Monetary Policy, Economic Activity and the Stock Market: An Empirical Analysis of the Kuala Lumpur Stock Exchange

Muzafar Shah Habibullah
Ahmad Zubaidi Baharumshah
Tan Hui Boon

ABSTRACT

This study attempts to answer the question whether the Kuala Lumpur Stock Exchange (KLSE) is informationally efficient with respect to both money and output. The Information Efficient Market (IEM) hypothesis is tested using the Johansen-Juselius multivariate cointegration approach. Stock prices are proxied by the Composite, Industrial, Finance, Property, Plantation and Tin indices. The measures of money supply used include the narrowly defined M1 and broadly defined M2. Output is proxied by the real Gross Domestic Product (GDP). The empirical results suggest that the stock market is informationally inefficient with respect to M2 and output.

ABSTRAK

Kajian ini cuba menjawab soalan samada Bursa Saham Kuala Lumpur (KLSE) adalah cekap dari segi maklumat penawaran wang dan output. Hipotesis "Information Efficient Market" (IET) diuji menggunakan pendekatan multivariat Johansen-Juselius. Harga-harga saham diproksi oleh indeks Komposit, Perindustrian, Kewangan, Harta, Perladangan dan Timah. Penawaran wang yang digunakan dalam kajian ini termasuk M1 and M2. Output pula diwakili oleh Keluaran Dalam Negara Kasar Benar (KDNK). Keputusan empirikal kajian ini menunjukkan bahawa pasaran saham tersebut adalah kurang cekap dari segi maklumat penawaran wang M2 dan output.

INTRODUCTION

Determining whether stock prices are related to money and/or output is important, at least for three reasons. Firstly, if both money and output affect stock prices, then investors can use the information on changes in these variables to predict the movements in prices. In other words, investors can consistently earn excess profit from the transactions. Secondly, if strong relationships among stock prices, money and output exist then it casts serious doubts at the macro-level about the ability of the market to perform its primary role of channeling funds to the most productive sectors of the

economy. Finally, if it is inefficient then the authorities can in principle intervene to smoothen fluctuations in the market.

A market that is predictable as described above is referred to as an 'informationally inefficient market', a term popularized by Fama (1970). According to Fama, in an informational efficient market, changes in, say, money supply and national output cannot be used as a trading rule by investors to earn more than normal rate of return. An efficient market ensures that current and past movements in these variables are fully reflected in asset prices so that investors are unable to formulate a profitable trading rule using available information. Therefore, the growth in money supply and output will not have a systematic lagged effect or any economic importance in an efficient market. Consistent with this hypothesis is that stock prices will accurately and fully anticipate future monetary and/or output growth.

Since the pioneer work by Sprinkel (1964) on relationships between money supply and national stock price indices, the money supply-stock market nexus has been widely tested. The interesting issue that provoked this investigation is that changes in money supply are expected to have direct effects on individual's portfolio and indirect effects on real-activity variables. Thus, money supply is postulated to be a fundamental determinant of stock prices (Cooper 1974; Hamburger & Kochin 1972; Homa & Jaffee 1971; Rozeff 1974). Recent studies on money supply-stock market relationships in the major international stock markets include Malliaris and Urrutia (1991), Mookerjee (1987) and Jeng et al. (1990). They all find evidence that supports the efficient market hypothesis, that is, the major stock markets are informationally efficient with respect to monetary policy.

While most of these studies are confined to the effects of money supply on stock prices, few have uncovered the relationship between national output and stock prices. A study by Fama (1981) shows that there is a strong relationship between stock prices and industrial production or gross national product. Malliaris and Urrutia (1991) reported that money supply leads the stock market and the performance of the money market may be used as an indicator for real economic activities in the United States. Chang and Pinegar (1989) and Chen et al. (1986) also claimed that real economic activities and stock prices are strongly related. Thornton (1993) arrived at the same conclusion, when the hypothesis was tested for the United Kingdom stock market.

