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THE EFFECT OF COST OF CREDIT ON MONEY DEMAND:EMPIRICAL EVIDENCE FROM MALAYSIA

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ABSTRACT

This paper investigates the dynamic of long-run relationship between cost of credit and real money balances in Malaysia. The Johansen-Juselius (1990) likelihood ratio tests support the importance of the cost of credit in the real broad money demand function. The sample period spans from 1978:q1 through 1997:q4. The results provide empirical evidence for the long-run relationship between cost of credit and broad money balances in Malaysia.

Key words: *Johansen-Juselius (1990) likelihood ratio test, demand for money, cost of credit, developing country.*

ABSTRAK

Kertas ini mengkaji perhubungan jangka panjang antara kos kredit dan baki wang benar di Malaysia. Ujian nisbah kebolehjadian Johansen-Juselius (1990) menyokong kepentingan kos kredit untuk fungsi permintaan wang meluas benar. Jangka masa kajian bermula daripada 1978:q1 sehingga 1997:q4. Keputusan menyarankan bahawa wujudnya hubungan jangka panjang antara kos kredit dan baki wang meluas di Malaysia.

INTRODUCTION

The objective of this paper is to empirically investigate whether cost of credit acts as an important determinant of broad money (M2) demand function in the Malaysian case. It is generally accepted that demand for money has an important implication in monetary policy changes in many economies. In developed economies, the monetary policy is used to alter the short-run business cycle fluctuation as well as to stabilise the long-run price movements. However, among developing economies, the monetary policy places greater emphasis on long-run economic growth, where the monetary expansion is frequently used as a major instrument in government's demand-side economic management. The public demand for a newly created money such as credit, has important implications on critical macroeconomic variables such as income, interest rate, inflation and cost of credit, hence credit availability. Basically, the demand for real money balances could be divided into three components. Firstly, the transactions demand which is positively related to income. Secondly, the precautionary demand which is positively related to income and finally, the speculative demand which is inversely related to interest rate.

This paper attempts to include the cost of credit as an additional determinant of demand for money in addition to the standard text book variables, that is, income and interest rate. Why does cost of credit matter? The whole idea stems from the fact that banks' actions influence the availability of credit and the money supply. That means, whenever banks increase their loans, the money supply increases by the amount of the loans. Thus, money demand must change for money market to return to equilibrium condition. Therefore, we postulate that changes in the cost of borrowing or credit are likely to affect the demand for money.

This paper is organised as follows. Section 2 highlights existing literature in the area of monetary policies. Section 3 sets up the empirical model. Section 4 presents the method of estimation. Section 5 reports the empirical results and finally, Section 6 offers our concluding remarks.

LITERATURE REVIEW

Generally, empirical studies regarding money demand relationships in developing countries have used a log-level Goldfeld type model[1]. Such a model relates desired real money balances to a scale variable measured by real income, and the opportunity cost of holding money as measured by the returns of one or more alternative assets. A majority of these studies also include a lagged dependent variable term to approximate the short-run dynamic adjustments. Most of the elasticity estimates from the previous studies are generally based on annual data. Those studies also assume that portfolio decision processes in small developing countries are made over financial or real domestic assets. Hence, they use either the domestic interest rate or expected inflation as the measure of the opportunity cost of holding money. However, as suggested by Arango and Nadiri (1981), the portfolio decision should include, at least, domestic real assets, domestic financial assets and foreign financial assets. The omission of the opportunity cost variable of some assets may result in a mispecified money demand function.

Darrat (1986) examined the money demand functions for three OPEC countries; Saudi Arabia, Lybia and Nigeria, over the quarterly period from 1963 to 1979. The empirical results strongly suggest that expected real income is positively related to real money demand while expected inflation rate is negatively related to real money demand. In addition the author found that foreign interest rates exerted a strong negative effect on the money demand equation. The author argued that in contemporary open economies, an international opportunity cost of money (foreign interest rate)[2] could be as important as its domestic counterpart (domestic interest rate) due to the lack of adequate domestic financial assets in which to hold wealth. Further investigation by Arize (1994) estimated money demand functions for four small open economies of Asia: Pakistan, the Philippines, Korea and Thailand by incorporating the external economies of the world economy as summarized by short-term foreign interest rates and technological change. The results suggest that at least some of the measures of external monetary development appear to have some significant influence on money-demand behavior in these small developing countries.

