAR systems, i.e. baseline and extended VARs to a Chow's breakpoint test following Chow (1960). The *F*-statistic has an exact finite sample *F*-distribution under the null hypothesis of no structural change assuming if the errors are independent and identically distributed normal random variables. In the event the estimated individual equations corresponding to each of the sub-period is found to be significantly different (in accordance with our expectations), the VARs for both sub-periods are estimated. Estimation of VAR for the individual sub-periods is necessary to distinguish the dynamics of output and prices during the pre- and post-1990:3 period. Since VARs are essentially in reduced-form, it is not possible to ascertain the key factors behind changes in the monetary policy transmission framework, if any. As a result, specific tests involving structural framework are required.

Stage Two Analysis

In the New Keynesian tradition, models of monetary policy are grounded in dynamic general equilibrium theory and capture the forward-looking behaviour of optimizing firms and consumers (for example, see Clarida, Gali and Gertler (1999)). A baseline New Keynesian IS equation[6] that abstracts from investment and capital accumulation is of the following form:

[6]This equation is often called the intertemporal IS equation, which lies at the core of many recent macroeconomic models. It is similar to the traditional Keynesian-type IS equation, in the sense that it relates output negatively to the real interest rate. However, output is also affected by expected future output, as consumers tend to smooth

$$ygap_t = E_t(ygap_{t+1}) - \varphi\,[i_t - E_t(\pi_{t+1})] + \delta_t \quad (1)$$

where $ygap_t$ is the percentage deviation from a long-run trend.

According to Roldos (2006), the empirical performance of the New Keynesian-type models are not satisfactory and backward elements have to be added to achieve a reasonable fit. The empirical result presented in the next section confirms this finding by Roldos (2006). Accordingly, we modify Equation (1) above to include lagged endogenous persistence, as well as replacing the current real interest rate with the lagged real interest rate. The specification of the baseline IS equation therefore takes the following form:

$$ygap_t = \alpha_0 + \alpha_1 E_t(ygap_{t+1}) + \alpha_2 ygap_{t-1} + \alpha_3 r_{t-1} + \varepsilon_t \quad (2)$$

Estimation of Equation (2) is done by applying OLS. In view that we are studying the effects of increased financial disintermediation beginning in the early 1990s, we extend the baseline IS equation to account for these recent trends. To accomplish this, we make the coefficient, α_3 a function of the variables, *F2* and *F3,* following the approach of Roldos (2006) i.e.

$$ygap_t = \alpha_0 + \alpha_1 E_t(ygap_{t+1}) + \alpha_2 ygap_{t-1} + (\alpha_{31} + \alpha_{32} Fi_t) r_{t-1} + \varepsilon_t \quad (3)$$

where $i = 2, 3$. The extended IS equation is then estimated for both sub-periods. Next, by employing simple *t*-tests, the sensitivity of the main coefficient, α_{31}, is compared and contrasted. The coefficient α_{31} indicates the real interest rate elasticity (or more accurately, the elasticity of intertemporal in consumption), and this measure will serve as a guide for examining the effectiveness of monetary policy in Malaysia in recent years.

The likely presence of serial correlation in our model specification can lead to inefficient estimates and biased standard errors. In order to remedy the problem, we also re-estimate the IS equation by increasing the number of lag lengths to two. In addition, we are able to conduct further analysis by examining the dynamism of longer lag lengths in our model. The specification of Equations (2) and (3) now takes the following form:

$$ygap_t = \beta_0 + \beta_1 E_t(ygap_{t+1}) + \sum_{j=1}^{2} \beta_{2j}\, ygap_{t-j} + \sum_{j=1}^{2} \beta_{3j}\, r_{t-j} + \varepsilon_t \quad (4)$$

$$ygap_t = \beta_0 + \beta_1 E_t(ygap_{t+1}) + \sum_{j=1}^{2} \beta_{2j}\, ygap_{t-j} + \sum_{j=1}^{2} (\beta_{3j,i} + \beta_{4j,i} Fi_t)\, r_{t-j} + \varepsilon_t \quad (5)$$

their consumption over time. An equation of this form can be obtained as a log-linear approximation to a consumption Euler equation in a fairly large variety of models. The coefficient φ is more appropriately known as the elasticity of intertemporal substitution in consumption, and δ represents unforecastable demand shocks.

where $i = 2, 3$. The re-estimated real interest rate elasticities in Equations (4) and (5) are now given by $\beta_{31} + \beta_{32}$ and $\beta_{31,i} + \beta_{32,i}$, respectively. The re-estimated coefficient capturing the interaction effect of the real interest rate and measures of financial disintermediation in the extended IS Equation (5) is given by ($\beta_{41,i} + \beta_{42,i}$). Finally, we employ the *F*-coefficient restriction test in order to determine whether the real interest rate elasticities, and the coefficient capturing the interaction effect of real interest rate and measures of financial disintermediation are statistically significant.

III. RESULTS AND DATA ANALYSIS

Figure 1 shows the trend of financial disintermediation measured using two indicator ratios for the period 1980 to 2005 (see Item 11 of Table 1 for further explanation of these indicators). It is evident from Figure 1 that the trend of financial disintermediation is on the rise. The ratios are larger in magnitude since 1990:3, an indication of a likely reduction in financial frictions beginning in the 1990s. Thus, the post-1990:3 period is characterized by increased capital market activities.[7]

Stage One Results

The order of integration of the variables in this study is determined using the widely applied augmented Dickey-Fuller (ADF) as well as the Phillips and Perron (PP) unit root tests. Table 3 reports the results for the tests when both the constant and trend component are present in the test regression. The results of the unit root test for the full sample are within our expectations. For the full sample period, with the exception of $ygap_t$, $ygapf_t$, $F2_t$ and $F3_t$, both ADF and PP tests do not provide evidence against the presence of unit roots in the level variables. However, the test on the first differences indicates strong rejection of the null hypothesis at 1% level, implying that these variables appear to be first-difference stationary, i.e. they are integrated of order one, I(1). These time-series properties remain the same for both the sub-periods.

The variables $ygap_t$, $ygapf_t$, $F2_t$ and $F3_t$, on the other hand, appear to be stationary at the level variables, i.e. there are integrated of order zero, I(0) for the full sample period. For individual sub-periods, the results of the unit root tests appear to be mixed for the variables, $F2_t$ and $F3_t$. Specifically for the first sub-period, the ADF test suggests first-difference stationary (at 1% level) for both $F2_t$ and $F3_t$. However, the PP test indicates otherwise. Nonetheless, the results for the second sub-period with respect to both $F2_t$ and $F3_t$ are consistent, i.e. they are I(0). According to Choi (1992), the PP test is relatively more powerful than the ADF test in finite samples. Indeed, in our study, the PP test is able to reject the null hypothesis in several cases where the results of the ADF test are found to be insignificant (see for example, $ln\ BL_t$, $ln\ M_t$ and $ln\ C_t$). For further analysis of the variables of interest, we shall henceforth rely on the results of the PP test in our study.

[7] The process of financial disintermediation has become more apparent especially with the establishment of Rating Agency Malaysia Berhad (RAM) in November 1990, the Securities Commission (SC) in March 1993 and the Malaysian Rating Corporation Berhad (MARC) in October 1995.

Following the above, the Johansen (1988) framework is adopted to investigate if long-run linkages exist empirically amongst the variables in our study. The Johansen's method is achieved by testing the null hypothesis of at least *r* cointegrating vectors against a general hypothesis of more than *r* cointegrating vectors. The lag length that minimizes the BIC is once again used for this purpose. The result of the Johansen cointegration test is reported in Table 4.

The result of the Johansen cointegration test indicates that at 1% level of significance, one cointegrating vector is found for the baseline model, while three cointegrating vectors are found for the extended model. In view of the existence of long-run empirical relationship amongst the variables in both models, the dynamic interaction between the variables are henceforth analyzed more appropriately using VAR in levels. Both the baseline and extended VARs are estimated using OLS. The BIC consistently choose lag length of order one for both the baseline and extended VARs. The results are summarized in Table 5. At least one of the variables lagged one period is significant in explaining the dependent variable. In the output equation, interest rate is significantly and negatively related to output.