Recently the relationship between macroeconomic variables and stock market were examined for the Asian economies. For example, Fung and Lie (1990) showed that Taiwan's stock market is closely related with both money supply and national output. Their conclusion is supported by Lin (1993) who showed that the growth in money supply can be used to predict the stock prices. Lin also showed that both the stock markets of Korea and Singapore are related with money supply. In the former, money supply leads

the stock market, but for the later, stock market leads money supply. Ho (1983) using Hsiao's (1981) method, tested the efficiency hypothesis on the stock markets of the Asian-Pacific countries and concluded that information on money supply can be used to predict stock prices in Hong Kong, Japan, Philippines, Australia and Thailand. However, the results cannot be generalized for the Singapore market. In a related study, Mak and Cheung (1991) investigated the relationship between the United States money supply and the Asian-Pacific stock markets, namely, Australia, Hong Kong, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan and Thailand. They found that the efficient market hypothesis could not be rejected. This indicates that fluctuations in the supply of a dominant currency can have significant effects on international stock markets.

The primary purpose of this paper is to extend the previous empirical work for the case of Malaysia, which is relatively small. In general, the evidence provided above showed that macroeconomic variables, in particular money supply and national output can influence national stock markets. In other words, stock markets are informationally inefficient with respect to both money supply and output. Thus the question whether stock price leads money supply and output or otherwise is important for policy makers of Malaysia.

In this study, we try to determine whether macroeconomic variables, in particular money supply and national output can be used to predict the stock prices in Malaysia. In other words, we intend to test for the informational efficient market (IEM) hypothesis proposed by Fama (1970). The IEM hypothesis is tested using the multivariate cointegration approach. The rest of the paper is organized as follows. The next section briefly discusses the concept of cointegration. Information regarding the data used is provided in the third section. The fourth section presents and discusses the empirical results. The final section concludes the study.

METHODOLOGY

THE CONCEPT OF COINTEGRATION

The concept of cointegration was first introduced by Granger (1981). It is related to the notion of a long-run (or equilibrium) relationship among two or more variables in economics. Granger (1981) demonstrated that the movement of cointegrated series may be diverged in the short run but they may be tied together in the long run, that is, they move closely to each other over time. A very important implication of this time-series property is that one variable can be used to predict the other (see Granger 1986; Engle & Granger 1987).

In cointegration analysis, it is important that the series under investigation to have the same order of integration. Series X_t and Y_t are said to be integrated of the same order, denoted by $X_t \sim I(d)$ and $Y_t \sim I(d)$, if the two time series are required to be differenced d times to achieve stationarity. A series that is integrated of order one, denoted as $X_t \sim I(1)$, needs to be differenced once to achieve stationarity, that is, to become an $I(0)$. According to Granger (1986), an $I(0)$ series has a mean (not necessarily zero), and there is a tendency for the series to return to the mean. In other words, the series tends to fluctuate around the mean, crossing that value frequently and with rare extensive excursions.

For a pair of $I(1)$ series, for example X_t and Y_t, it is generally true that the linear combination of these two series is also an $I(1)$. However, if there exists a constant A, such that $z_t = X_t - AY_t$ is stationary or $I(0)$, then X_t and Y_t are said to be cointegrated, and A is referred to as the cointegrating parameter. If this is not true, then the variables could drift apart without bound and is contrary to the concept of equilibrium. In other words, if X_t and Y_t are $I(1)$ and cointegrated, then the relationship given by, $X_t = AY_t$ is a long run (or equilibrium) relationship, with z_t measures the extent to which the system is out of equilibrium (see Granger,1986). Hence, the existence of a linear combination of two $I(1)$ series that is $I(0)$ suggests that these series generally move together over time.

