DIVISIA MONETARY AGGREGATES AND STOCK PRICES IN MALAYSIA: AN EMPIRICAL NOTE

*Muzafar Shah Habibullah**
*Ahmad Zubaidi Baharumshah**

ABSTRACT

The purpose of the present study is to investigate the empirical relationship between money supply and stock prices in the Kuala Lumpur Stock Exchange (KLSE) using quarterly data that span 1st quarter 1981 to 4th quarter 1994. Specifically, in this study we test for market informational efficiency in KLSE, by testing the existence of a long-run relationship between money supply and stock prices using alternative monetary aggregates namely, the Simple-Sum and Divisia monies. Results from our error-correction models suggest that money supply and KLSE Composite stock price series are cointegrated, thus implying that the market informational efficiency hypothesis can be rejected for KLSE with respect to the growth of money supply, in particular to Simple-sum M1 and M2, Divisia M1 and M2.

INTRODUCTION

Money supply is one of the more important factors affecting stock prices that has received attention from researchers in the area of economics and finance. Despite extensive investigations, the precise nature of the relationship between money supply and the stock market remains controversial. However, one important issue that has received less attention concerns the appropriate definition of money supply that should be used. In other words, is it a narrow or broad definition of money supply that will have greater impact on the stock market? Does the choice of money supply measure really matter? Kraft and Kraft (1977a, 1977b) conclude that the presence or absence of a lead-lag relationship between money supply and stock prices was insensitive to the choice of the definition of money supply used. However, recent empirical evidence suggests that the choice of money supply may be important.

Studies have shown that the presence or the absence of lead-lag relationships between money supply and stock prices is indeed sensitive to the choice of the definition of money supply used. For example, Mookerjee (1987) found that for Canada, the stock market is efficient with respect to narrow money

---

**Dr. Muzafar Shah Habibullah and Dr. Ahmad Zubaidi Baharumshah are both with the Department of Economics, Universiti Putra Malaysia.*

supply M1, but with broad money supply M2, the results suggest that money supply is a leading indicator for the stock price. Earlier studies by Cooper (1974) and Rozeff (1974) have shown that money supply has no bearing on the stock market. However, more recent studies by Thornton (1993), Ho (1983) and Jones and Uri (1987) tend to point to the conclusion that the stock market is sensitive to different measures of money supply. Therefore, we can conclude that different choices of definition of money supply can have different impact on stock prices.[1]

More recently, a new development in monetary economics concerns the appropriate measurement of money. It has been the general practice that monetary authorities all over the world have used the 'traditional' Simple-sum monetary aggregate for policy purposes. The Simple-sum aggregate is derived by adding all the asset components together. According to Barnett (1980), this approach of measuring money is an incorrect measurement of the flow of monetary services. Since the traditional Simple-sum monetary aggregates are 'accounting' measures, they are not suitable to measure 'money is what money does', that is providing services to the holder. Barnett points out that the Simple-sum monetary aggregates are calculated on the assumption that their components receive equal weights of one and are therefore considered to be perfect substitutes. A meaningful economic measure would be a weighted-sum aggregate with weights reflecting relevant value-shares.

Barnett offers the Divisia monetary aggregate as an alternative to the Simple-sum aggregate, and has shown that the Divisia aggregate can be derived theoretically from economic aggregation theory and first-order conditions for utility optimization. It can thus be argued that Divisia money is appropriate for measuring the flow of monetary services of a country. Although the application of Divisia monetary aggregates has been widespread in economic literature, its application in finance, in particular in studying the money-stock market nexus has been limited. An exception was the study by Serletis (1993), who has attempted to investigate the long-run relationship between Divisia monetary aggregates and stock prices in the United States. However, using the Engle-Granger two-step procedure and the Johansen maximum likelihood approach, he found that money (both Simple-sum and Divisia) and stock prices are not cointegrated.

The purpose of this paper is two-fold. First, in testing the efficient market hypothesis of the KLSE, we have used both the traditional Simple-sum and Divisia monetary aggregates in searching if there is any long-run relationship between these monetary aggregates and stock prices in Malaysia. Although Malaysia has been considered as belonging to the second generation NIEs (with Indonesia and Thailand) and has undergone rapid financial changes in the past twenty years, in many instances, Malaysia has been omitted from similar studies of the money-stock market nexus. Thus, the present paper is to complement the existing literature of testing the informational market efficiency of the stock market in the developing countries with respect to money supply. Second, with the recent developments in the field of econometrics, we will be able to analyze the long-run relationships between money supply and stock prices in the context of cointegration approach proposed by Granger (1986) and Engle and Granger (1987).