In Table 6, the *F*-statistics of the break point test suggest that (with the exception of $ln\ BL_t$), the single-equation parameters are significantly different from the parameters of the separate equations for each sub-period. The *F*-statistic for output, $ln\ y_t$ and prices, $ln\ P_t$ are particularly of interest. At 1% level of significance, the result suggests that the structural change in both output and prices coincide with changes in the financial system beginning in the 1990s.

We proceed to estimate the VARs for each sub-period in view of the significance of the Chow's breakpoint test. These results are reported in Tables 7 and 8. The estimated VARs are then used to compute the variance decomposition (VDC) of 12 quarters ahead to evaluate the contribution of the interest rate shock to the variance of output as well as price (see Table 9). The 12 quarters ahead VDC shows that the contribution of interest rate shock to the variance of output fluctuations seems to have decreased dramatically in the second sub-period as compared to the first sub-period under both VAR models.

The characterization of monetary transmission mechanism appeared to have deteriorated in the post-1990:3 period when credit/financial variables are included in the VAR analysis. This is particularly true for the first sub-period. Under the baseline VAR, innovations in the policy interest rate have accounted for up to 48.60% of the output variations in the first sub-period within a three-year time horizon. The same output variation that is attributable to innovations in the interest rate fell to under 10% when we consider the extended VAR. Relative to the baseline VAR, this is indeed a significant reduction, suggesting that monetary policy shocks have accounted for very little variability in output during the first sub-period when credit/financial variables are included in the VAR analysis.

Similarly, interest rate innovations seemed to have accounted for lesser variability in prices in the extended VAR model. For a 12-quarter ahead forecast, variation in prices is as high as 12.96% in the first sub-period under the baseline VAR. This percentage variation has fallen to just under 4% under the extended VAR. Another important finding is that when we include the credit variables in the extended VAR, variations in prices have fallen dramatically in the second sub-period, i.e. the percentage variation attributable to interest rate innovations has reduced from 22.34% (baseline VAR) to 3.80% (extended VAR).

Based on the results obtained above, our findings that the effect of monetary policy shocks on output appears to have reduced in the post-1990:3 period (in both the baseline or the extended VAR) are consistent with the findings of several researchers such as Leeper, Sims and Zha (1996) and Boivin and Giannoni (2002) in the US, and Roldos (2006) in Canada. Boivin and Giannoni (2002) states that, 'Regardless of the evolution of the variance of monetary policy shocks, the fraction of variance of output and inflation due to these shocks has decreased dramatically since the beginning of the 1980s'. In this study, the role of interest rate as a policy tool in affecting output and prices has reduced when the financial/credit variables are taken into account. We should also take note that the standard deviation of interest rate shocks has reduced from the first sub-period to the second sub-period (see Table 10).

Stage Two Results

The objective of the Stage Two analysis is to derive the real interest rate elasticities for the structural IS equation for both baseline model and models incorporating measures of financial disintermediation. The elasticities provide an indication on the degree of amplification of an exogenous monetary policy shock on output and prices. The IS equations (2) and (3) are estimated for both the full sample and individual sub-periods. The results are reported in Table 11.

The results suggest that the real interest rate elasticities, α_3 are correctly signed, and significantly different from zero in the full sample period. When real interest rate elasticity is made a function of measures of financial disintermediation, *F2* and *F3,* the coefficient α_{31} also appears to be significantly different from zero. For the individual sub-period estimates, α_3 is not significant for both sub-periods under the baseline model. However, for models with *F2* and *F3*, the real interest rate elasticities are found to be significantly negative only in the first sub-period. Further, contrary to the full sample estimates, the coefficient α_{32} which captures the interaction effect of the real interest rate and measures of financial disintermediation appears to be significantly different from zero but *only* in the first sub-period.

The insignificance of the real interest rate elasticity in the second sub-period is particularly interesting. This result indicates that the responsiveness of aggregate demand to real interest rates – a key parameter in the monetary transmission mechanism has not been significant in influencing real variables in the second sub-period. However, before we begin our interpretation and evaluation of the above findings, we subject our estimated results to several diagnostic tests. These tests include the White's heteroscedasticity test, the autoregressive conditional heteroscedasticity (ARCH) test of one lag, and the Breusch-Godfrey serial correlation LM test of one lag. The test results suggest the presence of serial correlation in models (2) and (3). Such departure from the classical assumptions may have caused the results of our *t*-tests to be biased.

The lag lengths are increased to two in order to eliminate the presence of serial correlation, as well as to examine the dynamics of higher-order lag lengths in our model specification. The results of the estimated Equations (4) and (5) are reported in Table 13. With the increase in the number of lags, the extent of serial correlation has been reduced substantially. At 1% level, there is no evidence of serial correlation. The results are consistent across both the full sample as well as individual sub-periods. In order to test the significance of the real interest rate elasticity, and the coefficient incorporating measures of financial disintermediation, we apply the *F*-coefficient restriction test to our estimated results which we have summarized in Table 12. The test results are reported in Table 13.

The results suggest that with increased lag length in the model specification, the real interest rate elasticity remains significantly different from zero in the full sample period for both the baseline IS as well as the IS models incorporating measures of financial disintermediation. Individual sub-period analysis suggests that with increased lag length, the real interest rate elasticity is not significantly different from zero under the baseline IS for both sub-periods. Similar to the results in Table 11, real interest rate elasticity remains significant but, only in the first sub-period for IS models incorporating the variables *F2* and *F3.* Apart from the above, the coefficients capturing the interaction effect of the real interest rate and measures of financial disintermediation appear to be significant at either at 1% or 5% levels. We note that significance is once again, only for the first sub-period.

Discussion of Results

Following innovations in the policy interest rate, evidence from VDC suggests that the inclusion of credit/financial variables in the VAR analysis has accounted for lesser variability in output and prices in the second sub-period. In other words, the inclusion of credit/financial variables appears to have absorbed some of the variability of output and prices.

The full sample analysis indicates that the real interest rate elasticity has increased significantly when we include measures of financial disintermediation. When individual sub-periods are examined, our results indicate larger and significant real interest rate elasticity for both models incorporating measures of financial disintermediation in the first sub-period. Further, the interaction effect between the real interest rate and *F2/F3* has been found to be significant. The real interest rate elasticity in the baseline IS model is not significantly different from zero, but becomes significant with the inclusion of variables *F2* and *F3*. On the basis of this finding, innovations in the policy interest rate prior to the 1990:3 have accounted for larger variations in output and inflation in the presence of financial disintermediation. In fact, real interest rate elasticity has been much larger in the presence of financial disintermediation (although activities in the capital market have been very much subdued during this period).

The real interest rate elasticity is not statistically different from zero in the second sub-period under the extended IS model. The dynamics of monetary transmission mechanism appeared to have changed in the second sub-period, resulting in lower output and price variability following an exogenous monetary policy shock. Our results therefore suggest that increased financial disintermediation since the early 1990s has contributed towards changes in the propagation of an exogenous monetary policy shock.

The contribution of the interest rate shock to the variability of output (and prices) tends to fall when the broad credit channel of monetary transmission mechanism is included, alongside with the traditional interest rate channel beginning in the early 1990s. We could therefore make an assertion that monetary policy appears to be more effective in influencing real variables prior to the 1990:3 period in Malaysia. From the above assertion, it would appear that increased financial disintermediation in the early 1990s may have caused real interest rate elasticity to lose their significance in influencing real variables. Monetary policy in this respect is therefore less effective in influencing real variables during this period. Output (and prices) tends to be stabilized because as long as firms and households are unconstrained in their access to credit, they would become less responsive to the current and/or changing economic condition. The implication is the lowering of the persistence of movement in the output gap.

IV. CONCLUSION

The primary objective of this study is to draw statistically justifiable conclusion which would enable us to judge the relative effectiveness of monetary policy in Malaysia in recent years with increased capital market activities. Specifically, we wish to ascertain whether the dynamics of monetary transmission mechanism have changed following structural changes that took place in the financial system beginning in the early 1990s. This empirical study has been carried out in view of the expectation that the Malaysian capital market will play an integral role in further developments of the Malaysian financial system. Accordingly, in our view, further activities in the capital market would likely affect the monetary transmission mechanism, and ultimately, the conduct of monetary policy in Malaysia.

