Real Versus Nominal Adjustment Mechanism in the Malaysian Demand for Money Function

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Key words: Money demand; stock adjustment; specification test; stability; ex-post forecast.

Abstract
This article investigates the issue of real versus nominal adjustment mechanism in the Malaysian money demand function. The test for stability and ex-post forecasting ability of the model are also conducted. The results suggest that for M1, both specifications are the 'true' model, and for M2 and M3, the nominal specification is the 'true' model. The stability test indicates that only the real specification for M2 and M3 are stable, and the results of the ex-post forecast suggest that the nominal specification has a better forecasting ability compared to the real specification of the Malaysian money demand function.

Introduction
This paper explores the specifications of the real versus nominal adjustment mechanism in the Malaysian money demand function. In section 2, the basic model used in this study, the real partial adjustment hypothesis (RPAH) and nominal partial adjustment hypothesis (NPAH) are discussed. Discussion on the empirical results and a test for misspecification of the money demand function are given in section 3. The stability test and ex-post forecasting ability of the Malaysian demand for money function are presented in section 4 and 5 respectively. The last section contains our summary and conclusions.

Studies on money demand function either related to the developed countries or related to the developing countries are numerous. Usually the demand for money functions in these studies are specified in real terms, that is, the money stock and at least the scale variable, income level, are deflated by the price level.

However, despite its widespread use, apprehension about the real specification of the money demand function continues. Laumas and Spencer (1980) and Liang (1984) argue that the nominal specification of the demand for money function is more stable and gives a more accurate forecast than the real one. Laumas and Spencer's study was based on U.S. quarterly data for the period 1959:2 - 1980:4. Also, Milbourne (1983) and Spencer (1985) using the U.S. quarterly data for the period 1952:1 - 1981:2 and 1952:1 - 1982:4 respectively, provide a similar finding and further state that money
demand function which assumes a real partial adjustment hypothesis is misspecified when the rate of inflation is incorporated in the model.

In Malaysia, two available studies on demand for money employing the conventional money demand function (income level and interest rate as the only variables), are due to Semudram (1981) and Yahya (1984). Although they differ in their period of study (Semudram (1981) used annual data for the period 1959–1977 and Yahya (1984) used quarterly data for the period 1967:1–1983:4, and for the method of estimation Semudram (1981) used Ordinary Least Squares and Yahya (1984) used the Hatanaka estimation procedure), both authors reported the same conclusion. They concluded that for M1, the Malaysian money demand function are determined by real income and the relevant rate of interest (12-month Treasury bill rate for Semudram (1981) and 9-month time deposit rate for Yahya (1984)). For M2, it is also a function of real income and interest rate. Both studies assume real partial adjustment hypothesis in their models. The similarity in their results, nevertheless, are not strong enough evidence to abandon further investigations of the money demand specification for Malaysia.

**METHODOLOGY**

The Model

The long-run demand for money stock in a log-linear form is specified as

\[ \log M^*_t = \log a_o + a_1 \log y_t + a_2 \log r_t + a_3 \log P_t \]

(1)

where \( M^*_t \) is desired nominal money stock, \( y_t \) is real income, \( r_t \) is the relevant rate of interest and \( P_t \) is the general price level. Following Chow (1966), the real partial adjustment hypothesis (RPAH) can be expressed as

\[ \log \left( \frac{M^*_t}{P_t} \right) - \log \left( \frac{M^*_{t-1}}{P_{t-1}} \right) = \gamma [ \log \left( \frac{M^*_t}{P_t} \right) - \log \left( \frac{M^*_{t-1}}{P_{t-1}} \right) ] + U^*_t \]

(2)

where \( M^*_{t-1} \) and \( P^*_{t-1} \) are the last period money stock and price level respectively and \( U^*_t \) is the stochastic disturbance term. Substituting equation (1) into (2) and assuming \( a_3 = 1 \), we obtain the short-run demand for money balance as

\[ \log m_t = \alpha_0 + \alpha_1 \log y_t + \alpha_2 \log r_t + \alpha_3 \log m_{t-1} + U_t \]