UNIT ROOT TEST FOR INTEGRATION

In cointegration analysis, it is important to determine the order of integration of the individual series. This is because only variables of the same order of integration may constitute a potential cointegrating relationship. In this study, we employed the non-parametric unit root tests suggested by Phillips (1987), and Phillips and Perron (1988). They are 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,

$$\Delta Y_t = \mu_1 + \alpha Y_{t-1} + \varepsilon_{1t} \tag{1}$$

$$\Delta Y_t = \mu_2 + \theta t + \beta Y_{t-1} + \varepsilon_{2t} \tag{2}$$

where ΔY_t denotes the first difference of Y_t. Parameters α, β, and θ are to be estimated, μ_1, and μ_2 are constants (drift terms), t is a deterministic time trend, and ε_1 and ε_2 are residuals. In Equation (2), the null hypothesis of unit root, without non-linear trend and without drift, that is, H_0: $\beta=0$, $\theta=0$ and $\mu_2=0$, is tested against the alternative $\beta<0$, $\theta\neq0$ and $\mu_2\neq0$ by means of the adjusted t- and F-statistics $Z(t_\beta)$, $Z(\Phi_2)$ and $Z(\Phi_3)$ respectively. While in Equation (1), the null hypothesis of unit root, without drift, that is, H_0: $\alpha=0$ and $\mu_1=0$, is tested against the alternative $\alpha<0$ and $\mu_1\neq0$ by means of the

adjusted test statistics $Z(t_\alpha)$ and $Z(\Phi_1)$ respectively. We first estimate the general model given by Equation (2) and test whether the null hypothesis can be rejected. If the null hypothesis of unit root cannot be rejected then Equation (1) will be estimated. These tests are transformations of the regression t-statistics so that they allow for the effects of serially correlated and heterogeneously distributed innovations (see West, 1987). The computations of $Z(t_\alpha)$ and $Z(t_\beta)$ are detailed in Phillips (1987), Perron (1988) and Phillips and Perron (1988). The critical values of $Z(t_\alpha)$ and $Z(t_\beta)$ are tabulated in MacKinnon (1991), and the critical values for $Z(\Phi_1)$, $Z(\Phi_2)$ and $Z(\Phi_3)$ are tabulated in Dickey and Fuller (1981).

These tests could be sensitive to the choice of truncation lag parameters; Nelson and Plosser (1982), and Perron (1988) used a range of truncation lag parameters to evaluate the stationarity of the time series variables of interest. However, a less extensive approach to determine the appropriate lag length is given by Schwert (1987, 1989). Schwert (1987, 1989) criteria sets the lag length equal to the integer portion of two values of l, that is, $l_4=\text{int}\{4(T/100)^{1/4}\}$ and $l_{12}=\text{int}\{12(T/100)^{1/4}\}$, where T is the number of observations.

THE MULTIVARIATE COINTEGRATION TESTS

After determining that the series are of the same order of integration, next we determine whether linear combination of the series that are non-stationary in levels are cointegrated. In earlier studies, the Engle-Granger (1987) two-step estimation procedure is frequently used to test for cointegration. However, this procedure has been criticized for being static and having several econometric problems. First, Banerjee et al. (1986) noted that although Engle-Granger procedure produces super consistent parameter estimates, for small sample the biases could be quite severe. Second, when cointegration relationships are not unique as in the present case, then the Engle-Granger procedure performs less satisfactory. The estimates are not invariant to the choice of normalization. Finally, regressing integrated series by using OLS method tend to invalidate statistical inferences (see Perman 1991).

Johansen (1988) and Johansen and Juselius (1990) have suggested an alternative method, the maximum likelihood estimation procedure, to test for cointegrating relationship. The approach is free from the problems mentioned above. Detailed exposition on the Johansen-Juselius technique has been provided in Dickey et al. (1991), Cuthbertson et al. (1992) and Charemza and Deadman (1992). However, a brief discussion on the Johansen-Juselius technique is provided below. We begin with by defining a k-lag vector autoregressive (VAR) representation

$$X_t = \alpha + \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + ... + \Pi_k X_{t-k} + \omega_t \quad (t=1, 2,..., T) \tag{3}$$