Our data suggest that when we take into account the credit/financial variables into the analysis, the variability of output and inflation fell dramatically. Our data also suggest that (considering only the extended VAR model) the dynamics of monetary transmission mechanism have changed significantly from the pre-1990:3 period (first sub-period) to the post-1990:3 period (second sub-period). Specifically, output variability that is attributable to interest rate innovations in the post-1990:3 period appeared to have fallen substantially as compared to the pre-1990:3 period. Following reduced output variability (and to a lesser extent, prices) in the post-1990:3 period, monetary policy appears to be less effective in influencing real variables. In contrast, in the pre-1990:3 period, the existence of financial disintermediation appears to have led to an increased in real interest rate elasticity, although market activity has been somewhat subdued during this period.

There is strong evidence suggesting greater effectiveness of monetary policy in influencing real variables during the pre-1990:3 period when the process of financial disintermediation is taken into account. The interaction effect of the real interest rate and measures of financial disintermediation has been found to be significant in the first sub-period. These evidences suggest that the subdued capital market activities may have caused monetary policy to be relatively more potent during the pre-1990:3 period. There is evidence indicating that the increased financial disintermediation activities in the post-1990:3 period has been associated with reduced effectiveness of monetary policy in influencing real variables. As a result, the findings of our study support the hypothesis that increased financial disintermediation in the early 1990s has contributed to changes in dynamics of monetary transmission mechanism in Malaysia.

The empirical evidence that we have reported suggests that the lower variability of output (and to a much lesser extent, prices) in the post-1990 period is consistent with the results obtained by Boivin and Giannoni (2002) in the US and Roldos (2006) in Canada. A given exogenous change in the policy interest rate has led to smaller response of output (and inflation).

Although our results supported the findings of several researchers mentioned above, one aspect of our result is strikingly different from that of Roldos (2006). In his study of financial disintermediation in Canada, Roldos (2006) argued that increased capital market activities has been associated with greater real interest rate elasticity, implying that the output gap in Canada is relatively more responsive to changes in real interest rate in recent years.

The findings of lower variability of output (and inflation) as well as the greater real interest rate elasticity in Canada imply that the systematic component of monetary policy (one that is characterized by monetary policy reaction function) has likely to have become more important with greater use of market-based financing. Clearly, from the results that we have reported, this particular situation is not observed in Malaysia. The situation in Malaysia appears to be different in the sense that although the effectiveness of an exogenous monetary policy shock appears to have diminished, the real interest rate elasticity has also appeared to have lost its significance in influential the output gap in the post-1990 period. In this regard, the increased financial disintermediation since the early 1990s appears to have made the conduct of monetary policy more difficult. Our findings confirm the argument made by Chong and Goh (2005) whom suggest that in recent years, the use of interest rate alone may be limited in its effectiveness for affecting real economic activities.

Our study involves the examination of real interest rate elasticity as a function of financial disintermediation. An examination of the extent of market-based financing of the NFCS in Malaysia shows that gross nominal funds raised in the capital market accounted for, on average, only 12.16% (for *F2*) and 9.59% (for *F3*) for the period 1990:3 to 2005:4. As at the end of 2005, bank loans accounted for more than 85% of total NFCS' total financing. In industrialized economies such as Canada, this percentage is as low as 40%. It is thus not surprising that the capital market (direct financing) channel of monetary policy transmission mechanism appears to be overshadowed by the interest rate channel, resulting in the insignificance of the interaction effect of the real interest rate and measures of financial disintermediation in influencing real variables in the post-1990:3 period.

Nonetheless, we ought to acknowledge that the reduced variability in output and prices in recent years may in actual fact be non-financial in nature (Kuttner and Mosser (2002)). Other factors such as changing behaviour of firms and consumers, re-organization of markets, as well as more effective management of inventories could have contributed to the apparent stability in output and prices in recent years. These are legitimate arguments that warrants further consideration.

REFERENCES

Attila, Emam, (2000), *"Overview of the Malaysian Capital Market and Recent Developments",* Paper presented at the seminar of Malaysian Capital Market Development and Regulation, Kuala Lumpur.

Azali, M. and Matthews, K.G.P., (1999), *"Money-Income and Credit-Income Relationships during the Pre- and Post-Financial Liberalization Periods: Evidence from Malaysia",* Applied Economics, 31, pp 1161-1170.

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

__________________ *Monthly Statistical Bulletin*, various issues, Bank Negara Malaysia, Kuala Lumpur.

__________________ *Quarterly Economic Bulletin*, various issues, Bank Negara Malaysia, Kuala Lumpur.

Bardsen, G., (1989), *"Estimation of Long-run Coefficients in Error Correction Models",* Oxford Bulletin of Economics and Statistics, 51(2), pp 345-351.

Bean, C., Larsen, J. and Nikolov, K., (2002), *"Financial Frictions and the Monetary Transmission Mechanism: Theory, Evidence and Policy Implications",* European Central Bank Working Paper Series, No. 113.

Bernanke, B.S. and Blinder, A.S., (1988), *"Credit, Money and Aggregate Demand",* American Economic Review, 78, pp 435-439.

___________________________ (1992), *"The Federal Funds Rate and the Channels of Monetary Transmission",* American Economic Review, 82, pp 901-921.

Bernanke, B.S. and Gertler, M., (1995), "*Inside the Black Box: The Credit Channel of Monetary Policy Transmission",* Journal of Economic Perspectives, 9(4), pp 27-48.

Boivin, J. and Giannoni, M., (2002), "*Has Monetary Policy Becoming Less Powerful?",* Federal Reserve Bank of New York Staff Reports, No.144.

Bursa Malaysia, via www.bursamalaysia.com

Choi, I., (1992), *"Effects of Data Aggregation and the Power of Tests for Unit Root",* Economic Letters, 40, pp 397-401.

Chong, C.S. and Goh, K.L. (2005) *"Inter-temporal Linkages of Economic Activity, Stock Price and Monetary Policy in Malaysia"*, Asia Pacific Journal of Economics and Business, 9(1), pp 48-61.

Chow, G.C., (1960), *"Tests of Equality Between Sets of Coefficients in Two Linear Regressions,"* Econometrica, 28, pp 591-605.

Christiano, L.J., Eichenbaum, M. and Evans, C., (1994), *"The Effects of Monetary Policy Shocks: Some Evidence form the Flow of Funds",* NBER Working Paper, No. 4699.

Clarida, R., Gali, J. and Gertler, M., (1999), *“The Science of Monetary Policy”,* Journal of Economic Literature, 37(4), pp 1661-1707.

Dale, S. and Haldane, A.G., (1995), *“Interest Rate and the Channels of Monetary Transmission Mechanism: Some Sectoral Estimates”,* European Economic Review, 39, pp 1611-1626.

Department of Statistics’ *Monthly Statistical Bulletins*, various issues, Jabatan Perangkaan Malaysia, Kuala Lumpur.

____________________ *Quarterly Statistical Bulletins*, various issues, Jabatan Perangkaan Malaysia, Kuala Lumpur.

Dickey, D. and Fuller, W., (1979), *“Distribution of the Estimators for Autoregressive Time-series with a Unit Root”*, Journal of the American Statistical Association, 74, pp 427-431.

Disyatat, P. and Vongsinsirikul, P., (2003), *“Monetary Policy and the Transmission Mechanism in Thailand”,* Journal of Asian Economics, 14, pp 389-418.

Estrella, A., (2004), “*Banks and Monetary Transmission in the Current US Environment”,* Paper written for the 25th SUERF colloquium on Competition and Profitability in European Financial Services: Strategic, Systematic and Policy Issues.

Engle, R.F. and Granger, C.W.J., (1987a), *“Cointegration and Error Correction: Representation, Estimation and Testing”*, Econometrica, 55, pp 251-276.

___________________________ (1987b), *“Long-run Economic Relationships: Readings in cointegration”,* Oxford University Press, New York.