RESULTS OF INTEGRATION AND COINTEGRATION TESTS [2]

Since our interest is to determine the long-run relationships between monetary aggregates and stock prices, the first step is to verify the order of integration of each of the series involved. Phillips and Perron (1988) provide a non-parametric method of detecting whether a time series contain a unit root. This test is robust to a wide variety of serial correlation and time dependent heteroskedasticity. The tests involved estimating the following equations for a variable, say y_t,

$$\Delta y_t = \mu_1 + \theta t + \beta y_{t-1} + \varepsilon_{1t} \qquad (1)$$

where Δy_t denotes the first-difference of y_t, μ is a drift term and t is a deterministic time trend. For y_t to be stationary around a linear trend in equation (1), the adjusted *t*-statistic $Z(t_\beta)$ should be negative and significantly different from zero. If the null hypothesis of a unit root cannot be rejected, the series is further tested for a second unit root using the following equation

$$\Delta^2 y_t = \mu_2 + \alpha \Delta y_{t-1} + \varepsilon_{2t} \qquad (2)$$

The null hypothesis of two unit roots can be rejected if the adjusted $Z(t_\alpha)$ is found to be negative and significantly different from zero. The critical values for $Z(t_\alpha)$ and $Z(t_\beta)$ are tabulated in MacKinnon (1991). Table 1 presents the results of the Phillips-Perron (PP) tests for all series[3] involved in the analysis, in logarithmic form in levels and first-differences. Our results indicate that non-stationarity cannot be rejected for the levels at the five percent significance level. When the series are in first-differences, non-stationarity can be rejected for all series. The Z-statistic suggests that all five series are integrated of order one, whereas the first-differences are integrated of order zero. Therefore, all series is best characterised as difference-stationary process instead of trend-stationary process.

---

[2] *See Rao (1994) for an elaborate discussion on the concept of integration and cointegration.*
[3] *Detailed descriptions on sources of data used in the analysis and the method used to construct the Divisia monetary aggregates are presented in Appendix A.*

Table 1: Results of the Phillips-Perron Unit Root Tests

Series	Levels		First-differenced	
	Truncation lag parameters		Truncation lag parameters	
	$Z(t_\beta),\ell_4=3$	$Z(t_\beta),\ell_{12}=10$	$Z(t_\alpha),\ell_4=3$	$Z(t_\alpha),\ell_{12}=10$
Stock price	-2.54	-2.44	-7.95*	-8.13*
Simple-sum M1	-0.28	-0.35	-7.08*	-7.43*
Simple-sum M2	-0.32	-0.64	-6.64*	-6.81*
Divisia M1	-0.28	-0.54	-7.25*	-7.30*
Divisia M2	-1.28	-1.42	-8.08*	-8.04*

Notes: Critical values are from MacKinnon (1991). For 50 observations, the critical values for $Z(t_\beta)$ and $Z(t_\alpha)$ at 5 percent level are -3.49 and -2.91 respectively. Asterisk (*) indicates statistically significant at 5 percent level.
The truncation lag parameter was set to the lag length equal to the integer (int) portion of two values of ℓ, that is, $\ell_4 = \text{int}\{4(T/100)^{1/4}\}$ and $\ell_{12} = \text{int}\{12(T/100)^{1/4}\}$, where T is the number of observations (see Schwert 1987).