None of the studies above attempted to include the cost of credit as a possible determinant for money demand function as suggested by Arango and Nadiri (1981) who argued that the omission of the opportunity cost variable of some domestic assets may result in a mispecified money demand function. However, on developed economy, a recent study by Howells and Hussein (1998) showed that rational wealth maximisers in the United Kingdom must make a decision about their gross financial wealth in which the cost of credit will affect both the demand for credit and the demand for money. By broadening the cost of credit to include the non-pecuniary costs, they found that the money demand model, where the costs of borrowing are considered, outperformed the standard demand for money models. The results show that the pecuniary and non-pecuniary costs of credit are important determinants of the demand for real M4 in the short-run and long-run periods.

THE MODEL

The general agreement in the literature is that a money demand function should contain a scale variable relating to the level of transactions in the economy and a variable representing the opportunity cost of holding money. However, Wong (1977) argued that there may be some rationale for the inclusion of interest rates in the demand for money in developing countries as there exists certain links between formal and informal credit markets, and borrowing is still a means of financing economic activities. In view of this argument, the following money demand function that incorporates three explanatory variables for estimation purposes is specified as follows:

$$\text{Log } M2_t = a + b \log IP_t + c \log IR_t + d \log LR_t + \varepsilon_t \qquad (1)$$

where, Log $M2_t$ is the log of real money (M2) holding at time t; Log IP_t is the log of real Industrial Production Index (1990=100) at time t as a proxy of real income[3]; Log IR_t is the log of interest rates at time t (proxy by deposit rate)[4]; Log LR_t is the log of lending rate as a proxy of cost of credit at time t; and ε_t is an error term at time t.

Sources of Data

In this study, we utilise quarterly data for the period from 1978:q1 to 1997:q4. All data are collected from various issues of Quarterly Economic Bulletin published by Bank Negara Malaysia (BNM). The detailed description of the data are summarised in Table 1.

METHOD OF ESTIMATION

Test for Order of Integration

The purpose of unit root test is to determine whether each data series is non-stationary (that is unit root exist) or stationary (unit root do not exist). The conceptual existence of equilibrium relationships proposed by economic theory means that certain economic variables should not move freely or are independent of each other, instead, they are expected to move together so that, they do not drift too far apart. The easiest way to introduce this test is to apply the Augmented Dicky-Fuller (ADF) test. The ADF test is an extension of the Dicky-Fuller (DF) test by allowing a higher order of autoregressive process, such that:

$$\Delta X_t = \alpha_0 + \alpha_1 X_{t-1} + \sum_{i=2}^{p} \beta_i \Delta X_{t-i} + \mu_t \qquad (2)$$

$$\Delta X_t = \alpha_0 + \alpha_1 X_{t-1} + \alpha_2 t + \sum_{i=2}^{p} \beta_i \Delta X_{t-i} + \mu_t \qquad (3)$$

Table 1
Key Variables and Description

Variable	Description	Note
M2	Monetary Aggregate, M2 (M1 + Quasi money)	M2 deflated by Consumer Price Index.
IPI	Industrial Production Index (1990 = 100)	As a proxy of Gross Domestic Product (GDP).
IR	Interest Rate (deposit rate)	Modes of the range of rate quoted for three month time deposits at commercial banks.
LR	Lending Rate	As a proxy for cost of credit.

where p is the number of lagged changes in X_t necessary to make μ_t serially uncorrelated. Equations (2) and (3) are with and without deterministic trend respectively. By testing H_0: $\alpha_1 = 0$ against H_a: $\alpha_1 < 0$, if the observed t-statistic is sufficiently negative compared to the critical value at the accepted value of significant, the null hypothesis of unit root cannot be rejected.

Cointegration Test

This study adopts the Johansen-Juselius (1990) maximum likelihood method in the context of the multivariate regression test, which is generally applied to $I(1)$ variables. This method is the extended work of Johansen (1988)[5] and it provides a likelihood-ratio statistic to test for the maximum number of independent equilibrium vectors in the co-integrating matrix[6]. Consider the following co-integrating vectors of the system,

$$\beta' X_t = z_t \qquad (4)$$

The matrix β is called the co-integrating matrix. For N jointly determined variables it will be of the dimension N x N, but of the rank $r \leq N-1$, where r is the number of linearly independent co-integrating vectors. In specification form, the model can be written as:

$$\Delta X_t = \delta + \sum_{i=1}^{k-1} \Pi_i \Delta X_{t-i} + \Pi X_{t-k} + \varepsilon_t \qquad (5)$$

where X_t is a column vector of the two variables. If Π has zero rank, no stationary linear combination can be identified. In other words, the variables in X_t are non-co-integrated. If the rank is r, however, there will now exist r possible stationary linear combinations. From equation (5), the general hypothesis of the r co-integrating vector can be formulated as:

$$H_0: \Pi = \alpha\beta'; \qquad (6)$$

where β' is the r x p matrix of cointegrating vectors, and α the p x r matrix of adjustment or error correction coefficient. This procedure provides two different likelihood ratio tests to determine the value of rank, r, of the matrix Π in (6). The first is known as the trace test. This test provides a test of the null hypothesis H_0: $r \leq r_0$ against H_α: $r > r_0$ where r refers to the number of co-integrating vectors:

$$Tr_{trace} = -T \sum_{i=r+1}^{p} \text{In}(1-\hat{\lambda}_i) \qquad (7)$$

The second likelihood ratio test is the maximal eigenvalue test (λ-max) statistics of

$$H_0: r = r_0 \text{ against } H_a: r = r_0 + 1:$$

$$\lambda_{max} = T\ \text{In}(1-\hat{\lambda}_{i+1}) \qquad (8)$$

where $\hat{\lambda}$'s are the estimated eigenvalues from Π; and T is the number of observations.

EMPIRICAL RESULTS

The empirical results are presented in the following tables: the variables properties in Table 2, the results of cointegration analysis in Table 3, and the Johansen-Juselius likelihood ratio test results in Table 4.

The ADF tests are applied to the levels and first-differences for all variables. The results show that all variables are stationary in their first-differences. Therefore, it could be concluded that all variables are integrated of order one and denoted by $I(1)$.

The next step is to apply the Johansen-Juselius (1990) co-integration procedure, which is based on the maximum-likelihood estimation technique. This procedure yields two test statistics known as λ-max and λ-trace that are used to identify the number of co-integrating vectors. In applying the technique, however, we need to decide the lag order of VAR. When data are quarterly, a common practice is to use four lags. However, we carry out the procedure using 2 lags. Table 4 highlights the results of λ-max and λ-trace tests where different variants of money demand equations (with unrestricted intercept and no trends) are included in co-integrating space.

Two set of relationships are tested. Set I consists of real money balances (M2), real IPI (IP), and deposit rate (IR). Set II consists of variables in Set I plus cost of credit (LR). Both the λ-max and λ-trace tests reject the null hypothesis of no-cointegrating vector at 95% critical value when we include cost of credit in the model. This implies that the variables are cointegrated with at least one cointegrating vector.

Table 2
Augmented Dicky-Fuller (ADF) Test Statistics

Variables	Levels		First-differences	
	Intercept, No Trend	Intercept, Trend	Intercept, No Trend	Intercept, Trend
Malaysia				
M2	0.6630[2]	-1.4086[2]	-2.4494[2]@	-3.8937[2]*
IP	0.8032[2]	-2.6997[2]	-7.2111[2]*	-.5480[2]*
IR	-2.5582[2]	-2.6652[2]	-3.9614[2]*	-.9453[2]*
LR	-2.5809[2]	-3.0036[2]	-4.8655[2]*	-.8999[2]*

Notes:
Figures in brackets are the lag lengths.
* denotes significant at the 10% level.
@ denotes almost significant at the 10% level.
10% significant value for no trend (with trend) is –2.57 (-3.13).

Table 3
Cointegration Analysis (with unrestricted intercept and no trends)

Series in Cointegrating vector	H_0:	H_a:	λ-max lag = 2	95% cv⊕	λ-trace lag = 2	95% cv⊕
Set I:	r = 0	r = 1	20.21	21.12	26.41	31.54
M2 IP IR	r ≤ 1	r = 2	5.38	14.88	6.19	17.86
	r ≤ 2	r = 3	0.81	8.07	0.81	8.07
Set II:	r = 0	r = 1	30.26*	27.42	56.02*	48.88
M2 IP IR LR	r ≤ 1	r = 2	18.50	21.12	25.76	31.54
	r ≤ 2	r = 3	5.37	14.88	7.25	17.86
	r ≤ 3	r = 4	1.88	8.07	1.88	8.07

Note:
r is the number of co-integrating vector.
* denotes statistical significant at the 95% level.
⊕cv denotes critical value.