Friedman, M. and Schwartz, A., (1993), *“A Monetary History of the United States, 1867-1960”,* Princeton University Press.

Ghazali, N. A. (1998), *“Financial Liberalization, Innovation and the Response of Malaysian Commercial Banks’ Portfolio to Monetary Shocks”,* Paper presented at the 10th Conference on Asia-Pacific Financial Markets in the Next Millennium: Issues and challenges, Kuala Lumpur.

Hussein, A., (1992), *“Financial Liberalization and Interest Rate Determination in Malaysia”,* Bank Negara Malaysia’s Discussion Paper No. 12, Economics Department, Bank Negara Malaysia.

Hussein, A., (1994), *“Financial System”* in Jomo, K.S., ed., Malaysia’s Economy in the Nineties, Pelanduk Publications, pp 137-169.

International Monetary Fund, *International Financial Statistics,* various issues, IMF.

Jallah, S., (2004), *“A VAR Analysis of the Effects of Monetary Policy in Malaysia”,* MEc dissertation submitted to the Faculty of Economic and Administration, University of Malaya.

Johansen, S. (1988), *“Statistical Analysis of Cointegrating Vectors”*, Journal of Economic Dynamics and Control, 12, pp 231-254.

Kuttner, K.N. and Mosser, P.C. (2002), *“The Monetary Transmission Mechanism: Some Answers and Further Questions”,* Economic Policy Review, May, Federal Reserve Board of New York.

Leeper, E.M., Sims, C.A. and Zha, T., (1996), *“What Does Monetary Policy Do?”* Brookings Papers on Economic Activity, 2, pp 1-63.

Levin, A.T., Natalucci, F.B. and Zakrajsek, E., (2004), *“The Magnitude and Cyclical Behaviour of Financial Market Frictions”,* Finance and Economics Discussion Series, 70, Federal Reserve Board.

Lin, S.Y., (1991), *“The Malaysian Financial Markets”,* Paper presented at the 3rd Annual Pacific-Basin Finance Conference, Seoul, South Korea.

Mansor, I., (2002), *"Money, Credit, Asset Prices and Monetary Transmission Mechanism: Evidence from Malaysia",* Paper presented in the 8^{th} Convention of the East-Asian Economic Association, Kuala Lumpur.

Masih, A. and Masih, R., (1996), *"Empirical Tests to Discern the Dynamic Causal Chain in Macroeconomic Activity: New Evidence from Thailand and Malaysia based on Multivariate Cointegration/Vector Error Correction Modeling Approach",* Journal of Policy Modeling, 18, pp 531-560.

Mulayana, S., (1995), *"Financial Reforms and Transmission Mechanism of Monetary Policy in SEACEN Countries",* SEACEN Research and Training Centre, Kuala Lumpur.

Nelson, C.R. and Plosser,C.I., (1982), *"Trends and Random Walks in Macroeconomic Time Series",* Journal of Monetary Economics, 10, pp 139-162.

Perron, P., (1989), *"The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis",* Econometrica, 57, pp 1361-1401.

Phillips, C.B. and Perron, P., (1987), *"Does GNP Have a Unit Root?: A Re-evaluation",* Economic Letters, 23, pp 119-216.

Raghavan, V.R., (2000), *"The Effects of Financial Liberalisation on Monetary Policy: The Malaysian Experience",* MEc dissertation submitted to the Faculty of Economic and Administration, University of Malaya.

Ramaswamy, R. and Sloek, T., (1997), *"The Real Effects of Monetary Policy in the European Union: What Are the Differences?",* IMF Working Paper, December 1997.

Roldos, J., (2006), *"Disintermediation and Monetary Transmission Mechanism in Canada",* IMF Working Paper, March 2006.

Romer, D., (2001), *"Advanced macroeconomics",* 2^{nd} Ed., McGraw-Hill, New York.

Schmidt, R.H., Hackethal, A. and Tyrell, M., (1999), *"Disintermediation and the Role of Banks in Europe: An International Comparison",* Journal of Financial Intermediation, 8, pp 36-67.

Sellon, G. Jr, (2002), "*The Changing US Financial System: Some Implications for the Monetary Transmission Mechanism",* Economic Review, Quarter 1, Federal Reserve Bank of Kansas City.

Shanmugam, B., Nair, M., and Ong, W.L., (2003), *"The Endogenous Money Hypothesis: Empirical Evidence from Malaysia"*, Journal of Post-Keynesian Economics, 25(4), pp 599-611.

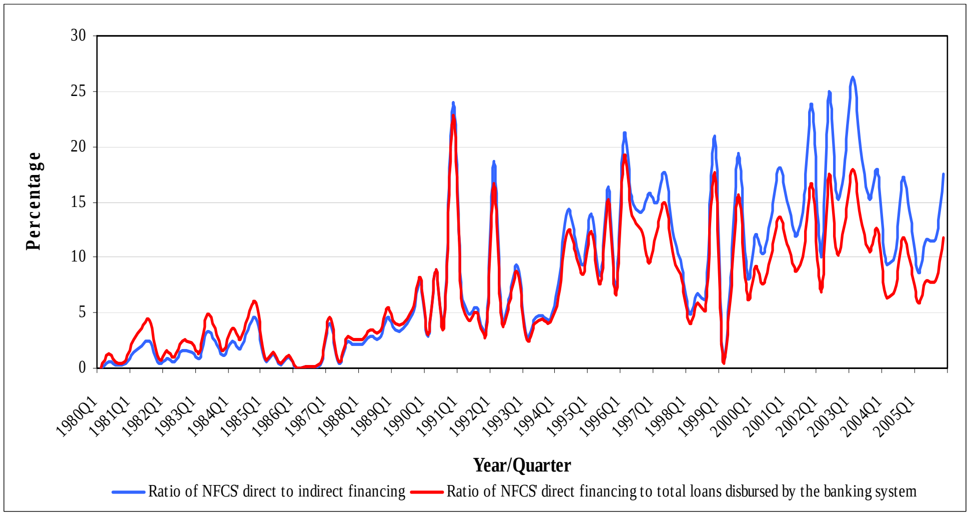
Sims, C.A., (1982), *"Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered"*, American Economic Review, 70(2), pp 250-257.

Tan, K.G., and Cheng, C.S., (1995), *"The Causal Nexus of Money, Output and Prices in Malaysia"*, Applied Economics, 27, pp 1245-1251.

Taylor, J., (1993), *"Discretion versus Policy Rules in Practice",* Carnegie-Rochester Conference Series on Public Policy, 39, pp 195-214.

Tee, C.G., (2001), *"The Response of Bank Lending to Interest Rate Changes: The Case of Malaysia",* MEc Research Paper submitted to the Faculty of Economic and Administration, University of Malaya.