(3)

where

\[ \alpha_0 = \gamma \log a_o, \quad \alpha_1 = \gamma a_1, \quad \alpha_2 = \gamma a_2, \quad \alpha_3 = (1 - \gamma), \]

\[ m_t = \frac{M^*_t}{P_t}, \quad m_{t-1} = \frac{M^*_{t-1}}{P_{t-1}} \text{ and } U_t = \gamma U^*_t. \]

It is assumed that \( U_t = \gamma U^*_t \) has mean zero and constant variance. In this formulation, the price level no longer appears in the final equation (3).

On the other hand, Goldfeld (1973, 1976) offered the nominal partial adjustment hypothesis (NPAH) as follows

\[ \log M_t - \log M^*_{t-1} = \theta (\log M^*_t - \log M^*_{t-1}) + \xi_t \]

(4)

where \( \xi_t \) is the stochastic disturbance term. Substituting equation (1) into (4) and again assuming \( a_3 = 1 \), we have

\[ \log M_t = \log a_o + \theta a_1 \log y_t + \theta a_2 \log r_t + \theta \log P_t + (1 - \theta) \log M^*_{t-1} + \xi_t \]

(5)

Adding \( \log P_t \) to both sides of equation (5), and rearranging terms, results in

\[ \log m_t = \beta_0 + \beta_1 \log y_t + \beta_2 \log r_t + \beta_3 \log (\frac{M^*_{t-1}}{P_{t-1}}) + \epsilon_t \]

(6)

where \( \beta_0 = \theta \log a_o, \quad \beta_1 = \theta a_1, \quad \beta_2 = \theta a_2, \quad \beta_3 = (1 - \theta) \) and \( \epsilon_t = \theta \xi_t \). It is assumed that \( \epsilon_t = \theta \xi_t \) has mean zero and constant variance. Comparing equations (3) and (6), shows that the difference is in the last term, that is, under NPAH the last period money stock is deflated by the current price level.

**RESULTS AND DISCUSSION**

**Model Estimation and Data**

This study is based on annual time series data for
### TABLE 1

Results of the maximum likelihood estimation of the money balances, M1, M2 and M3

<table>
<thead>
<tr>
<th>Model</th>
<th>Constant</th>
<th>$Y_t$</th>
<th>$r_t$</th>
<th>$M_{t-1} - P_{t-1}$</th>
<th>$M_{t-1} - P_t$</th>
<th>$R^2$</th>
<th>D.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAHM1</td>
<td>-1.0068</td>
<td>0.63662</td>
<td>-0.18691</td>
<td>0.43976</td>
<td></td>
<td>0.9931</td>
<td>1.9746</td>
</tr>
<tr>
<td></td>
<td>(-1.9020)*</td>
<td>(3.1116)***</td>
<td>(-1.9021)*</td>
<td>(2.3844)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPAHM1</td>
<td>-1.2651</td>
<td>0.72696</td>
<td>-0.15799</td>
<td>0.37188</td>
<td></td>
<td>0.9881</td>
<td>1.9623</td>
</tr>
<tr>
<td></td>
<td>(-2.1651)**</td>
<td>(3.0492)***</td>
<td>(-1.5343)</td>
<td>(1.6550)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAHM2</td>
<td>-1.1444</td>
<td>0.57099</td>
<td>-0.13478</td>
<td>0.65092</td>
<td></td>
<td>0.9983</td>
<td>2.1172</td>
</tr>
<tr>
<td></td>
<td>(-2.1701)**</td>
<td>(2.9767)***</td>
<td>(-1.9876)*</td>
<td>(5.3151)***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPAHM2</td>
<td>-1.3403</td>
<td>0.62512</td>
<td>-0.12195</td>
<td>0.63372</td>
<td></td>
<td>0.9974</td>
<td>1.9769</td>
</tr>
<tr>
<td></td>
<td>(-2.9760)***</td>
<td>(5.7263)***</td>
<td>(-2.0298)*</td>
<td>(5.7449)***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAHM3</td>
<td>-0.36643</td>
<td>0.26919</td>
<td>-0.12396</td>
<td>0.84793</td>
<td></td>
<td>0.9982</td>
<td>2.0018</td>
</tr>
<tr>
<td></td>
<td>(-0.88889)</td>
<td>(1.6539)</td>
<td>(-2.0431)*</td>
<td>(8.4314)***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPAHM3</td>
<td>-0.72677</td>
<td>0.38353</td>
<td>-0.09900</td>
<td>0.79947</td>
<td></td>
<td>0.9975</td>
<td>1.9938</td>
</tr>
<tr>
<td></td>
<td>(-2.4893)**</td>
<td>(3.2466)***</td>
<td>(-2.3232)**</td>
<td>(10.671)**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ***Statistically significant at the one percent level.
**Statistically significant at the five percent level.
*Statistically significant at the ten percent level.
Figures in parentheses are the 't-statistics'