Next is to test whether there is a linear long-run relationship between the monetary aggregates and stock price. In other words, are monetary aggregates and stock price cointegrated? The common practice is to use Engle and Granger's (1987) two-step procedure. However, recent developments in cointegration and error-correction suggest that the Engle-Granger's two-step test for cointegration has low power. Banerjee, Dolado, Hendry and Smith (1986) have shown that the Engle-Granger estimates of the cointegrating vector have large finite sample biases. Kremers, Ericsson and Dolado (1992) have argued that standard *t*-ratio for the coefficient on the error-correction term in the dynamic equation is a more powerful test for cointegration than those of the Dickey-Fuller type tests. From the statistical point of view, the estimation of the error-correction model provides a test on the robustness of the conclusions from cointegration analysis. In fact according to the Granger Representation Theorem, not only does cointegration imply the existence of an error-correction model but also the converse applies, that is the existence of an error-correction model implies cointegration of the variables (Engle and Granger 1987). In a bivariate case, the following 'conditional model' for Δy_t is estimated directly,

$$\Delta y_t = c_0 + \sum_{i=1}^{q} \phi_i \Delta y_{t-i} + \sum_{j=1}^{p} \lambda_j \Delta x_{t-j} + \gamma \omega_{t-1} + \varepsilon_t \qquad (3)$$

where ω_{t-1} is the lagged residuals saved from running the static cointegrating regression with y_t on a constant and x_t. The hypothesis that x_t does not cause y_t must be rejected if the coefficient on the error-correction term γ is significant, regardless of the joint significance of the λ_j coefficients. Our poin of interest is that $\gamma<0$ and significantly different from zero implies that x_t and y_t are cointegrated. Furthermore, Banerjee *et al.* (1986) and Kremers *et al.* (1992) showed that standard asymptotic theory can be used when conducting the test in the context of an error correction model; specifically, the t-statistic on the error-correction term coefficients γ, have the usual distribution. For evaluating the t-statistic on the error-correction coefficient, Kremers *et al.* (1992) suggest using the critical values tabulated in MacKinnon (1991).

Results of the error-correction models estimated for each of the monetary aggregates are presented in Table 2. The final error-correction models estimated were derived according to Hendry's 'general-to-specific' specification search. In all four equations estimated, the error-correction term is strongly significant and above the five percent critical value in MacKinnon's (1991) table, thus providing support for the hypothesis of cointegration. The error-correction term indicates the speed with which deviations from long-run equilibrium will be corrected. In all cases, this would appear to take place quite slowly. About 29% to 35% of the deviation is eliminated after about one-quarter. Results in Table 2 suggest that the market informational efficiency of the KLSE with respect to money supply can be rejected. Not only is the KLSE informationally inefficient towards the traditional Simple-sum M1 and M2, but also with respect to the Divisia monetary aggregates.

Table 2. Results of the Error-Correction Models

Variables	Simple-sum M1	Simple-sum M2	Divisia M1	Divisia M2
Constant	-0.0377	-0.0535	-0.0225	-0.0362
	(1.7822)	(1.2403)	(0.7772)	(0.9291)
EC_{t-1}	-0.3043	-0.3097	-0.3521	-0.2914
	(4.0052)*	(4.0176)*	(4.2921)*	(3.9129)*
Δm_t	2.2014	1.2395	0.9999	1.2361
	(4.6204)*	(1.4191)	(1.4388)	(1.5461)
Δm_{t-1}		0.9666	0.6644	0.6037
		(1.1020)	(0.9734)	(0.7578)
Dummy87:4	-0.5014	-0.4448	-0.4786	-0.4811
	(4.0039)*	(3.1131)*	(3.4264)*	(3.3857)*
R-squared	0.500	0.364	0.400	0.362
SER	0.123	0.140	0.136	0.140
DW	1.948	1.799	1.809	1.843
LM χ^2 (4)	1.465	2.192	0.665	1.021
	[0.832]	[0.700]	[0.955]	[0.906]

Notes: EC denotes error correction term, i.e. ϖ_t, the residuals from running the static cointegrating regression. SER denotes standard error of regression and DW denotes Durbin-Watson statistic. LM(4) is the Breusch and Godfrey's Lagrange Multiplier test for residual serial correlation of the fourth-order process. Dummy87:4 captures the effect of October stock market crash with a value of 1 in 1987:4 and 0 otherwise.

Numbers in the round brackets (.) are *t*-statistics and numbers in the square brackets [.] are *p*-values. Critical value for the error-correction term at 5 percent level of significance is -3.45 (see MacKinnon, 1991).