Figure 1
Indicators of financial disintermediation in Malaysia, 1980:1 – 2005:4



Source : Bank Negara Malaysia and Bursa Malaysia

Table 1

Description of variables

No.	Variables	Proxy variables
1.	Output	Nominal GDP deflated by the aggregate price level, y_t (in logarithmic) Due to the non-availability of GDP data from 1980:1 to 1990:4, it was necessary to interpolate the annual series on real GDP to obtain quarterly series based on Goldstein and Khan (1976). Refer to Appendix I for details.
2.	Output gap	Difference between actual output and potential output where potential output is a Hodrick-Prescott filtered version of the actual output series, $ygap_t$ (in percentage) The Hodrick-Prescott filter (HP-filter) is used as a detrending method. Supposing the original series y_t is composed of a trend component, g_t and a cyclical component, c_t, i.e. $y_t = g_t + c_t$. The HP-filter isolates the cyclical component by solving the following minimization problem. $$\sum_{t=1}^{T}(y_t - g_t)^2 + \lambda\sum_{t=2}^{T-1}\left[(g_{t+1} - g_t) - (g_t - g_{t-1})\right]^2$$ The output gap is computed as $ygap_t = (y_t - g_t)/y_t$
3.	Expected output gap	Difference between forecasted output and the potential output, $ygapf_t$ (in percentage) Forecasted output is computed based on the estimated output equation from the extended VAR (see discussion below). Expected output gap is then computed in the manner similar to the output gap, i.e. as the percentage difference in the forecasted output series from the detrended output series.
4.	Aggregate price level	Consumer Price Index (CPI) (1980 = 100), P_t (in logarithmic)
5.	Nominal interest rate	Average BNM's 3-month Inter-bank Rate/Overnight Policy Rate (OPR), i_t
6.	Real interest rate	Ex-post/actual real interest rate, r_t $r_t = i_t - E_t(\pi_{t+1})$, where expected inflation, $E_t(\pi_{t+1}) = \pi_t + \mu_t$, $E(\mu_t) = 0$
7.	Nominal exchange rate	Average bilateral exchange rate between US and Malaysia, s_t (in logarithmic) (expressed as units of domestic currency per unit of foreign currency),
8.	Loans to the NFCS (in real terms)	Loans disbursed by the banking system to the NFCS, deflated by the aggregate price level, BL_t
9.	Household mortgage credit (in real terms)	Outstanding household mortgage extended by the banking system to the household sector, deflated by the aggregate price level, M_t (in logarithmic)
10.	Household consumption credit (in real terms)	Outstanding household consumption credit extended by the banking system to the household sector, deflated by the aggregate price level, C_t (in logarithmic)
11.	Financial disintermediation (i) Measure of financial disintermediation activities (ii) Measure of both financial disintermediation activities and growth in household mortgage and consumption credit	• Ratio of NFCS' direct to indirect financing[i], $F2_t$ • Ratio of NFCS' direct financing to total loans disbursed by the banking system[ii], $F3_t$
12.	Measure of broad external finance premium	Difference between the average lending rates extended by commercial banks to the NFCS and the average discount rate of the 3-month Treasury Bill, D_t
13.	Time	Quarterly, t

Notes:

(i) Direct financing refers to gross equity & private debt securities raised by the NFCS from the capital market, while indirect financing refers to total loans disbursed by the banking system to the NFCS.

(ii) Loans disbursed by the banking system[a] primarily comprise loans to the (1) agriculture, hunting, forestry and fishing sector, (2) mining and quarrying sector, (3) manufacturing sector, (4) utility sector (electricity, gas, water), (5) wholesale and retail trade, (6) broad property sector (excluding purchase of residential property), and (7) finance, insurance and business services sector.

[a] *Loans disbursed to the government are included, however these loans are insignificant, representing less than one percent of the total loans disbursed by the banking system.*

Table 2
Sources of data

No.	Data	Sources of data
1.	Nominal GDP	Department of Statistic's Monthly and Quarterly Bulletins (various issues); and IMF's International Financial Statistics
2.	CPI	Department of Statistic's Monthly and Quarterly Bulletins (various issues)
3.	3-month Inter-bank Rate	BNM's Monthly Statistical Bulletins and Quarterly Economic Bulletins (various issues)
4.	Discount rate of 3-month Treasury Bill	
5.	Commercial banks' lending rate	
6.	Nominal exchange rate (units of domestic currency per unit of foreign currency)	
7.	Loans disbursed to the NFCS	
8.	Household mortgage credit	
9.	Household consumption credit	
10.	NFCS' direct financing; NFCS' indirect financing; and Total loans disbursed by the banking system to the NFCS	BNM's Monthly Statistical Bulletins and Quarterly Economic Bulletins (various issues), and Bursa Malaysia

Table 3
Summary of the ADF and PP unit root tests

Variables	Test statistics (full sample)			
	Level		First difference	
	ADF[(a)]	PP	ADF[(a)]	PP
$ln\ y_t$	-3.5768	-2.3801	-5.8749 **	-10.9857 **
$ln\ s_t$	-1.8011	-2.1999	-6.6054 **	-6.7678 **
i_t	-3.0571	-3.5770 *	-6.2713 **	-11.1369 **
$ln\ P_t$	-1.8589	-1.6225	-5.0421 **	-8.1416 **
r_t	-2.0510	-3.3681	-8.6290 **	-13.0332 **
$ygap_t^{\#}$	-7.0753 **	-4.1383 **	-	-
$ygapf_t$	-3.9715 **	-2.7530 **	-	-
$F2_t$	-4.8215 **	-9.6939 **	-	-
$F3_t$	-5.2375 **	-9.9219 **	-	-

Variables	Test statistics (individual sub-periods)							
	1st sub-period				2nd sub-period			
	Level		First difference		Level		First difference	
	ADF	PP	ADF	PP	ADF[(b)]	PP	ADF[(b)]	PP
$ln\ y_t$	-2.3493	-1.7467	-2.7751 ^	-2.8654 ^	-2.9099	-2.5107	-5.6585 **	-9.6555 **
$ln\ s_t$	-2.7926	-2.6401	-5.5196 **	-6.8925 **	-2.1386	-2.1031	-5.9997 **	-4.7852 **
i_t	-3.0641	-3.4082	-7.5149 **	-8.4153 **	-4.1316	-2.2947	-5.3398 **	-4.9099 **
$ln\ P_t$	-3.0734	-2.6702	-5.3483 **	-5.6483 **	-3.0571	-1.5368	-7.0869 **	-5.7687 **
r_t	-2.3354	-2.3152	-6.9362 **	-7.4725 **	-3.4032	-2.1658	-4.9718 **	-6.4560 **
D_t	-0.4736	-0.6354	-5.3212 **	-5.2695 **	-2.9242	-2.8411	-3.8776	-9.6046 **
$ln\ BL_t$	-2.0371	-2.4972	-2.6443	-5.8125 **	-1.9230	-0.8090	-2.9691	-4.7517 **
$ln\ M_t$	-1.6403	-1.2693	-10.2821 **	-10.5444 **	-2.8254	-2.0807	-4.7034	-13.9640 **
$ln\ C_t$	-1.7057	-1.1199	-4.7906 **	-5.0959 **	-2.7356	-2.0917	-3.6587	-3.8642 *
$ygap_t^{\#}$	-3.3985 **	-2.0892 *	-	-	-5.1138 **	-4.5791 **	-	-
$ygapf_t^{\#}$	-2.0761 *	-1.9715 *	-	-	-4.0179 **	-2.4389 *	-	-
$F2_t$	-1.9553	-5.4244 **	-12.2363 **	-	-4.3341 *	-7.8223 **	-	-
$F3_t$	-2.4516	-5.5752 **	-12.0044 **	-	-4.5922 *	-8.4765 **	-	-

Notes:

^ (*) (**) Denotes rejection of the null of the unit root at 10% (5%) and (1%) level.

\# The ADF test applied to all the variables are assumed to follow a process containing a drift and a deterministic time trend. For $ygap_t$ and $ygapf_t$, the deterministic time trend is not included.

(a) The 5% and 1% critical values (for λ ≈ 0.3) for the adjusted ADF-type unit root test are -4.17 and -4.78 respectively (Perron, 1989).

(b) The 5% and 1% critical values (for λ ≈ 0.5) are -4.24 and -4.90 respectively (Perron, 1989).

Table 4

Summary of the Johansen cointegration test: Full sample

No. of cointegrating relations	Trace statistics	
	Baseline model	Extended model
None	62.4371 **	271.0997 **
At most 1	29.0037	199.9442 **
At most 2	7.3040	137.9139 **
At most 3	1.7313	77.5240 **
At most 4	-	39.8331

Note:
*(**) Denotes significance at 5% (1%) level.

Table 5

(a) Summary of the baseline VAR estimates: Full sample

Independent variable	Dependent variable			
	i_t	$\ln s_t$	$\ln y_t$	$\ln P_t$
Constant	9.8659 *	-0.0390	-0.0824	0.1441 **
	(1.6823)	(-0.2288)	(-0.4768)	(4.4824)
i_{t-1}	0.7729 **	0.0007	-0.0041 **	0.0005
	(13.4544)	(0.3930)	(-2.3990)	(1.6127)
$\ln s_{t-1}$	-1.5674	0.9586 **	-0.0696 *	0.0172 **
	(-1.1992)	(25.2593)	(-1.8068)	(2.3974)
$\ln y_{t-1}$	3.6014 **	0.0636	0.9368 **	0.0398 **
	(2.5633)	(1.5588)	(22.6200)	(5.1614)
$\ln P_{t-1}$	-8.7622 *	-0.1137	0.1690	0.8870 **
	(-2.3080)	(-1.0311)	(1.5101)	(42.6113)

Notes:
*(**) Denotes significance at 5%(1%) level.
The numbers in parentheses are the *t*-statistics.