### TABLE 2

The estimated adjustment period for M1, M2 and M3*

<table>
<thead>
<tr>
<th>Model</th>
<th>(adjustment process)</th>
<th>OLS</th>
<th>Semudram (1981)</th>
<th>1.84 quarters</th>
<th>OLS</th>
<th>Yahya (1984)</th>
<th>2.28 quarters</th>
<th>BM</th>
<th>G &amp; H</th>
<th>2.24 quarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAHM1</td>
<td>(adjustment process)</td>
<td>OLS</td>
<td>Semudram (1981)</td>
<td>1.84 quarters</td>
<td>OLS</td>
<td>Yahya (1984)</td>
<td>2.28 quarters</td>
<td>BM</td>
<td>G &amp; H</td>
<td>2.24 quarters</td>
</tr>
<tr>
<td>NPAHM1</td>
<td>(adjustment process)</td>
<td>HEP</td>
<td>Semudram (1981)</td>
<td>2.88 quarters</td>
<td>HEP</td>
<td>Yahya (1984)</td>
<td>2.52 quarters</td>
<td>BM</td>
<td>G &amp; H</td>
<td>2.51 quarters</td>
</tr>
<tr>
<td>RPAHM3</td>
<td>(adjustment process)</td>
<td>OLS</td>
<td>Semudram (1981)</td>
<td>1.84 quarters</td>
<td>OLS</td>
<td>Yahya (1984)</td>
<td>0.61 quarters</td>
<td>BM</td>
<td>G &amp; H</td>
<td>0.61 quarters</td>
</tr>
<tr>
<td>NPAHM3</td>
<td>(adjustment process)</td>
<td>OLS</td>
<td>Semudram (1981)</td>
<td>1.84 quarters</td>
<td>OLS</td>
<td>Yahya (1984)</td>
<td>0.80 quarters</td>
<td>BM</td>
<td>G &amp; H</td>
<td>0.80 quarters</td>
</tr>
</tbody>
</table>

Note: *OLS denotes Ordinary Least Square, HEP denotes Hatanaka estimation procedure and BM denotes Beach and McKinnon maximum likelihood estimation procedure.
the period 1961–1983. The variables used in this study are money stock M1 (defined as currency plus demand deposits held by non-bank private sector), M2 (M1 plus saving deposits and fixed deposits of commercial bank), M3 (M2 plus saving deposits and fixed deposits at other financial institutions), consumer price index (1967 = 100), gross national product (GNP) and 3-month Treasury bill rate.

All data were obtained from various issues of Quarterly Economic Bulletin published by Bank Negara Malaysia. In this study the equation to be estimated are equations (3) and (6). All regression equations are tested for real money balance M1, M2 and M3, using the full information maximum likelihood estimation technique due to Beach and Mackinnon (1978). The regression results are presented in Table 1. All estimated equations show goodness of fit of 0.98 and above, implying that more than ninety percent of the variation in real money balances is explained by the independent variables. The Durbin-Watson statistics for both specifications show that there is no auto-correlation present.