where X_t is a (px1) vector of non-stationary I(1) variables, α is a px1 vector of constant terms, Π_1, Π_2 ... Πk are pxq coefficient matrices and ω_t is a px1

vector of white Gaussian noises with mean zero and finite variance. Equation (3) can be reparameterised as

$$\alpha X_t = \alpha + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + ... + \Gamma k \Delta X_{t-k+1} + \Pi_k X_{t-k} + \omega_t \qquad (4)$$

where $\Gamma_i = -(I + \Pi_1 + \Pi_2 + ... + \Pi_i)$, $(i = 1, 2,...k-1)$ and Π is defined as

$$\Pi = -(I + \Pi_1 + \Pi_2 + ... + \Pi_k). \qquad (5)$$

Johansen (1988) has shown that the coefficient matrix Π_k contains the essential information about the cointegrating or equilibrium relationship between the variables in the data set. Specifically, the rank of the matrix Π_k indicates the number of cointegrating relationships existing between the variables in X_t. In our case, X_t = (stock prices, money supply and national output) and so p=3. The hypothesis of cointegration relationships among stock prices, money supply and output is equivalent to the hypothesis that the rank of Π_k = 2. In other words, the rank r must be at most equal to p-1, so that $r \leq p-1$, and there are p-r common stochastic trends. If r=0, then there are no cointegrating vectors and there are p stochastic trends.

The Johansen-Juselius procedure begins with the following least square estimating regressions

$$\Delta X_t = \alpha_1 + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \mu_{1t} \qquad (6)$$

$$X_{t-p} = \alpha_1 + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \mu_{2t} \qquad (7)$$

Defining the product moment matrices of the residuals as $S_{ij} = T \sum_{t=1}^{T} \mu_{it} \mu_{jt}$ (for i,j=1,2), Johansen (1988) shows that the likelihood ratio test statistic for the hypothesis of at most equilibrium relationships is given by

$$-2 \ln Q_r = -T \sum_{i=r+1}^{P} \ln\left(1 - \lambda_j\right) \qquad (8)$$

where $\lambda_1 > \lambda_2 > ... \lambda_p$ are the eigenvalues that solve the following equation

$$|\lambda S_{22} - S_{21} S_{11}' S_{12}| = 0. \qquad (9)$$

The eigenvalue are also called the squared canonical correlations of μ_{2t} with respect to μ_{1t}. The limiting distribution of the -2lnQ, statistic is given in terms of a p-r dimensional Brownian motion process, and the quantiles of the distribution are tabulated in Johansen and Juselius (1990) for p-r =1,...,5 and in Osterwald-Lenum (1992) for p-r =1,... 10.

Equation (8) is usually referred to as the trace test, which may be rewritten as

$$L_{trace} = -T \sum_{i=r+1}^{P} \ln\left(1 - \lambda_j\right) \tag{10}$$

where $\lambda_{r+1}, ... \lambda_p$ are the p-r smallest squared canonical correlation or eigenvalue. The null hypothesis is there are at most r cointegrating vectors. The other test for cointegration is the maximal eigenvalue test based on the following statistic

$$L_{max} = -T.\ln(1-\lambda_{r+1}) \tag{11}$$

where λ_{r+1} is the $(r+t)^{th}$ largest squared canonical correlation or eigenvalue. The null hypothesis is there are r cointegrating vectors, against the alternative of r+1 cointegrating vectors. Johansen and Juselius (1990) indicated that the trace test might lack power relative to the maximal eigenvalue test. Based on the power of the test, the maximal eigenvalue test statistic is often preferred.