(b) Summary of the extended VAR estimates: Full sample

Independent variable	Dependent variable							
	i_t	$\ln s_t$	D_t	$\ln BL_t$	$\ln C_t$	$\ln M_t$	$\ln y_t$	$\ln P_t$
Constant	42.7418 **	0.0608	-10.4969	-0.2682	-2.4648 **	1.1807	0.2872	0.2178
	(2.6851)	(0.1209)	(-1.1417)	(-0.7322)	(-3.8777)	(1.1039)	(0.5713)	(2.3270)
i_{t-1}	0.6056 **	0.0001	0.0569	0.0011	0.0032	-0.0121 **	-0.0072 **	0.0000
	(7.5906)	(0.0470)	(1.3509)	(0.6668)	(1.1029)	(-2.4642)	(-3.1290)	(0.1416)
$\ln s_{t-1}$	-1.4529	0.9916 **	-1.3091 *	-0.0911 **	-0.0207	0.0778	-0.1129 **	0.0236 **
	(-1.0435)	(24.6407)	(-1.7803)	(-3.1082)	(-0.4072)	(0.9098)	(-2.8064)	(3.1537)
D_{t-1}	0.1847	0.0096 **	0.8577 **	-0.0034	-0.0243 **	0.0021	-0.0103 **	0.0010 *
	(1.4064)	(2.5217)	(12.3658)	(-1.2479)	(-5.0733)	(0.2617)	(-2.7183)	(1.4710)
$\ln BL_{t-1}$	-1.0665	0.0258	0.0430	0.9693 **	0.0426	-0.1416 *	0.0007	-0.0178 *
	(-0.9973)	(0.8343)	(0.0761)	(43.0792)	(1.0912)	(-2.1559)	(0.0237)	(-3.0931)
$\ln C_{t-1}$	2.9053 **	0.0006	-0.3531	-0.0123	0.7953 **	0.1570 **	0.0281	0.0126
	(2.6778)	(0.0201)	(-0.6161)	(-0.5383)	(20.0744)	(2.3556)	(0.8963)	(2.1544)
$\ln M_{t-1}$	-2.0212 **	-0.0069 *	0.0533	-0.0150	0.0437	0.7847 **	-0.0255	-0.0140 *
	(-2.5112)	(-0.2987)	(0.1253)	(-0.8884)	(1.4874)	(15.8687)	(-1.0950)	(-3.2390)
$\ln y_{t-1}$	0.5503	0.1798 **	-0.7982	0.1305 **	0.3577 **	-0.2726 *	0.7319 **	0.0398 **
	(0.2221)	(2.5100)	(-0.6099)	(2.5030)	(3.9533)	(-1.7908)	(10.2270)	(2.9850)
$\ln P_{t-1}$	-8.9800	-0.4318 **	4.5064	-0.0732	-0.0186	0.7516 *	0.5346 **	0.9124 **
	(-1.5403)	(-2.5628)	(1.4636)	(-0.5968)	(-0.0874)	(2.0985)	(3.1752)	(29.1032)

Notes:
*(**) Denotes significance at 5%(1%) level.
The numbers in parentheses are the *t*-statistics.

Table 6

Summary of the Chow's breakpoint test

Equation	*F*-Statistics+ (Break point – 1990:3)	
	Baseline VAR	**Extended VAR**
i_t	3.6329 **	3.2557 **
$ln\ s_t$	2.9165 *	4.7534 **
D_t	-	2.3706 *
$ln\ BL_t$	-	1.5856
$ln\ C_t$	-	4.3850 **
$ln\ M_t$	-	4.7890 **
$ln\ y_t$	7.8250 **	5.7104 **
$ln\ P_t$	4.8010 **	3.7506 **

Notes:

^ (*) (**) Denotes significance at 10% (5%) and (1%) level.

+ The *F*-statistics are the single equation test statistics.

Table 7

(a) Summary of the baseline VAR estimates: 1st sub-period

Independent variable	Dependent variable			
	i_t	$ln\ s_t$	$ln\ y_t$	$ln\ P_t$
Constant	-21.2514 (-0.8807)	-0.2772 (-0.8328)	0.3810 (1.1886)	0.4133 ** (3.6128)
i_{t-1}	0.5764 ** (4.4971)	0.0003 (0.1693)	-0.0045 ** (-2.6236)	0.0000 (0.0443)
$ln\ s_{t-1}$	-12.0675 ** (-2.4290)	0.9023 ** (13.1672)	0.0063 (0.0949)	0.0210 (0.8897)
$ln\ y_{t-1}$	5.1334 (1.4673)	0.0833 * (1.7258)	0.9979 ** (21.4766)	0.0259 (1.5619)
$ln\ P_{t-1}$	-3.2051 (-0.4484)	-0.0925 (-0.9382)	-0.0658 (-0.6928)	0.8591 ** (25.3511)

Notes:

*(**) Denotes rejection of the null of the unit root at 5%(1%) level.

The numbers in parentheses are the *t*-statistics.

Table 7

(b) Summary of the baseline VAR estimates: 2nd sub-period

Independent variable	Dependent variable			
	i_t	$ln\ s_t$	$ln\ y_t$	$ln\ P_t$
Constant	10.8592 * (1.8630)	-0.6009 (-1.5610)	-0.3094 (-0.8861)	0.1258 ** (3.0057)
i_{t-1}	0.8921 ** (20.5651)	0.0044 (1.5245)	-0.0042 (-1.5994)	0.0007 * (2.2436)
$ln\ s_{t-1}$	1.5055 * (1.6565)	1.0149 ** (16.9102)	-0.2435 ** (-4.4731)	0.0254 ** (3.8882)
$ln\ y_{t-1}$	7.9335 ** (5.0255)	0.2935 ** (2.8150)	0.4759 ** (5.0313)	0.0530 ** (4.6746)
$ln\ P_{t-1}$	-18.7300 ** (-4.8330)	-0.4976 * (-1.9443)	1.2054 ** (5.1915)	0.8612 ** (30.9606)

Notes:

*(**) Denotes rejection of the null of the unit root at 5%(1%) level.

The numbers in parentheses are the *t*-statistics.

