Short-Term Interest Rate and Own Rate of Money in Malaysian Money Demand Function

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ABSTRACT

This article has examined empirically the issues of the role of short-term interest rate and rate of return on money in a money demand function of a developing economy—Malaysia. The results suggest that short-term interest rate and rate of return on money play important role in the Malaysian money demand function, and excluding it from the model could subject it to misspecification error. Also, the model that incorporates short-term interest rate and the rate of return on money is stable over time (in Malaysia, this is true for M2). The results of ex-post forecast suggest that the model that incorporates both short-term interest rate and rate of return on money has better forecasting ability.

INTRODUCTION

Traditionally, the demand for money balances is determined by a scale variable-usually real income, and an opportunity cost variable such as expected inflation or expected interest rate on alternative financial
assets (Laidler 1977; Goldfeld 1973, 1976). However, in many of the studies pertaining to developing countries, the expected interest rate is usually excluded from the model. The final model is usually left with only inflation rate (to proxy for the opportunity cost of holding money) and income level for estimation.

There are several reasons for excluding the interest rate from the model. First, many authors claimed that it is due to the unavailability of data on interest rate. Since there is no agreement as to which interest rates would best represent the cost of holding money, varieties of interest rates must be acquired before estimation. This would be time consuming and computationally burdensome. Second, it is due to the relatively thin market for financial securities such that the only relevant substitute for money is capital goods (Khan 1980). Third, in most developing nations, interest rates are controlled and administered by the government and as such there is no sufficient variation in these interest rates to influence the estimated demand for money function (Aghevli et al. 1979). Fourth, due to the underdeveloped nature of the financial market in the developing countries, expected rate of inflation is considered as the appropriate variable (Crockett and Evans 1980). Finally, the Shaw - McKinnon theorists argue that, due to the fragmentation of capital and financial markets in developing economies the demand for money function should be modified in contrast to the Keynesian tradition. Instead of arguing that money and capital are substitutes, they argue that there is complementary relationship between capital and money (McKinnon 1973; Shaw 1973).

In view of the above, it is not surprising that most studies on the demand for money pertaining to developing countries has totally ignored the role of interest rate and/or the own rate of money in the money demand model. Therefore, the aim of this paper is to justify empirically the role of short-term interest rate and the own rate of money in the demand for money function in Malaysia. This paper is divided into seven sections. The model used in this study will be discussed in section 2 and in section 3, empirical results will be presented. The test for specification, stability and ex-post forecasting ability are presented in section 4, 5 and 6 respectively. The final section contains the conclusion.

THE MODEL

Traditionally, the demand for real money balances is determined by a scale variable and the opportunity cost of holding money variable
Malaysian Money Demand Function

(Goldfeld 1973, 1976; Laidler 1977). The scale variable measure the volume of transactions in an economy in which gross national product is usually employed as a proxy. On the other hand, the return in holding money in alternative financial assets is measured by the opportunity cost of holding money variable. Other than holding money in financial assets, one can also purchase capital goods. The former is usually measured by the expected interest rate of that financial assets and the latter is measured by the expected rate of inflation. Further, since money is composed of deposits that yield returns, one can include own rate of return on deposit into the model (Khan 1980; Artis and Lewis 1976; Leahey and Robins 1985). Thus, the demand for money function could be specified by the following functional form:

$$m_t^* = f(y_t, P_t, r_{it}, r_{Mt})$$  \hspace{1cm} (1)

where $m_t^*$ is the desired real money balances, $y_t$ is the real income level, $P_t$ is the rate of inflation, $r_{it}$ is the interest rate on alternative financial assets and $r_{Mt}$ is the rate of return on money (for example, the relevant deposit interest rate).

With the inclusion of $r_{Mt}$ in the model, question would arise as to what is the rate of return on the narrow definition of money stock $M1$. This is because it is commonly assumed that $M1$ which is composed of demand deposit bears zero return. However, more recently the issue of zero return on demand deposit has been taken more seriously in the literature. Authors argue that banks do pay implicit interest on demand deposits by giving services such as cheque clearing, computerization, branching, promotion and the like. Startz (1979), Rush (1980), Leaf (1984), Mitchell (1979) and Klein (1974) have given different views in estimating the implicit interest of demand deposit. Startz, Rush, Leaf and Mitchell estimate the implicit interest on demand deposit by using primary data on cost rendered in giving services on demand deposit to customers. This is a direct measure of estimating implicit interest on demand deposit. On the other hand, Klein (1974) provides an indirect estimate of implicit interest by giving the following formula for the rate of return ($r_{M1}$) on money $M1$:

$$r_{M1} = r_L [(DD - RES)/M1]$$  \hspace{1cm} (2)

where $r_L$ is the yield of commercial bank's investment (for example, lending rate), DD is demand deposits, RES is the reserves and $M1$ is the narrow definition of money stock. Since there is no agreement as
to how to estimate the own rate of money, as an alternative to the above formulation, a modified version of the above is given as follows

\[ r_{M1} = \{r_L - [r_L/(r_{SD} + r_{TD})](D/D|BA)\} \quad (3) \]

where \( r_{SD} \) is saving deposit rate, \( r_{TD} \) is time deposit rate (12-month), and \( BA \) is total bank assets. The own rate of money, \( r_{M1} \) will indirectly measure the implicit interest on demand deposits. To the bank implicit interest is the marginal cost of giving services in the form of tangible (bank branches, promotion, computerization) and intangibles (courtesy campaign, cheque clearing services) in attracting demand deposits from the customers. To the customer, this rate is 'realised' in the form of banking services that they received in depositing their money in checking account.