THE DATA

In this study, we used 177 monthly data on stock price indices, money supply and national output that spans from January 1978 to September 1992. The price indices include Composite, Industrial, Finance, Property, Plantation and Tin sectors. For money supply, we used both definition of money supply that is narrow money M1 and broad money M2. Money supply M1 includes currency in circulation and demand deposits held by non-bank private sector. Money supply M2 consists of M1 plus saving and fixed deposits, negotiable certificate of deposits and repos held at the commercial banks. National output (Q) is measure by gross national product (GDP) deflated by the consumer price index. Since data for GDP is only available in annual figures, we have extrapolated annual GDP into monthly GDP using a method proposed by Gandolfo (1981). GDP and money supply data used in this study were compiled from various issues of the Quarterly Bulletin published by Bank Negara Malaysia. Data on the stock price indices were collected from various issues of the Investors Digest published by KLSE. All series were transformed into natural logarithm form.

ESTIMATION RESULTS

For all the variables, we carried out the integration tests outline in the previous section, first in levels and then in first-differences. After determining the order of integration, we then proceeded with the cointegration tests to determine the relationships among the stock prices and macroeconomic variables.

TABLE 1. Results of integration tests for series in levels

Variables	Results based on Equation (2)			Results based on Equation (1)	
	$Z(t_\beta)$	$Z(\Phi_2)$	$Z(\Phi_3)$	$Z(t_\alpha)$	$Z(\Phi_1)$
Composite	-2.71	3.19	3.91	-2.29	3.58
Finance	-2.73	4.01	4.50	-2.55	5.01*
Industrial	-2.94	3.55	4.52	-2.04	3.03
Property	-2.28	2.68	3.57	-2.66	4.01
Plantation	-3.24	4.89*	6.68*	-3.51*	6.89*
Tin	-2.58	2.31	3.46	-2.31	2.70
M1	-2.12	8.26*	2.28	-0.70	15.76*
M2	-2.38	34.09*	3.84	-1.75	46.49*
Q	-2.43	5.61*	3.15	-1.30	6.11*

Note. For Equation (2): Critical value for $Z(t_\beta)$ at .05 level is -3.43 (MacKinnon, 1991). Critical values for $Z(\Phi_3)$ and $Z(\Phi_2)$ at .05 level are 6.34 and 4.75 respectively (Dickey and Fuller, 1981). For Equation (1): Critical value for $Z(t_\alpha)$ at .05 level is -2.88 (MacKinnon, 1991). Critical value for $Z(\Phi_1)$ at .05 level is 4.63 (Dickey and Fuller, 1981). The asterisk (*) indicates that the null hypothesis is rejected at the 5% significance level.

Table 1 presents the results of the unit root tests on the level of the series. Following Schwert's formula, for a monthly data set with T = 177, the truncation lag parameter is determined at l_{12}=13. Thus, throughout the analysis this truncation lag length is used. The results from estimating Equation (2) show that none of the series is able to reject the null hypothesis of unit root. In all cases, the test statistics $Z(t_\beta)$ are larger than the critical value of -3.43 tabulated in MacKinnon (1991) at five percent level of significance. The adjusted test statistics $Z(\Phi_3)$ are insignificantly different from zero for all the variables suggesting that the null hypothesis that (μ_2, θ, β)=(0,0,0) in Equation (2) cannot be rejected. This implies that all the series have unit root without drift. On the other hand, the test statistics $Z(\Phi_2)$ indicate that in some cases, the null hypothesis that θ=0 can be rejected, for example the Plantation Stock Index, M1, M2 and national output. This indicates that Equation (1) is more appropriate to represent these series.

Results of the test statistics $Z(t_\alpha)$ for all series in level form using Equation (1) clearly show that, except for Plantation stock index, the null hypothesis of unit root cannot be rejected. As for the Plantation stock index, the test statistics $Z(t_\alpha)$ are significantly different from zero at five percent level, indicating that the series is stationary in level. Thus, we conclude that all the series, except for Plantation stock index are non-stationary in their level form.