CONCLUSIONS

Since 1985, the Central Bank of Malaysia has given greater emphasis to the use of broad money, M2 and M3 as guide for monetary policy purposes (Bank Negara Malaysia, 1985).[4] However, Ghosh and Gan (1994) have questioned the role of broad money as a monetary instrument, and they conclude that the broad concept (M3) is unsuitable since in the Malaysian economy, the more relevant stock of money seems to be the conventional narrow one (M1). The conclusion reached by Ghosh and Gan is not without support. Habibullah (1992) has investigated the effectiveness of money M1, M2 and M3 by testing the Gurley-Shaw hypothesis. Gurley and Shaw (1960) hypothesised that the presence of

[4]In Malaysia, narrow money M1 has been de-emphasised as intermediate indicator for monetary policy action due to its instability as a result of financial deregulation and financial innovations in the financial system in the 1980s.

interest-bearing financial assets offered by non-bank financial intermediaries would increase the interest rate elasticity of money demand, and as a result will hinder the effectiveness of M1, M2 and M3 for monetary policy purposes. Habibullah concludes that the Malaysian monetary data do not support the Gurley-Shaw contention that changes in the financial markets and the growth of money substitutes will increase the interest elasticity of money demand for M1, M2 and M3. These results imply that money supply M1, M2 and M3 have been stable for the period under study and Bank Negara Malaysia may use all three definitions of money supply for monetary policy purposes. Therefore, excluding M1 for monetary management is unnecessary. In other words, Habibullah's study indicates that money supply M1, M2 and M3 are equally good monetary instruments affecting economic conditions in Malaysia.

The purpose of the present study is to investigate the empirical relationship between money supply and stock prices in the KLSE using quarterly data from 1st quarter 1981 to fourth quarter 1994. Specifically, in this study we have tested for market informational efficiency in KLSE, using the traditional Simple-sum monetary aggregates. We have also introduced an alternative 'weighted' monetary aggregate - the Divisia money. Our results from the error-correction models suggest that all measures of monetary aggregates and stock price are cointegrated, thus implying that the market informational efficiency hypothesis can be rejected for KLSE.

The above results have important implications from the viewpoint of the market participants as well as the monetary authority. From the viewpoint of the market participants, an inefficient market with respect to the growth of money supply will indicate that in the long-run investors may be able to predict stock prices in the Kuala Lumpur Stock Exchange using information on the growth of money supply as a trading rule and may consistently earn excess return in the long-run. As for the monetary authority, in the long-run, money supply (Simple-sum M1 and M2, and Divisia M1 and M2) may be useful as additional monetary instruments in influencing the stock market when the need arises. These results further suggest that there is a role for Divisia monetary aggregates as monetary policy instruments in Malaysia.

REFERENCES

Bank Negara Malaysia. 1985. *Quarterly Economic Bulletin* 18: 118-125.

Bank Negara Malaysia. *Quarterly Bulletin*. various issues.

Banerjee, A., J.J. Dolado, D.F. Hendry and G.W. Smith. 1986. Exploring Equilibrium Relationship in Econometric through Static Models: Some Monte Carlo Evidence. *Oxford Bulletin of Economics and Statistics* 48: 253-277.

Barnett, W.A. 1982. The Optimal Level of Monetary Aggregation. *Journal of Money, Credit and Banking* 14: 687-710.

Barnett, W.A. 1978. The User Cost of Money. *Economics Letters* 1: 145-149.

Barnett, W.A. 1980. Economic Monetary Aggregates: An Application of Index Number and Aggregation Theory. *Journal of Econometrics* 14: 11-48.

Barnett, W.A., E.K. Offenbacher and P.A. Spindt. 1981. New Concepts of Aggregated Money. *Journal of Finance* 36: 497-505.

Binner, J.M. 1990. The Construction, Interpretation and Analysis of Divisia Monetary Aggregates for the U.K. Unpublished Ph.D. Thesis, The University of Leeds.

Cooper, R.V.L. 1974. Efficient Capital Markets and the Quantity Theory of Money. *Journal of Finance* 29: 887-908.

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

Ghosh, B.N. and S.C. Gan. 1994. On the Choice of Appropriate Money Stock for Malaysia. *The Indian Journal of Economics* LXXV: 269-278.

Granger, C.W.J. 1986. Developments in the Study of Cointegrated Economic Variables. *Oxford Bulletin of Economics and Statistics* 48: 213-218.