**EMPIRICAL RESULTS**

In this study we employed time series data for the period 1960 to 1984. All data are compiled from various issues of the Quarterly Economic Bulletin published by Bank Negara Malaysia. For the money stock; \( M1 \) is represented by currency in circulation plus demand deposit of non-bank private sectors, \( M2 \) equals \( M1 \) plus savings and time deposits held at commercial bank, and \( M3 \) is \( M2 \) plus savings and time deposits of finance companies, merchant banks, National Saving Bank and Employee Provident Funds. In this study the appropriate relevant interest rate on short-term financial asset is the 3-month Treasury bill rate. On the other hand, the appropriate rate of return on \( M2 \) is measured by commercial bank saving rate and for \( M3 \) the commercial bank 12-month fixed deposit rate. Other variables used in this study are real income as measured by gross national product deflated by consumer price index, and lastly inflation rate as measured by the growth rate of consumer price index.

Three different models were estimated for each of the definition of money stock for comparison. After allowing for partial adjustment (Chow 1966), we arrived at the following estimating models in logarithm form:

**MODEL I:**

\[
\log m_t = \alpha_0 + \alpha_1 \log y_t + \alpha_2 \log (P_t/P_{t-1}) \\
+ \alpha_3 \log m_{t-1} + \mu_t
\]
MODEL II:
\[ \log m_t = \beta_0 + \beta_1 \log y_t + \beta_2 \log \left( \frac{P_t}{P_{t-1}} \right) + \beta_3 \log r_{it} + \beta_4 \log m_{t-1} + \varepsilon_t \]  

(5)

MODEL III:
\[ \log m_t = \theta_0 + \theta_1 \log y_t + \theta_2 \log \left( \frac{P_t}{P_{t-1}} \right) + \theta_3 \log r_{it} + \theta_4 \log r_{Mt} + \theta_5 \log m_{t-1} + \tau_t \]  

(6)

The stochastic disturbance terms; \( \mu_t, \varepsilon_t \) and \( \tau_t \) are assumed to have zero means and constant variance. However, due to the presence of lagged dependent variable \( m_{t-1} \), as one of the regressor, in this study we employed the maximum likelihood method due to Beach and MacKinnon (1978) to correct for autocorrelation.

Table 1 shows the estimated regression equations for the money stock \( M_1 \). For the estimating Model III, we employed both formulation – Klein’s version and the modified version. Both options are reported in Table 1. The results in Table 1 show that, in all cases the goodness of fit is very satisfactory. The estimated coefficients of the parameters have correct signs and all are significant except for the rate of inflation which is not significant in the first three of the four estimated regression equations. The rate of inflation is significant at the five percent level in regression equation of Option II for Model III, that is, when \( r_{M1} \) is included in the model. Comparing the regression equation for both options, the results suggest that Option II which used the modified version in estimating \( r_{Mt} \) is superior than the regression equation (Option I) which used Klein’s formula. Further, the estimated coefficient has the correct sign and all variables are significant at the one percent level except for the rate of inflation which is significant at the five percent level.

On the other hand, Table 2 present the estimation results for money stock \( M_2 \). In all cases the estimated coefficients have the correct signs. Going through regression equation from Model I to Model III there is an appreciable improvement in the coefficient of the multiple determination \( (R^2) \) and also in the significance of the variables shown by the ‘t-statistics’. In Model III, when \( r_{M2} \) is included in the model, all variables are significant at the one percent level.

The regression results for the money stock \( M_3 \) are shown in Table 3. In all cases the goodness of fit is very satisfactory. All estimated coefficients have the correct signs. The importance of the rate of return on money \( M_3 \), is shown by the regression equation in
<table>
<thead>
<tr>
<th>MODEL</th>
<th>Constant</th>
<th>$Y_t$</th>
<th>$P_t/P_{t-1}$</th>
<th>$r_{it}$</th>
<th>$r_{M1t}$</th>
<th>$m_{t-1}$</th>
<th>$R^2$</th>
<th>D.W.</th>
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**Note:** ***Statistically significant at the one percent level<br>** Statistically significant at the five percent level<br>* Statistically significant at the ten percent level<br>Figures in the parentheses are the 't-statistics'.
<table>
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<th>$r_{M2t}$</th>
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**Statistically significant at the five percent level  
*Statistically significant at the ten percent level  
Figures in the parentheses are the 't-statistics'.
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<th>MODEL</th>
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<th>$r_{M3t}$</th>
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Note: ***Statistically significant at the one percent level
**Statistically significant at the five percent level
*Statistically significant at the ten percent level
Figures in the parentheses are the ‘t-statistics’. 
Model III where all variables are significant at the one percent level except for real income which is significant at the five percent level when $r_{M3}$ is incorporated in the model.