The results reported in Table 1 indicate that, for M1, the Malaysian money balance is a function of income and the rate of interest for the real specification. These results are consistent with the ones obtained by Semudram (1981) and Yahya (1984). For the nominal specification, however, the Malaysian M1 is only determined by the level of income. For M2, both specifications indicate that M2 is a function of income level and short term interest rate and again conform with the results of Semudram (1981) and Yahya (1984). On the other hand, for M3, the nominal specification shows that, it is determined by income level and short-term interest rate, but for the real specification, only short-term interest rate determines the demand for M3.

The estimated coefficients of the lagged money stock variable, given in Table 2, also includes the results of studies by Semudram (1981) and Yahya (1984). Our results (G & H) indicate that for all cases, the adjustment period is short, being 2.24 quarters and 2.51 quarters for real and nominal specifications respectively, for money stock M1. The adjustment period for M2 is about 1.40 quarters for real and 1.47 quarters for nominal specification and M3 is about 0.61 quarters for real and 0.80 quarter for nominal specification.

Table 3 shows the long-run elasticities for both specifications. For purpose of comparison the table also includes elasticity values obtained

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAHM1</td>
<td>Y</td>
<td>1.12</td>
<td>1.42</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>−0.80</td>
<td>−0.42</td>
</tr>
<tr>
<td>NPAHM1</td>
<td>Y</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RPAHM2</td>
<td>Y</td>
<td>1.56</td>
<td>1.67</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>−0.50</td>
<td>−0.24</td>
</tr>
<tr>
<td>NPAHM2</td>
<td>Y</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RPAHM3</td>
<td>Y</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>NPAHM3</td>
<td>Y</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: The choice of r for Semudram (1981) is the 12-month Treasury bill rate, Yahya (1984) is the 9-month time deposit rate and our study is the 3-month Treasury bill rate.
REAL VERSUS NOMINAL ADJUSTMENT MECHANISM IN THE MALAYSIAN DEMAND FOR MONEY FUNCTION

by Semudram (1981) and Yahya (1984). For the long-run income elasticities, our results are more comparable to Semudram’s results of 1.12 for M1, and for M2 our results are more comparable to Yahya’s study of 1.67. On the other hand, the long run interest rate elasticities of our results are more inelastic compared to Yahya’s study of about 0.4 and 0.8 of Semudram (1981) for money stock M1. For M2 the long-run interest rate elasticity of our study is 0.4 and Semudram (1981) is 0.5 compared to 0.2 of Yahya (1984). Further, in our study the long-run income and interest rate elasticities for both specifications is about 1.1 and 0.3 respectively and there is no substantial difference between the two specifications. The same argument goes for M2 where the long-run income elasticities are 1.6 for real and 1.7 for nominal respectively, and about 0.3 for both specifications for the long-run interest rate elasticities. However, for M3, obvious differences are observed for both specifications for both long-run income and interest rate elasticities. For M3, the long-run income elasticity is about 1.7 for real compared to 1.9 for nominal specification. The long-run interest rate elasticities are about 0.8 and 0.4 for real and nominal equations respectively.

Test of Model Specification

Our main objective is to test whether the real or the nominal specification is the ‘true’ model for the Malaysian demand for money function. Since the regression results (see Table 1) show that all equations perform well in terms of goodness of fit, there is thus no a priori basis to determine which of the two equations specify the correct model for each definition of money stock. As such a more appropriate measure to select the correct model need to be used. For this purpose the J-test developed by Davidson and Mackinnon (1981) was used. The test procedure has been detailed in other studies (Yahya, 1984; and Spencer, 1985). However, here, it is mentioned very briefly.