Gurley, J.G. and E.S. Shaw. 1960. *Money in the Theory of Finance*. Washington D.C.: The Brookings Institution.

Habibullah, M.S. 1992. Real Versus Nominal Adjustment Mechanism of the Malaysian Money Demand Function: Further Evidence. *Malaysian Management Journal* 1: 57-69.

Ho, Y.K. 1983. Money Supply and Equity Prices: An Empirical Note on Far Eastern Countries. *Economic Letters* 11: 161-165.

Jones, J.D. and N. Uri. 1987. Money Supply Growth, Stock Returns and the Direction of Causality. *Socio-Economic Planning Science* 21: 321-325.

Klein, B. 1974. Competitive Interest Payments on Bank Deposits and the Long-Run Demand for Money. *American Economic Review* 64: 931-949.

Kraft, J. and A. Fraft. 1977a. Determinants of Common Stock Prices: A Time Series Analysis. *Journal of Finance* 32: 417-425.

Kraft, J. and A. Kraft. 1977b. Common Stock Prices: Some Observations. *Southern Economic Journal* 43: 1365-1367.

Kremers, J.J.M., N.R. Ericsson and J.J. Dolado. 1992. The Power of Cointegration Tests. *Oxford Bulletin of Economics and Statistics* 54: 325-348.

Kuala Lumpur Stock Exchange. *Investors Digest*. Various issues.

MacKinnon, J. 1991. Critical Values for Cointegration Tests. In R.F. Engle and C.W.J. Granger (eds.). *Long-Run Economic Relationships: Reading in Cointegration.* New York: Oxford University Press.

Mookerjee, R. 1987. Monetary Policy and the Informational Efficiency of the Stock Market: The Evidence from Many Countries. *Applied Economics* 19: 1521-1532.

Mullineux, A. (ed.). 1996. *Financial Innovation, Banking and Monetary Aggregates.* Cheltenham: Edward Elgar.

Offenbacher, E.K. 1980. Economic Monetary Aggregates: Comment. *Journal of Econometrics* 14: 55-56.

Phillips, P.C.B. and P. Perron. 1988. Testing for a Unit Root in Time Series Regression. *Biometrika* 75: 335-346.

Rao, B.B. (ed.). 1994. *Cointegration for the Applied Economist.* Basingstoke and London: St. Martin Press.

Rozeff, M.S. 1974. Money and Stock Prices. *Journal of Financial Economics* 1: 245-302.

Schwert, G.W. 1987. Effects of Model Specification as Tests for Unit Roots in Macroeconomic Data. *Journal of Monetary Economics* 20: 73-103.

Serletis, A. 1993. Money and Stock Prices in the United States. *Applied Financial Economics* 3: 51-54.

Thornton, J. 1993. Money, Output and Stock Prices in the UK: Evidence on Some (Non) relationships. *Applied Financial Economics* 3: 335-338.

APPENDIX A

Sources of Data Used and the Computation of Divisia Monetary Aggregates

In this study we used quarterly time series data for the Kuala Lumpur Stock Exchange (KLSE) Composite stock price index. The data was collected from various issues of the Investors Digest published monthly by KLSE. Money supply M1 (Simple-sum aggregate) comprises currency in circulation and demand deposits held by non-bank private sector; and M2 comprises M1 plus saving deposits, fixed deposits, and negotiable certificates of deposit at commercial banks. Data on monetary aggregates were taken from various issues of the Quarterly Bulletin published by Bank Negara Malaysia. In this study the data used spans 1981:1 to 1994:4. All data used in the analysis were transformed into logarithm.

In this study, we differentiate between the traditional Simple-sum monetary aggregates and Divisia monetary aggregates. The reason for considering Divisia aggregate is that the traditional Simple-sum monetary aggregate is not a good measure of monetary services of a country. According to Barnett (1980), the assumptions made in constructing the Simple-sum aggregate are contrary to the voluminous studies existing in the literature which indicate that each monetary asset has a certain degree of 'moneyness' associated with it. Therefore, according to the proponents of the Divisia approach, it is not which assets are to be included in the measure of money stock which is important, but rather how much of each monetary asset is to be included. This points to the conclusion that each component should be given a different weight when adding the various components of financial assets to arrive at the official monetary aggregates.