Table 8

(a) Summary of the extended VAR estimates: 1st sub-period

Independent variable	Dependent variable							
	i_t	***$\ln s_t$***	***D_t***	***$\ln BL_t$***	***$\ln C_t$***	***$\ln M_t$***	***$\ln y_t$***	***$\ln P_t$***
Constant	37.5691	0.6480	5.8037	0.2296	-1.7088	0.7587	-0.3949 *	0.0952
	(0.9797)	(1.3488)	(0.4995)	(0.3941)	(-1.6023)	(0.7323)	(-0.8291)	(0.5796)
i_{t-1}	0.3737 **	0.0025	0.0718	0.0030	0.0139 **	-0.0173 **	-0.0032 *	-0.0005
	(2.5642)	(1.3428)	(1.6257)	(1.3470)	(3.4340)	(-4.3883)	(-1.7483)	(-0.8031)
$\ln s_{t-1}$	-18.1995 **	0.6897 **	-2.2831	-0.2080 *	-0.2855	0.0816	0.0657	0.0914 **
	(-2.5480)	(7.7083)	(-1.0549)	(-1.9164)	(-1.4372)	(0.4231)	(0.7406)	(2.9896)
D_{t-1}	-0.0357	-0.0000	0.7948 **	-0.0108 *	-0.0377 **	0.0272 **	-0.0142 **	0.0006
	(-0.0911)	(-0.0135)	(6.6893)	(-1.8137)	(-3.4597)	(2.5685)	(-2.9244)	(0.3351)
$\ln BL_{t-1}$	-3.0167	-0.2063 *	1.0320	0.5878 **	-0.2843	0.4038 *	0.0373	0.1117 **
	(-0.3767)	(-2.0568)	(0.4253)	(4.8310)	(-1.2769)	(1.8665)	(0.3753)	(3.2587)
$\ln C_{t-1}$	6.0671 *	0.0667 *	-0.1135	0.0848 *	0.8886 **	0.1689 *	-0.0920 **	-0.0341 *
	(1.9122)	(1.6782)	(-0.1181)	(1.7587)	(10.0712)	(1.9702)	(-2.3359)	(-2.5121)
$\ln M_{t-1}$	-1.1174	0.1811 **	0.2987	0.1640 **	0.3024 **	0.4652 **	0.0218	-0.0689 **
	(-0.2769)	(3.5824)	(0.2442)	(2.6741)	(2.6947)	(4.2670)	(0.4340)	(-3.9869)
$\ln y_{t-1}$	-2.7860	0.1106	-2.9303 *	0.0288	0.3770 *	-0.0825	0.8873 **	0.0349
	(-0.4358)	(1.3808)	(-1.5127)	(0.2965)	(2.1205)	(-0.4775)	(11.1744)	(1.2739)
$\ln P_{t-1}$	0.9625	-0.2965	2.7933	0.3936	-0.0807	-0.1759	0.3546 *	0.8344 **
	(0.0563)	(-1.3832)	(0.5388)	(1.5141)	(-0.1696)	(-0.3806)	(1.6686)	(11.3895)

Table 8

(b) Summary of the extended VAR estimates: 2nd sub-period

Independent variable	Dependent variable							
	i_t	***$\ln s_t$***	***D_t***	***$\ln BL_t$***	***$\ln C_t$***	***$\ln M_t$***	***$\ln y_t$***	***$\ln P_t$***
Constant	62.8806 **	2.0935 **	-8.0539	0.6257	0.7072	-2.4134	1.7475 *	0.1806
	(4.5699)	(2.3523)	(-0.4804)	(1.0304)	(1.0205)	(-1.2622)	(2.0322)	(1.5517)
i_{t-1}	0.6704 **	-0.0113 **	-0.0578	-0.0029	-0.0141 **	-0.0059	-0.0076 *	0.0007
	(10.5109)	(-2.7336)	(-0.7435)	(-1.0125)	(-4.3812)	(-0.6680)	(-1.9153)	(1.2127)
$\ln s_{t-1}$	0.6958	1.0124 **	0.8488	-0.1515 **	-0.2190 **	0.4052 **	-0.3050 **	0.0223 **
	(0.7225)	(16.2522)	(0.7233)	(-3.5635)	(-4.5154)	(3.0279)	(-5.0671)	(2.7418)
D_{t-1}	0.1023	-0.0014	0.6107 **	-0.0012	-0.0125 **	-0.0376 **	0.0033	0.0008
	(1.0984)	(-0.2313)	(5.3834)	(-0.2909)	(-2.6733)	(-2.9032)	(0.5659)	(0.9534)
$\ln BL_{t-1}$	-0.3476	-0.0520	1.6641	0.9788 **	0.0522 *	-0.8602 **	-0.1690 *	0.0064
	(-0.2583)	(-0.5971)	(1.0146)	(16.4766)	(0.7700)	(-4.5988)	(-2.0093)	(0.5600)
$\ln C_{t-1}$	4.1973 **	0.2583 **	-0.7414	0.0733	1.0613 **	0.3592 **	0.2406 **	-0.0010
	(3.8327)	(3.6472)	(-0.5556)	(1.5157)	(19.2424)	(2.3601)	(3.5158)	(-0.1065)
$\ln M_{t-1}$	-1.7233	-0.1812 **	-0.3395	-0.0323	-0.0214	0.1726	-0.1051	0.0065
	(-1.6011)	(-2.6024)	(-0.2589)	(-0.6794)	(-0.3943)	(1.1540)	(-1.5629)	(0.7138)
$\ln y_{t-1}$	3.5582 *	0.1024	3.8804 *	-0.0011	-0.1231	0.3382	0.2232 *	0.0482 **
	(1.8286)	(0.8139)	(1.6366)	(-0.0125)	(-1.2558)	(1.2508)	(1.8357)	(2.9260)
$\ln P_{t-1}$	-23.4573 **	-0.6457 *	-7.8859	-0.1111	0.0053	2.4801 **	1.4518 **	0.8363 **
	(-4.6333)	(-1.9719)	(-1.2783)	(-0.4974)	(0.0209)	(3.5253)	(4.5888)	(19.5248)

Notes:

*(**) Denotes significance at 5%(1%) level. The numbers in parentheses are the *t*-statistics.

Table 9
(a) Variance decomposition (in percentage) of output to monetary policy shock

		Baseline VAR	
Quarters	**Full sample**	**1st sub-period**	**2nd sub-period**
2	6.46	27.07	1.10
4	12.84	42.04	2.14
6	17.40	48.04	2.65
8	20.13	49.86	2.61
10	21.56	49.67	2.50
12	22.17	48.60	2.50
		Extended VAR	
Quarters	**Full sample**	**1st sub-period**	**2nd sub-period**
2	12.90	13.62	0.73
4	19.00	18.97	1.02
6	19.90	17.67	4.70
8	19.87	14.91	7.81
10	19.82	12.08	8.31
12	19.88	9.72	7.82

Table 9
(b) Variance decomposition (in percentage) of aggregate price level to monetary policy shock

		Baseline VAR	
Quarters	**Full sample**	**1st sub-period**	**2nd sub-period**
2	5.01	2.10	12.98
4	5.40	1.53	19.87
6	3.86	2.03	21.92
8	3.11	4.48	22.53
10	3.80	8.46	22.57
12	5.37	12.96	22.34
		Extended VAR	
Quarters	**Full sample**	**1st sub-period**	**2nd sub-period**
2	0.94	2.92	8.49
4	0.58	7.54	5.91
6	1.42	7.54	5.91
8	3.24	5.37	5.42
10	5.45	4.30	4.26
12	7.58	3.50	3.80

Table 10
Standard deviation of interest rate shocks

VAR category	**Full sample**	**1st sub-period**	**2nd sub-period**
Baseline VAR	1.12	1.27	0.54
Extended VAR	1.06	1.34	0.60

Note:
The residuals from the interest rate equation in the VAR model are used for computation.

Table 11

(a) IS equation estimates and diagnostic tests: Full sample analysis

(I) IS equation estimates

Coefficient	Baseline model	Model with F2	Model with F3
α_0	0.9721 *	0.7846	0.7653
	(2.1494)	(1.7391)	(1.6857)
α_1	0.2571 *	0.2670 *	0.2734 *
	(2.0091)	(2.0166)	(2.0843)
α_2	0.5910 **	0.5761 **	0.5693 **
	(5.3741)	(5.2666)	(5.3117)
α_3	-0.3459 **	-	-
	(-2.3556)		
α_{31}	-	-0.3745 **	-0.3951 **
		(-2.3456)	(-2.4267)
α_{32}	-	0.01385	0.0202
		(0.8106)	(1.0087)

(II) Diagnostic tests

Test	Test statistics		
	Baseline model	Model with F2	Model with F3
Heteroscedasticity			
White's test	1.7924	1.5022	1.4264
(without cross terms)	[0.1087]	[0.1669]	[0.1957]
ARCH	0.0141	0.2891	0.3716
	[0.9056]	[0.5920]	[0.5435]
Autocorrelation			
Breusch-Godfrey LM test	6.1044 **	6.5457 **	6.9458 **
	[0.0032]	[0.0022]	[0.0015]