Suppose that the model is structured as

\[ RPAHM ; H_0 : M = X_1 \beta_1 + U_1 ; \quad \text{and} \]
\[ NPAHM ; H_1 : M = X_2 \beta_2 + U_2 \]

where M is the vector of observation on the dependent variable, X_1 and X_2 are the matrices of observations of the regressors in the two models, \( \beta_1 \) and \( \beta_2 \) are the corresponding vectors of coefficients, and \( U_1 \) are \( U_2 \) are the vectors of stochastic disturbance terms. To test whether the model RPAHM, the maintained hypothesis \( H_0 \), is the ‘true’ model, equation (8) is first regressed to obtain its predicted values, \( X_2 \hat{\beta}_2 \). The second step is to regress the equation

\[ M = (1 - \alpha_2) X_2 \beta_2 + \alpha_2 X_2 \hat{\beta}_2 + U'_2 \]

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

\[ F(P, N - K) = \frac{(RSS_1 - RSS_2)/(P)}{RSS_2/(N-K)} \]

where \( F(P, N - K) \) has an \( F(P, N - K) \) distribution under the maintained hypothesis, \( H_0 \); \( RSS_1 \) is the sum of the squared residuals of equation (7); \( RSS_2 \) is the sum of the squared residuals of equation (9). The number of restrictions is one, i.e. \( \alpha_2 = 0 \). The maintained hypothesis is rejected if the test statistic exceeds the critical value.

On the other hand, to test whether equation (8) is the correct model, the first step is to get the predicted value of \( X_1 \hat{\beta}_1 \), and then step two is to regress the following equation:

\[ M = (1 - \alpha_2) X_2 \beta_2 + \alpha_1 X_1 \hat{\beta}_1 + U'_2 \]

### TABLE 4

Calculated F-values for the J-test

<table>
<thead>
<tr>
<th>Maintained hypotheses</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>Critical F-values at 5 percent level</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>0.60</td>
<td>6.49*</td>
<td>22.20*</td>
<td>4.38 F(1, 19)</td>
</tr>
<tr>
<td>NPAH</td>
<td>0.16</td>
<td>0.03</td>
<td>0.45</td>
<td>4.38 F(1, 19)</td>
</tr>
</tbody>
</table>

Note: *Rejected at the 5 percent level of significance.
Then the J-statistics is obtained as outlined earlier.

Table 4 shows that for M1, the true model is either represented by the real specification or nominal specification. But for M2 and M3, the correct specification for the money demand function is the nominal specification.

**Stability Test**

A correct specification of the money demand function does not mean that it is stable over time and vice versa. In order to test for the stability of the Malaysian demand for money function for both specifications for each of the definition of the money stock, we employ the Chow test (Chow, 1960). To perform a Chow test, we decided to choose 1973 as the breaking point in order to subdivide the sample period into two equal halves. Table 5 presents the results of the present study. The F-statistics indicate that both specifications (real and nominal) are unstable for M1 and only the nominal specification is unstable for M2 and M3.

**The Ex-post Forecast**

One of the properties of an economic model is its ability to simulate 'real-world' phenomenon. One way of evaluating the performance of historical simulation or the ex-post forecast of the model is by using the Theil's inequality coefficient, defined as

\[
U = \sqrt{\frac{1}{T} \sum_{t=1}^{T} (y^*_t - y^*_{t-1})^2 + \frac{1}{T} \sum_{t=1}^{T} (y^*_{t-1})^2 - \frac{1}{T} \sum_{t=1}^{T} (y^*_t)^2}
\]

### TABLE 5

Calculated F-values for Chow's Stability Test*

<table>
<thead>
<tr>
<th>Model</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>Critical values at the 5 percent level</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>5.73*</td>
<td>1.22</td>
<td>1.22</td>
<td>2.90 F(4, 19)</td>
</tr>
<tr>
<td>NPAH</td>
<td>5.30*</td>
<td>5.17*</td>
<td>3.88*</td>
<td>2.90 F(4, 19)</td>
</tr>
</tbody>
</table>

Note: *Rejected at the five percent level of significance.