Following Barnett (1980), a Divisia monetary aggregate is constructed in the following manner: Let q_{it} and p_{it} represent the quantities and user costs of each asset to be included in the aggregate at time t. The expenditure share on the services of monetary asset i in period t is:

$$s_{it} = p_{it}q_{it}/\Sigma_j p_{jt}q_{jt}. \qquad \text{(A1)}$$

The user cost (see Barnett, 1978) of each asset is measured as:

$$p_{it} = (R_t - r_{i,t})/(1+R_t) \qquad \text{(A2)}$$

where R_t is the benchmark rate, the maximum $[r_i, r_j; i=1,2,...,n). j=1,2,..k. i\neq j]$. The growth rate of a Divisia aggregate then can be written as

$$G(Q_t) = \sum_{i=1}^{n} s_{it}^{*} G(q_{it}) \qquad \text{(A3)}$$

where $s_{it}^{*} = 0.5(s_{it} + s_{it-1})$ and n is the number of assets in the aggregate. Single period changes, beginning with a base period can be cumulated to determine the level of the Divisia aggregate in each succeeding period.

Details of the monetary components and their respective user costs in constructing the Divisia monetary aggregates are presented in Table A1. From Table A1, we can observe that the rate of return on currency is assumed to be zero since it is a perfectly liquid asset. On the other hand, although the explicit rate of return on demand deposits is also zero, Offenbacher (1980) and Barnett, Offenbacher and Spindt (1981) strongly argue that an implicit rate of return must be imputed to demand deposits, if the substitutability between currency and demand deposits is to be estimable. Barnett (1982, p. 699) proposes that, "In some cases implicit rates of return must be used in computing the interest rates in the formula p_i, especially when the own rate of return on an asset is subject to governmental rate regulation. An implicit imputation is also used in the measurement of R. The Divisia quantity index has been found to be robust to those imputations within the plausible ranges of error in the imputation".

Table A1: Information Used to Construct Divisia Aggregates

Money	Asset Components	Rate of Returns
Divisia M1	Currency in circulation	Zero
	Demand deposits	Implicit rate of return. Using Klein's (1974) method. The basic formula for computing Demand deposit rate of return (DDr) is as follows;DDr = r_L*(1-RRDD), where r_L is commercial bank's base lending rate (percent p.a.), and RRDD is reserve requirement on demand deposits.
Divisia M2	Saving deposits	Savings deposit rate (SDr) in percent p.a.
	Fixed deposits	Fixed deposit rate (FDr). FDr= max [(r_i)], where i=1, 3, 6, 9 & 12 months maturity (percent p.a.).
	Negotiable Certificate of Deposits	Rate on NCDs (NCDr). Proxied with the Interbank rates, r. NCDr= max [(r_i)], where i=overnight, 7-days, 1 month & 3-months call money (percent p.a.).
	Repurchase agreement (Repos)	Repo rate (REPOr). Proxied with the call money rate at discount houses, r. REPOr= max [(r_i)], where i=3, 6 & 12-months maturity (percent p.a.).
	Benchmark asset	*Maximum available rate. Max = {[DDr, SDr, TDr, NCDr, REPOr, r_j] + 0.1}, where i=rates at commercial banks and Finance companies; j= Treasury bill rates (3, 6 & 12-months) and yield on Government securities (5 & 20 years).*

Note: Due to unavailability of rate of returns on the components of monetary aggregate M3, we cannot compute Divisia money for M3.

However, the proper implicit rate imputation to demand deposits remains an open issue. Following Offenbacher (1980), the approach taken in this study is to compute an implicit rate using Klein's (1974) methodology. The formula used for constructing the implicit rate on demand deposits (DDr) is given as follows

$$DDr = r_L [1 - (BR/DD)] \qquad (A4)$$

where r_L is the rate of return on bank's earning assets and BR is bank reserves on demand deposits. As for the benchmark asset, as shown in Table A1, we follow the envelope approach, that is, a series of benchmark rates is formed by selecting that benchmark rate which is higher than the rate of return of each monetary asset component. This will ensure that $p_i \geq 0$ (see Mullineux, 1996). Furthermore, Binner (1990) proposes adding 0.10 point to the benchmark rate to ensure that this rate will be non-zero.