(b) IS equation estimates and diagnostic tests: Sub-period analysis

(I) IS equation estimates

Coefficient	Baseline model		Model with F2		Model with F3	
	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period
α_0	0.8460	-0.0424	0.4822	-0.1453	0.4317	-0.1111
	(1.4535)	(-0.0551)	(0.8987)	(-0.1757)	(0.8285)	(-0.1366)
α_1	0.0300	0.3908 *	0.0550	0.3733 **	0.0430	0.3785 *
	(0.1682)	(2.3692)	(0.3226)	(2.3314)	(0.2549)	(2.3545)
α_2	0.8942 **	0.2815 **	0.8364 **	0.2790 **	0.8372 **	0.2773 **
	(8.5431)	(3.1847)	(10.3404)	(3.1040)	(10.8659)	(3.1082)
	-0.2266	0.0137	-	-	-	-
	(-1.0043)	(0.0487)				
	-	-	-0.3298 **	-0.1125	-0.3462 **	-0.1254
			(-2.9258)	(-0.3486)	(-3.1156)	(-0.3609)
α_{32}	-	-	0.1082	0.0154	0.1063	0.0186
			(1.0412)	(0.5071)	(1.0161)	(0.4588)

(II) Diagnostic tests

Test	Test statistics					
	Baseline model		Model with F2		Model with F3	
	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period
Heteroscedasticity						
White's test	2.0307	2.1353	1.8685	1.4926	1.9432	1.5715
(without cross terms)	[0.0876]	[0.0644]	[0.0991]	[0.1832]	[0.0863]	[0.1568]
ARCH	0.1732	0.4834	0.3517	0.5807	0.4103	0.5966
	[0.6795]	[0.4897]	[0.5566]	[0.4492]	[0.5256]	[0.4431]
Autocorrelation						
Breusch-Godfrey	20.4402 **	8.8835 **	21.0931 **	8.1882 **	19.5220 **	7.9993 **
LM test	[0.0000]	[0.0043]	[0.0000]	[0.0060]	[0.0001]	[0.0066]

Notes:

** (*) Denotes significance at 5% (1%) level.

The numbers in parentheses and brackets are the *t*-statistics and the p-values respectively.

Table 12

(a) IS equation re-estimates: Full sample analysis

(I) IS equation estimates

Coefficient	**Baseline model**	**Model with F2**	**Model with F3**
β_0	0.9287 *	0.5926	0.5788
	(1.9025)	(1.2035)	(1.1621)
β_1	0.2788 *	0.3100 **	0.3219 **
	(2.2426)	(2.3412)	(2.4756)
β_{21}	0.7140 **	0.7008 **	0.6951 **
	(5.7285)	(5.5191)	(5.5873)
β_{22}	-0.2063 **	-0.2043 **	-0.2045 **
	(-3.2267)	(-3.2372)	(-3.2105)
β_{31}	-0.0830	-	-
	(-0.4427)		
$\beta_{31,i}$	-	0.0622 **	0.1023
		(0.3396)	(0.5957)
$\beta_{41,i}$	-	-0.0433	-0.0546
		(-1.1146)	(-1.2664)
β_{32}	-0.2537 *	-	-
	(-2.1191)		
$\beta_{32,i}$	-	-0.4493 **	-0.5337 **
		(-3.9024)	(-4.1452)
$\beta_{42,i}$	-	0.0674 *	0.0904 *
		(1.7842)	(2.0376)

(I) Diagnostic tests

Test	**Test statistics**		
	Baseline model	**Model with F2**	**Model with F3**
Heteroscedasticity			
White's test (without cross terms)	1.4120	1.1786	1.1206
	[0.1876]	[0.3061]	[0.3520]
ARCH	0.3241	0.0117	0.0903
	[0.5704]	[0.9142]	[0.7645]
Autocorrelation			
Breusch-Godfrey LM test	4.6501	6.7174	5.1739
	[0.0119]	[0.0111]	[0.0252]

Notes:

*(**) Denotes significance at 5%(1%) level.

The numbers in parentheses and brackets are the *t*-statistics and p-values respectively.

(b) IS equation re-estimates: Sub-period analysis

(I) IS equation estimates

Coefficient	Baseline model		Model with F2		Model with F3	
	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period
β_0	0.2770	-0.8068	0.1039	-0.8447	0.0870	-0.7965
	(1.1721)	(-0.8309)	(0.4271)	(-0.8039)	(0.3569)	(-0.7712)
β_1	0.0774	0.4406 *	0.1250	0.4245 *	0.1100	0.4241 *
	(0.9576)	(2.4674)	(1.5269)	(2.2666)	(1.3454)	(2.2923)
β_{21}	1.5301 **	0.3866 **	1.4294 **	0.3882 **	1.4178 **	0.3924 **
	(16.3765)	(4.1990)	(15.9237)	(3.9685)	(15.7896)	(4.0211)
β_{22}	-0.7124 **	-0.3917 **	-0.6609 **	-0.3730 **	-0.6470 **	-0.3714 **
	(-8.1313)	(-5.2737)	(-7.3131)	(-4.8568)	(-7.0068)	(-4.8365)
β_{31}	0.0825	0.7764	-	-	-	-
	(0.6905)	(1.4179)				
$\beta_{31,i}$	-	-	0.1280	2.0014 **	0.0886	1.9726 **
			(1.1332)	(2.9162)	(0.7913)	(2.7345)
$\beta_{41,i}$	-	-	0.0154	-0.1141	0.0392	-0.1377 *
			(0.2072)	(-1.4057)	(0.6284)	(-1.3659)
β_{32}	-0.1814	-0.4259	-	-	-	-
	(-1.3370)	(-0.6495)				
$\beta_{32,i}$	-	-	-0.3687 **	-1.7603 **	-0.3387	-1.7854 **
			(-3.1963)	(-2.6174)	(-1.1218)	(-2.5550)
$\beta_{42,i}$	-	-	0.0772	0.1267 *	0.0478	0.1572 *
			(1.4264)	(1.8491)	(1.1564)	(1.7827)

(II) Diagnostic tests

Test	Test statistics					
	Baseline model		Model with F2		Model with F3	
	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period
Heteroscedasticity						
White's test (without cross terms)	1.0512	0.9464	1.1386	0.8265	1.2243	0.8431
	[0.4276]	(0.5199)	[0.3737]	(0.6377)	[0.3166]	(0.6210)
ARCH	0.0090	0.7975	0.0187	0.1001	0.0304	0.1877
	[0.9250]	[0.3757]	[0.8918]	[0.7529]	[0.8625]	[0.6665]
Autocorrelation						
Breusch-Godfrey LM test	4.6432	1.7128	1.3146	3.4360	0.9003	3.1496
	[0.0167]	[0.1966]	[0.2601]	[0.0697]	[0.3498]	[0.0820]

Note:
*(**) Denotes significance at 5%(1%) level.
The numbers in parentheses and brackets are the *t*-statistics and p-values respectively.

Table 13

(a) Summary of *F*-test: Real interest rate elasticity

(I) Full sample

	Baseline model	Model with F2	Model with F3
$(\beta_{31} + \beta_{32})$	-0.3368 * (4.5596)	-	-
$(\beta_{31,i} + \beta_{32,i})$	-	-0.3871 * (5.2166)	-0.4315 * (6.1337)

(II) Sub-period analysis

	Baseline model		Model with F2		Model with F3	
	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period
$(\beta_{31} + \beta_{32})$	-0.0988 (1.5134)	0.3505 (0.9609)	-	-	-	-
$(\beta_{31,i} + \beta_{32,i})$	-	-	-0.2407 ** (9.4068)	0.2411 (0.4412)	-0.2501 ** (9.7778)	0.1873 (0.2549)

Notes:

*(**) Denotes significance at 5% (1%) level.

The numbers in parentheses are the *F*-statistics.

Table 13

(b) Summary of *F*-test: Interaction effect of real interest rate and measures of financial disintermediation

(I) Full sample

	Model with F2	Model with F3
$(\beta_{41,i} + \beta_{42,i})$	0.0241 (1.9925)	0.0357 ^ (3.3051)

(II) Sub-period analysis

	Model with F2		Model with F3	
	1st sub-period	2nd sub-period	1st sub-period	2nd sub-period
$(\beta_{41,i} + \beta_{42,i})$	0.0925 * (6.9272)	0.0125 (0.1404)	0.0870 ** (8.1453)	0.0195 (0.2238)

Notes:

^ (*) (**) Denotes significance at 10% (5%) (1%) level.

The numbers in parentheses are the *F*-statistics.