### TABLE 6

Result of ex-post simulation

<table>
<thead>
<tr>
<th>Model</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMSE</td>
<td>RPAH</td>
<td>0.04625</td>
<td>0.03498</td>
</tr>
<tr>
<td>Theil's inequality coefficient</td>
<td>0.006969</td>
<td>0.004247</td>
<td>0.003486</td>
</tr>
<tr>
<td>RMSE</td>
<td>NPAH</td>
<td>0.04605</td>
<td>0.03041</td>
</tr>
<tr>
<td>Theil's inequality coefficient</td>
<td>0.006938</td>
<td>0.003692</td>
<td>0.002479</td>
</tr>
</tbody>
</table>

1. For studies related to the developed countries, see Laidler (1977) and Goldfeld (1973); for developing countries, see Aghevli et al. (1979), Khan (1980) and Holden and Peel (1979).

2. The only effect of \( a_3 \) is reflected in the constant term of the regression equation.

3. Other financial institutions are represented by finance companies, merchant banks, National Saving Banks and Employee Provident Fund.

4. The lagged dependent variable, \( m_{t-1} \), which is interdependent with error term, \( u_{t-1} \), renders the OLS estimates not only biased, but also inconsistent. The OLS estimates are asymptotically biased, that is, the bias in small samples due to \( E(m_t u_{t-1}) \neq 0 \), does not vanish as \( n \rightarrow \infty \), hence the estimates are inconsistent. The violation of the above assumptions of the OLS method impairs the power of the 'd statistics' in detecting autocorrelation (Koutsoyianis, 1977).
where $y_t^*$ is the simulated value of $y_t$, $y_t$ is the actual value of $y_t$ and $T$ is the number of periods in the simulation. The root mean square error is shown by the numerator of $U$, and its value is always between 0 and 1 (Pindyck and Rubinfeld, 1981).

The simulation results for both real and nominal specifications for each of the definition of the money stock are given in Table 6. In all cases, we observed that the root mean square error (RMSE) as well as the Theil’s inequality coefficient for the nominal specification are appreciably lower than the real specification. For example, there is an improvement of 0.4 percent, 13 percent and 28 percent in the simulation error of the RMSE and Theil inequality coefficient from real to nominal specification for each of $M_1$, $M_2$ and $M_3$ respectively.

CONCLUSION
This paper has examined the issues of real and nominal adjustment mechanism of the Malaysian money demand function for the period 1961 - 1983. The results suggest that; the Malaysian money $M_1$ is a function of income level and short-term interest rate under the real specification. But, under the nominal specification, only income level is important. However, for the Malaysian money $M_2$, both specifications indicate that income level and short-term interest rate determined the holding of $M_2$. For $M_3$, the nominal specification suggests that the income level and short-term interest rate is significant.

From the misspecification test, the results suggest that both specifications are the ‘true’ model for Malaysian money $M_1$, but for $M_2$ and $M_3$, the nominal specification is the ‘true’ model. And, our stability test has indicated that only the real specifications for Malaysian money $M_2$ and $M_3$ are stable; and both specification for $M_1$, and nominal specification for $M_2$ and $M_3$ are unstable over time.

As regard to the ex-post forecast, the results indicate that the nominal specification has the superior forecasting ability compared to the real specification of the Malaysian money demand function.

REFERENCES


Then the J-statistics is obtained as outlined earlier.

Table 4 shows that for M1, the true model is either represented by the real specification or nominal specification. But for M2 and M3, the correct specification for the money demand function is the nominal specification.

**Stability Test**

A correct specification of the money demand function does not mean that it is stable over time and vice versa. In order to test for the stability of the Malaysian demand for money function for both specifications for each of the definition of the money stock, we employ the Chow test (Chow, 1960). To perform a Chow test, we decided to choose 1973 as the breaking point in order to subdivide the sample period into two equal halves. Table 5 presents the results of the present study. The F-statistics indicate that both specifications (real and nominal) are unstable for M1 and only the nominal specification is unstable for M2 and M3.