In Table 2, we show the results of unit root tests on the first-difference of the series. MacDonald (1990) and Perron (1988) have noted that since it

TABLE 2. Results of integration tests for series in first-differenced

Variables	Results based on Equation (1)	
	$Z(t_\alpha)$	$Z(\Phi_1)$
Composite	-11.61*	67.39*
Finance	-13.21*	87.36*
Industrial	-12.28*	75.32*
Property	-11.86*	70.44*
Tin	-12.57*	79.11*
M1	-15.14*	114.20*
M2	-12.18*	82.17*
Q	-7.78*	30.41*

Note. Critical value for $Z(t_\alpha)$ at .05 level is -2.88 (MacKinnon, 1991). Critical value for $Z(\Phi_1)$ at .05 level is 4.63 (Dickey and Fuller,1981). The asterisk (*) indicates that the null hypothesis is rejected at the 5% significance level.

was expected a *priori* that differencing would have removed the trend, implying that the appropriate estimating equation is Equation (1). As shown in Table 2, the hypothesis of a unit root is rejected by all of the series. The $Z(t_\alpha)$ statistics for all series are significantly different from zero and are greater than the critical value at five percent level. Therefore, we conclude that all series, except the Plantation Stock Index, are I(1) processes. Next we proceed to test whether the linear combination between the stock price indices and both money supply and output are stationary in level.

The results of the multivariate cointegration tests are presented in Tables 3 for Composite, Finance, Industrial, Property and Tin sectors. The Plantation Stock Index is excluded from the test since it is of different degree of integration from the other series. In this table, we reported both Johansen and Juselius's trace and maximal eigenvalue test statistics. Based on the results of the trace test statistic, the null hypothesis that there is no cointegration relationship among the stock price indices, money supply M1 and output cannot be rejected for Composite, Finance, Industrial and Property sectors. However, results obtained from the maximal eigenvalue test statistic suggest otherwise.

When the narrowly defined money supply M1 is replaced by the broad money M2 in the cointegration regressions, the results clearly indicate that there is at least one cointegrating vector among the stock price indexes, money supply M2 and output, as shown by both the trace and maximal eigienvalue test statistics in the table. The test statistics for all the stock indices, except for the case of Tin which indicates only one cointegrating vector, show that there are two cointegrating vectors among these indices, M2 and output. Based on these results, we conclude that the informational

TABLE 3. Multivariate cointegrating testing results

Tests	Null Hypo -thesis	Compo -site	Finance	Indus-	Property trial	Tin	5% Critical Value
			Cointegrating Test Statistics				
A. Stocks = f(M1, Q)							
Trace test	H_0:r = 0	35.45*	38.90*	36.10*	38.45*	33.60	34.91
	H_0:r ≤ 1	17.44	19.42	18.25	18.28	14.61	19.96
	H_0:r ≤ 2	5.68	6.24	4.47	6.79	4.13	9.24
Maximal	H_0:r = 0	18.00	19.47	17.85	20.16	18.99	22.00
eigenvalue	H_1:r = 1	11.75	13.18	13.78	11.49	10.47	15.67
test	H_0:r = 2	5.68	6.24	4.47	6.79	4.13	9.24
B. Stocks = f(M2, Q)							
Trace test	H_0:r = 0	57.75*	53.26*	58.73*	50.58*	45.56*	34.91
	H_0:r ≤ 1	26.42*	23.71*	24.03	23.30*	17.01	19.90
	H_0:r ≤ 2	4.21	5.47	3.66	3.75	3.80	9.24
Maximal	H_0:r = 0	31.33*	29.55*	34.70*	27.28*	28.54*	22.00
eigenvalue	H_0:r = 1	22.21*	18.23*	20.36*	19.55*	13.20	15.67
test	H_0:r = 2	4.21	5.47	3.66	3.75	3.80	7.24

Note. Critical values are from Osterwald-Lenum (1992). The asterisk (*) indicates that the null hypothesis is rejected at the 5% significant level.

efficient market hypothesis can be rejected for the Kuala Lumpur Stock Market with repect to money supply M2, and output.