**TEST OF MODEL SPECIFICATION**

The objective of this section is to test whether Model III is the 'true' model for the Malaysian demand for money function. As such we have to employ an appropriate measure to test for the correct model, and such test is the J-test developed by Davidson and MacKinnon (1981). The procedure has been detailed in other studies (for example, see Spencer 1985), however, here we mention it very briefly.

Suppose that the model

**Model I**

$$H_A: M = X_1 \beta_1 + \mu_1$$

(7)

**Model II**

$$H_B: M = X_2 \beta_2 + \mu_2$$

(8)

**Model III**

$$H_C: M = X_3 \beta_3 + \mu_3$$

(9)

where $M$ is the vector of observations on the dependent variable; $X_1$, $X_2$ and $X_3$ are the matrices of observations on the regressors in the three models; $\beta_1$, $\beta_2$ and $\beta_3$ are the corresponding vectors of coefficients, and $\mu_1$, $\mu_2$ and $\mu_3$ are the vectors of stochastic disturbance terms. In order to test that Model III, the maintained hypothesis is the 'true' model, the first step is to regress the following equation:

$$M = (1 - \phi_1 - \phi_2)X_3 \beta_3 + \phi_1 X_1 \beta_1 + \phi_2 X_2 \beta_2 + \mu_3$$

(10)

Then the J-statistic is obtained by performing an F-test with the restriction that all the $\phi$'s are zero. The F-statistic is specified as follows:

$$F_{(P, N - K)} = \frac{[RSS_0 - RSS_1]/P}{[RSS_1/(N - K)]}$$

where $F_{(P, N - K)}$ has an $F(P, N - K)$ distribution under the maintained hypothesis, $H$; $RSS_0$ is the sum of the squared residuals of equation (9); $RSS_1$ is the sum of the squared residuals of equation (10), $N$ is the total number of observations; $K$ is the number of estimated parameters including intercept; and $P$ is the number of restrictions. In
stability of Model I, Model II and Model III, we used the Chow test (Chow 1960). To perform a Chow test we must divide the period of study into two equal subsample periods; subsample period 1960–1972 and subsample period 1973–1984. The results are shown in Table 5. The F-statistics indicates that, demand for money function using Model II are stable for M2 and M3. On the other hand, the demand for money function employing Model III are stable for money stock M2 only.

EX-POST FORECASTING ABILITY

Another important criteria of a good model is how well it can predict. Therefore, an accepted good economic model (compared to the other alternative models) can closely resemble the ‘real world’. In this study the three models forwarded are tested for its ex-post forecasting ability. One way of assessing these tests is using the Theil’s inequality coefficient (U), defined as:

\[
U = \frac{\sqrt{\sum_{t=1}^{T} (M_t^s - M_t^a)^2}}{\sqrt{\sum_{t=1}^{T} (M_t^s)^2} + \sqrt{\sum_{t=1}^{T} (M_t^a)^2}}
\]

where \(M_t^s\) is the simulated value of \(M_t\), \(M_t^a\) is the actual value of \(M_t\) and \(T\) is the number of periods in the simulation.

The results of the simulation are presented in Table 6. Going through Model I to Model III for each of the money stock M1, M2 and M3, we observed that there is an appreciable improvement in the root mean square error (RMSE) and Theil’s inequality coefficient, where Model III attained the lowest value. Therefore, the results suggest that Model II which incorporates interest rate simulates better than Model I and on the other hand, Model III which incorporates both interest rate and own rate of money simulates better than Model II and subsequently better than Model I.

CONCLUSION

Most studies on estimating the demand for money function for developing countries have ignored the role of short-term interest rate and the rate of return on money as one of the variables in the money
demand model. More often that not, writers tend to blame the nature of the financial situation of that particular country as a scapegoat in excluding interest rate and/or own rate of money in the final estimating model without prior investigating the underlying background of the country under study.

This paper has examined empirically the issues of the role of short-term interest rate and rate of return on money in a money demand function of a developing economy—Malaysia. The results suggest that short-term interest rate and rate of return on money play important roles in the Malaysian money demand function and excluding it from the model would subject it to misspecification error (in Malaysia, this is true for M1 and M2). Also the model that incorporates short-term interest rate and the rate of return on money is stable over time (in Malaysia, this is true for M2). Our ex-post forecast suggested that the model that incorporate both short-term interest rate and own rate of money has a better forecasting ability.

It is concluded that the Malaysian demand for money function for money stock M1, M2 and M3 should be specified with the following variables as its explanatory variables; real income level, short-term interest rate, inflation rate and the own rate of money, such that appropriate policies could be manipulated by employing the underlying variables of the demand for money function.

REFERENCES