**The Ex-post Forecast**

One of the properties of an economic model is its ability to simulate 'real-world' phenomenon. One way of evaluating the performance of historical simulation or the ex-post forecast of the model is by using the Theil's inequality coefficient, defined as

$$U = \sqrt{\frac{1}{T} \sum_{t=1}^{T} (y_t^1 - y_t^*)^2 + \frac{1}{T} \sum_{t=1}^{T} (y_t^1)^2}$$

**TABLE 5**

Calculated F-values for Chow’s Stability Test*

<table>
<thead>
<tr>
<th>Model</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>Critical values at the 5 percent level</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>5.73*</td>
<td>1.22</td>
<td>1.22</td>
<td>2.90 F(4, 19)</td>
</tr>
<tr>
<td>NPAH</td>
<td>5.30*</td>
<td>5.17*</td>
<td>3.88*</td>
<td>2.90 F(4, 19)</td>
</tr>
</tbody>
</table>

Note: *Rejected at the five percent level of significance.

**TABLE 6**

Result of ex-post simulation

<table>
<thead>
<tr>
<th>Model</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMSE</td>
<td>RPAH</td>
<td>0.04625</td>
<td>0.03498</td>
</tr>
<tr>
<td>Theil’s inequality coefficient</td>
<td>RPAH</td>
<td>0.006969</td>
<td>0.004247</td>
</tr>
<tr>
<td>RMSE</td>
<td>NPAH</td>
<td>0.04605</td>
<td>0.03498</td>
</tr>
<tr>
<td>Theil’s inequality coefficient</td>
<td>NPAH</td>
<td>0.006962</td>
<td>0.005692</td>
</tr>
</tbody>
</table>

1 For studies related to the developed countries, see Laidler (1977) and Goldfeld (1973); for developing countries, see Aghevli et al. (1979), Khan (1980) and Holden and Peel (1979).

2 The only effect of $a_3$ is reflected in the constant term of the regression equation.

3 Other financial institutions are represented by finance companies, merchant banks, National Saving Banks and Employee Provident Fund.

4 The lagged dependent variable, $m_{t-1}$, which is interdependent with error term, $u_t$, renders the OLS estimates not only biased, but also inconsistent. The OLS estimates are asymptotically biased, that is, the bias in small samples due to $E(m_{t-1}^2)$ does not vanish as $n \to \infty$, hence the estimates are inconsistent. The violation of the above assumptions of the OLS method impairs the power of the ‘d statistics’ in detecting autocorrelation (Koutsoyianis, 1977).
where $y_t'$ is the simulated value of $y$, $y_t$ is the actual value of $y$, and $T$ is the number of periods in the simulation. The root mean square error is shown by the numerator of $U$, and its value is always between 0 and 1 (Pindyck and Rubinfeld, 1981).

The simulation results for both real and nominal specifications for each of the definition of the money stock are given in Table 6. In all cases, we observed that the root mean square error (RMSE) as well as the Theil's inequality coefficient for the nominal specification are appreciably lower than the real specification. For example, there is an improvement of 0.4 percent, 13 percent and 28 percent in the simulation error of the RMSE and Theil inequality coefficient from real to nominal specification for each of $M_1$, $M_2$ and $M_3$ respectively.

CONCLUSION
This paper has examined the issues of real and nominal adjustment mechanism of the Malaysian money demand function for the period 1961 - 1983. The results suggest that; the Malaysian money $M_1$ is a function of income level and short-term interest rate under the real specification. But, under the nominal specification, only income level is important. However, for the Malaysian money $M_2$, both specifications indicate that income level and short-term interest rate determined the holding of $M_2$. For $M_3$, the nominal specification suggests that the income level and short-term interest rate is significant.

From the misspecification test, the results suggest that both specifications are the 'true' model for Malaysian money $M_1$, but for $M_2$ and $M_3$, the nominal specification is the 'true' model. And, our stability test has indicated that only the real specifications for Malaysian money $M_2$ and $M_3$ are stable; and both specification for $M_1$, and nominal specification for $M_2$ and $M_3$ are unstable over time.

As regard to the ex-post forecast, the results indicate that the nominal specification has the superior forecasting ability compared to the real specification of the Malaysian money demand function.

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