CONCLUDING REMARKS

The aim of this paper is to investigate the info mational efficiency of the stock prices in the Kuala Lumpur Stock Exchange (KLSE) market with respect to both money supply (M1 and M2) and output. An informationally inefficient stock market indicates that the growth of money supply and/or national output can be used as a trading rule by market participants to predict stock prices, and earn abnormal profit consistently. To test this hypothesis we have adopted the multivariate cointegration approach suggested by Johansen (1988) and Johansen and Juselius (1990).

The summary of our results is as follows. Fi st, the results indicate that except for Plantation stock index, which is I(0), ll other stock price indices are non-stationary in level and need to be di ferenced once to achieve

stationarity, that is, they are I(1) processes. Second, the results of multivariate cointegration analysis reveal that stock prices of all sectors, except for tin and plantation, are cointegrated with both money supply and national output. This means that the stock prices are inefficient with respect to money and output, and traders can use a simple trading rule based on these macro-variables to earn more than normal rate of return. Third, our results tend to suggest that M2 is a more useful monetary instrument compared to its counterpart M1, since the M2 model exhibits more cointegrating vectors than the M1 model (See Table 3). These results seem to support the move by the Central Bank of Malaysia to shift their emphasis from monitoring the monetary aggregate of M1 to M2 (Bank Negara Malaysia 1985). The findings of this study are consistent with a number of studies done for the United Kingdom, United States and other emerging markets in the region. Finally, we want to note that this study is conducted based on the sample period from 1978 to 1992, and should be updated from time to time to incorporate more recent information.

REFERENCES

Banerjee, A., Dolado, J.J., Hendry, D.F. & Smith, G.W. 1986. Exploring equilibrium relationships in econometrics through static models: Some Monte Carlo evidence. *Oxford Bulletin of Economics and Statistics* 48: 253-278.

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

Chang, E.C. & Pinegar, J.M. 1989. Seasonal fluctuations in industrial production and stock market seasonals. *Journal of Financial and Quantitative Analysis* 24: 59-74.

Chen, N.F., Roll, R. & Ross, S.A. 1986. Economic forces and the stock market. *Journal of Business* 59: 383-403.

Charemza, W.W. & Deadman, D.F. 1992. *New directions in econometric practice.* England: Edward Elgar.

Cooper, R.V.L. 1974. Efficient capital markets and the quantity theory of money. *Journal of Finance* 29: 887-908.

Cuthbertson, K., Hall, S.G. & Taylor, M.P. 1992. *Applied Econometric Techniques.* New York: Philip Allan.

Dickey, D.A. & Fuller, W.A. 1981. Likelihood ratio statistics for auto-regressive time series with a unit root. *Econometrica* 49: 1057-1072.

Dickey, D.A., Jansen, D.W. & Thornton, D.L. 1991. A primer on cointegration with an application to money and income. *Federal Reserve Bank of St. Louis Economic Review* 73: 58-78.

Engle, R.F. & Granger, C.W.J. 1987. Cointegration and error correction: Representation, estimation arld testing. *Econometrica* 55: 251-276.

Fama, E.F. 1970. Efficient capital market: A review of the theory and empirical work. *Journal of Finance* 25: 383-417.

Fama, E.F. 1981. Stock returns, real activity, inflation and money. *American Economic Review* 71: 545-565.

Fung, H.G. & Lie, C.J. 1990. Stock market and economic activity: A causal analysis. In S. L. Rhee & R. P. Chang (Eds.), *Pacific-Basin capital markets research,* pp. 203-214. North-Holland: Elsevier Science.

Gandolfo, G. 1981. *Qualitative analysis and econometric estimation of continuous time dynamic models.* Amsterdam: North-Holland.

Granger, C.W.J. 1981. Some properties of time series data and their use in econometric model specification. *Journal of Econometrics* 16: 121 -130.

Granger, C.W.J. 1986. Developments in the study of cointegrated economic variables. *Oxford Bulletin of Economics and Statistics* 48: 213-228.

Hamburger, M.J. & Kochin, L.A. 1972. Money and stock prices: The channels of influence. *Journal of Finance* 27: 231-249.