Finally, the Johansen-Juselius likelihood ratio test is conducted to examine whether the lending rate is another important determinant of the money demand in our study. Based on Johansen and Juselius (1990, p. 194), they show that the likelihood ratio (LR) test of exclucing a variable is based on the estimated eigenvalues of unrestricted and restricted co-integrating space:

$$-2\mathrm{Ln}(Q) = T \sum_{i=1}^{r} \mathrm{In} \{(1 - \lambda^*_i) / (1 - \lambda_i)\} \tag{9}$$

where r is the number of co-integrating vectors, λ^* is the eigenvalue of the ith vector from the restricted space and λ is the eigenvalue of the ith vetcor from unrestricted co-integrating space. Asymptotically, this statistic has a χ^2 distribution with $r(p\text{-}s)$ degrees of freedom, where r is the number of co-integrating vector, p is the dimension of unrestricted co-integrating space and s is the dimension of restricted co-integrating space. If the computed χ^2 value exceeds the critical χ^2 value from the χ^2 table at the α percent level of significance, we reject the null hypothesis; otherwise we do not reject it.

Table 4 summarises the LR test statistics of restricted versus unrestricted co-integrating vectors after the normalisation on monetary aggregates. The restricted vector is derived from the co-integration test of variables in Set I, while the unrestricted vector is derived from the co-integration test of variables in Set II. The jointly determined chi-square statistics are significant at the 10% level. Hence, the result shows that the lending rate could be included in the long run money demand co-integrating vector. This result also implies that the long run coefficient of lending rate is not equal to zero. Hence, the cost of borrowing would have some effects on the non-bank public demand for real money balances.

Table 4
The J-J Likelihood Ratio Tests of Restricted and Unrestricted Co-Integrating Vectors

Series in	Restricted eigenvalue λ^*	Unrestricted eigenvalue λ	χ^2, $(p\text{-}s)r$
Set I	.37752		$\chi^2(1)$=2.94**
Set II		.39757	

Notes:
* and ** denote significant at the 5% and 10% respectively.
The critical value of χ^2 (1) = 3.84 (2.71) at the 5% (10%) significance level.

CONCLUSION

This study uses the Johansen and Juselius (1990) cointegrating technique to investigate the importance of cost of credit for the broad money (M2) demand function in Malaysia, over the period 1978:q1 to 1997:q4. Our findings indicate that cost of credit is an important additional determinant of demand for real money (M2) in the long-run. The estimated model suggests that the cost of credit should be considered in estimating money demand in Malaysia.

In conclusion, the possible extension of this study is to include several improvements to the money demand model such as the institutional variables (for example, type of payment system, number of bank branches, and overdraft facilities) in addition to the cost of credit.

ENDNOTES

1. See Goldfeld (1973).
2. Domestic money holdings in most contemporary economies are influenced by international monetary influences such as foreign rates and foreign exchanges rates movements.
3. The unavailability of quarterly GNP or GDP data over the period under study required us to use Industrial Production Index (IPI) as a proxy variable.
4. Log of interest rate is computed as (1+ir).
5. Johansen (1988) did not allow an intercept in the model.
6. The complete testing procedure is reported in Johansen (1988) and Johansen and Juselius (1990)

REFERENCES

Arango, S. & Nadiri, M. (1981). Demand for money in open economies. *Journal of Monetary Economics*, 7, 69-83.

Arize, A. C. (1994). A re-examination of the demand for money in small developing economies. *Applied economics*, 26, 217-228.

Darrat, A. (1986). The demand for money in some major OPEC members: regression estimates and stability results. *Applied Economics*, 18, 127-142.

Goldfeld, S.M (1973). The demand for money: revisited. *Brookings Papers on Economic Activity*, 3, 577-646.

Howells, P. & Hussein, K. (1998). The demand for broad money in the UK: does credit matter? *Applied Economics*, 30, 1421-1429.

Johansen, S. (1988) Statistical analysis of cointegration vectors. *Journal of Economic Dynamic and Control*, 12, 231-254.

Johansen, S. & Juselius, K. (1990) Maximum likelihood estimation and infrence on co-integration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52, 169-210.

Wong, C. (1977). Demand for money in developing countries: some theoretical and empirical results. *Journal of Monetary Economics*, January, 59-86.