Hansen, B.E. 1992. Efficient estimation and testing of cointegrating vectors in the presence of deterministic trends. *Journal of Econometrics* 53: 87-121.

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

Homa, K.E. & Jaffee, D.M. 1971. The supply of money and common stock prices. *Journal of Finance* 26: 1056-1066.

Hsiao, C. 1981. Autoregressive modelling and money-Income causality detection. *Journal of Monetary Economics* 7: 85-106.

Jeng, C.C., Butler,, J.S. & Liu, J.T. 1990. The informational efficiency of the stock market: The international evidence of 1921-1930. *Economics Letters* 24: 157-162.

Johansen, S. 1988. Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control* 12: 231 -254.

Johansen, S. & Juselius, K. 1990. Maximum likelihood estimation and inference on cointegration with application to the demand for money. *Oxford Bulletin of Economics and Statistics* 52: 169-210.

Kim, K. & Schmidt, P. 1990. Some evidence on the accuracy of Phillips-Perron tests using alternative estimates of nuisance parameters. *Economics Letters* 34: 345-350.

Lin, S.M. 1993. Stock Returns and Money Supply: A Comparison Among Three Asian Newly Industrialised Countries. In *Proceedings of the Third International Conference on Asian-Pacific Financial Markets,* K.A. Wong, Francis Koh & K.G. Lim (Eds.). Singapore: National University of Singapore.

MacDonald, G.A. 1990. Testing for stationarity and co-Integration: An application to Saudi-Arabian monetary data. *Applied Economics* 22: 1577-1590.

MacKinnon, J. 1991. Critical Values for Cointegration Tests. In *Long-run economic relationships: Readings in cointegration,* R.F. Engle & C.W.J. Granger (Eds.). pp. 267-276. New York: Oxford University Press.

Mak, B.S.C. & Cheung, D.W.W. 1991. Causality tests of the United States weekly money supply and Asian-Pacific stock markets. *Asia Pacific Journal of Management* 9: 253-260.

Malliaris, A.G. & Urrutia, J. L. 1991. An empirical investigation among real, monetary and financial variables. *Economic Letters* 37: 151 -158.

Mookerjee, R. 1987. Monetary policy and the informational efficiency of the stock market: The evidence from many countries. *Applied Economics* 19: 1521 -1532.

Nelson, C.R. & Plosser, C. I. 1982. Trends and random walks in macro-economic times series. *Journal of Monetary Economics* 10: 139-162.

Osterwald-Lenum, M. 1992. A note with quantiles of the asymptotic distribution of the maximum likelihood cointegration rank test statistics. *Oxford Bulletin of Economics and Statistics* 54: 461-472.

Perman, R. 1991. Cointegration: An introduction to the literature. *Journal of Economic Studies* 18: 3-30.

Perron, P. 1988. Trends and random walks in macroeconomic time series: Further evidence from a new approach. *Journal of Economic Dynamics and Control* 12: 297-332.

Phillips, P.C.B. 1987. Time series regression with unit roots. *Econometrica* 55: 277-302.

Phillips, P.C.B. &. Perron, P. 1988. Testing for a unit root in time series regression. *Biometrika* 75: 335-346.

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

Schwert, G.W. 1987. Effects of model specification on tests for unit roots in macroeconomic data. *Journal of Monetary Economics* 20: 73-103.

Schwert, G.W. 1989. Tests for unit roots: A Monte Carlo investigation. *Journal of Business and Economic Statistics* 7: 147-159.

Sprinkel, B.W. 1964. *Money and stock prices.* Homewood, IL: Irwin.

Thornton, J. 1993. Money, output and stock prices in the UK: Evidence on some (non)relationships. *Applied Financial Economics* 3: 335-338.

West, K. D. 1987. A specification test for speculative bubbles. *Quarterly Journal of Economics* 102: 553-580.

Department of Economics
Faculty of Economics and Management
Universiti Putra Malaysia
43400 UPM Serdang
Malaysia